Marriage, Fertility and Divorce: A Dynamic Equilibrium Analysis of Social Policy in Canada*

(Preliminary Version)

Nezih Guner and John Knowles†

May 29, 2000

Abstract

In this paper, we propose an answer to the following question: if Canada had adopted a social policy similar to that which prevailed until recently in the U.S., would Canada's income distribution and rate of single-parenthood have looked more like those of the US? Our answer is based on simulations of the Canadian economy under the two alternative social policies, and thus rules out noise from other variations between the two policy regimes. We find that U.S.-style transfer policies can indeed account for most of the higher rate of single-parenthood in the U.S. The Canadian policy is also more effective in alleviating poverty: the poorest 20% of the population are significantly worse off under the U.S. policy.

*Written for presentation at the CERF conference, "Families, Labour Markets and the Well-Being of Children," to be held in Vancouver, Canada June 1-2nd, 2000.

†Affiliations: Guner, The Pennsylvania State University; Knowles, University of Pennsylvania. The authors are grateful for financial support of this project from Statistics Canada.

1. Introduction

A recurring question in the design of social policy is whether the response of family decisions like marriage and fertility to the incentives implied by welfare programs is large enough to have economically significant effects on the distribution of income and family structure. Until recently for instance, the main U.S. welfare program, Aid to Families with Dependent Children (AFDC), penalized women for marriage and rewarded them for fertility outside of marriage, through increased eligibility and higher benefits. Despite rapidly increasing rates of single motherhood in the U.S., a significant decline in the marriage rate, and a large volume of empirical research, however, economists have not reached a consensus on whether this program had significant effects on family structure. The empirical estimation of these effects is plagued with identification problems, such as reverse causality and unobservable heterogeneity, both between recipients and non-recipients and among samples with different welfare policies; these issues are outlined in Moffitt (1997).

Canadian welfare programs on the other hand are much less biased against marriage, and less responsive to higher fertility. They are also much more generous on average than U.S. programs. While AFDC in the U.S. has been largely limited to single mothers, Canadian welfare programs, in principle at least, required neither that recipients be single nor parents; these programs also benefit married parents and childless adults, both married and unmarried. According to Allen (1993), these programs also have significant effects on extra-marital fertility and rates of single motherhood in Canada. It turns out however that Canada also has a much lower rate of children from single-parent families than does the U.S., but it is not clear whether this is due to the difference in welfare programs between the two countries, which also differ along many other dimensions. In particular, differences in the distribution of human capital and the returns to human capital could also explain differences in family structure, as could differences in social norms between the two countries. Picot and Myles (1996) have shown that the poverty rate among Canadian children was significantly affected by recent changes in demographic behavior.

In this paper, we propose an answer to the following question: if Canada had adopted

a social policy similar to that which prevailed until recently in the U.S., would Canada's income distribution and rate of single-parenthood have looked more like those of the U.S.? Our answer is based on simulations of the Canadian economy under the two alternative social policies, and thus rules out noise from other variations between the two policy regimes. Our method of simulation is in turn based on a dynamic-equilibrium model of Canadian households: we assume that the distribution of human capital depends on the decisions that parents make regarding their own marriages, their fertility and the education of their children. Because we would like to know how significant such a change in social policy would have been, we first calibrate our model so that income inequality and welfare recipiency in the steady-state equilibrium follow the same patterns with respect to family structure as in the Canadian data, and then measure the changes induced in this simulated economy when an AFDC-style policy is introduced.

This approach is complementary to the standard empirical approach in that we build into the model the types of responses that are difficult to observe directly, and see whether the model's output is consistent with the relationships estimated by empirical studies. Closely-related work, in terms of the basic approach, includes Aiyagari, Greenwood, and Guner (2000) and Greenwood, Guner, and Knowles (2000), which simulate the demographic effects of hypothetical welfare reforms in the U.S., and Regalia and Rios-Rull (1999), which asks whether changes in the sex-wage differential explain changes in marital patterns in the U.S.. The model is based on the general framework developed in Greenwood, Guner, and Knowles (1999); marriage is modeled as the outcome of a random-matching process, and the marriage market influences both single women and married couples in their decisions regarding labor supply, fertility and the education of their children.

For understanding poverty, an important feature of our model is that it distinguishes among children of 2-parent families, children from divorced parents, and those whose parents were never married. This is important for the exercise in question because empirical studies, summarized in McLanahan and Sandefur (1994), suggest that children's outcomes, such as future employment, wages and teenage fertility, depend at least as much on family structure

as they do on family income. In the model family structure affects children's outcomes by changing the optimal shares of time and income devoted to children's education.

The idea of simulating the effect of U.S. social policies on poverty in Canada does have at least one predecessor. From a policy perspective, Blank and Hanratty (1993) actually perform a much more intricate exercise than what we perform here; they compute the impact on poverty of changing the social programs, holding constant the composition and behavior of households. The exercise we carry out here is in some sense complementary to that of Blank and Hanratty (1993) because we focus on the evolution of the distribution of households over time, taking into account how their behavior would respond to changes in policy. While our formulation of the policy differences is more simplistic, we emphasize the changes in behavior and composition of households over time as agents respond optimally to the new policy. Thus we address directly the questions of moral hazard with respect to family decisions that have surrounded these programs.

In the next section, we compare income inequality, social policies and family structures in the two countries. This is followed first by a formal development of the model, and then by a description of the procedure used to calibrate the model to Canadian data. The next section then describes the effects of introducing an AFDC-style policy.

2. Income and Family Structure in the U.S. and Canada

Comparing social policies in the U.S. and Canada is a complex task, partly because there are many different ways policies might vary on paper, but also because poor families can benefit from a multitude of social programs, some of which are national in scope, like food stamps in the U.S. and child tax credits in Canada, while others, like welfare payments, vary according to the local jurisdictions, such as city, state and province. Furthermore, policies that are similar on paper may be administered quite differently across different jurisdictions, so that assembling an accurate picture of the social policy within each country is actually an ill-defined task.

Nevertheless, it is clear from the research of Blank and Hanratty (1993) that the dif-

ferences across countries are much larger than the differences within countries, so some abstraction is justified. Their results have several important lessons. We learn first that while there exists substantial variation in social programs within each country, that these intra-country differences generate only small changes in poverty rates; for instance, in their calculations if the U.S. adopted the programs of its most generous state,Vermont, the U.S. poverty rate would fall from 12.6% to 11.5% ; conversely, if Canada adopted that of its most generous province, Saskatchewan, the poverty rate would fall from 8.8% to 8.3%. In contrast, if the U.S. were to adopt the average Canadian social policy, then the poverty rate would fall by 50%, and the Canadian rate, under U.S. policies, would increase by 50%! These numbers are apparently reasonably robust to correcting for labor-supply response. We note however that the study takes as given the composition of households by human capital and marital status, as well as the fertility and matching behavior of the agents.

In this section, we proceed by measuring the social policies in terms of the transfer income actually reported by households in representative household surveys. Given household survey data for both countries, our approach is to estimate how transfer income depends on the earnings, marital status and family size of the recipients. This approach is not without serious shortcomings from an econometric perspective: the decision of rational agents whether or not to become a welfare recipient obviously depends on both the generosity of the benefits and the outside opportunities, so our procedure fails to identify program parameters. However our procedure results in an aggregate portrait of transfer payments in each country, and this is essential for identifying the key differences in social policy between the two countries, as well as for evaluating our simulation results.

The data are from the 1994 household surveys disseminated by the Luxembourg Income Study. Thus the U.S. data is an extract from the 1994 Current Population Survey and the Canadian data from the 1994 Survey of Consumer Finances. These are stratified samples, so the data analysis is based on the household weights included with each survey. More recent data is available, but the U.S. system was changing rapidly over the last few years as support for welfare reform grew, and many states had changed their policies even before the

reformed welfare system Temporary Assistance for Needy Families (TANF) replaced AFDC in 1998. Hence the year 1994 was chosen because it seemed more likely to reflect a longer-run outcome from the characteristic welfare system of the U.S., rather than a reflection of the new policy.

Households were included in the sample if they had children; i.e. if they were represented in the children data base. This latter database has the ages of the three youngest children; the ages of older children are not known, however the total number of children in the household is available, though not the total children ever born to each parent. To more accurately reflect the implications of social policy for children, the samples were reweighted by taking the product of the household weight and the number of children.

Table 1 shows means and standard deviations of the household samples for each country. Households were classified as Period 0 if the age of the youngest child was less than 8. If the youngest child was 9 or older, then the household was classed as Period 1. This division reflects the compressed lifecycle structure of the model to be developed here. Because Canadian data does not distinguish between divorced women and unmarried mothers, the marital status of parents was partitioned between married and single. Thus the single category includes widows, never-married women and divorced women. Canadian dollars were converted to U.S. by dividing by 1.2, a number drawn from the 1994 PPP index disseminated by the World Bank.

The table reveals a number of significant differences between the two countries, as well as differences by marital status and period that are common to both countries. The key differences between countries concern the distribution of children across family structure. In the U.S., 23% of period 0 children live with single parents, compared to 17% in Canada. Even more striking is the growth in the % of U.S. kids with single parents as the children age: 25% of U.S. children over the age of 9 live with single parents, compared to 15% in Canada. Thus not only is single-parenthood more common in the U.S., but children in two-parent families are at a higher risk of suffering a household breakup in the U.S.. The income of single-parent families is roughly the same in both countries. The average level of transfers

to these families is higher in Canada, but this difference is not statistically significant, due to the high standard deviation of this statistic. Married families however receive on average a much lower amount of income from government transfers in the U.S. than in Canada.

In assessing the significance of these income differences, it is important to bear in mind that both parental income and family structure have significant effects on the future income of the children. In the U.S. for instance, Stokey (1996) argues, on the basis of a number of empirical studies, that the intergenerational correlation of income is on the order of 0.7. In Canada, Corak and Heisz (1999) reports substantially higher degrees of mobility across generations, but notes that mobility is substantially less among low-income families. According to McLanahan and Sandefur (1994), the effect of being the child of a single parent in the U.S. is substantial, and they report that only about a half of this effect is explained by the lower income of single-parent families. In Canada, Pulkingham (1995) surveys a number of studies that conclude that single mothers with chidlren report declines in family income on the order of 40-70% after divorce.

-

TABLE 1: Average Sample Characteristics

	Married Parents				Single Parents			
	Period 0		Period 1		Period 0		Period 1	
	US	Canada	US	Canada	US	Canada	US	Canada
Observations*	10174	4635	4118	5279	3059	970	1396	949
% of Kids	76.88	82.69	74.68	84.76	23.12	17.31	25.32	15.24
Family:								
DPI	40202	37371.8	45484.7	40698.9	16725	17963.5	21040.9	21105
(std. dev.)	26112	17747.1	27968.9	21853.2	12435.4	10569.6	14364.8	12035.9
Fam. Earnings	47610	41738.6	54663.9	45840.8	11236.6	10077.1	17491.4	13349.1
(std. dev.)	38684	28061.2	40642.3	36560.3	16076.1	14329.3	17626.6	17084.1
Govt. Transfers	1743.2	4441.88	1786.67	4350.42	5964.33	8434.01	4005.42	7962.3
(std. dev.)	4311.3	5305.1	4478.74	5492.46	5766.42	5811.7	5191.11	6353.81
Kids	2.62	2.03	2.11	2.64	2.77	1.91	1.95	2.32
(std. dev.)	1.2469	0.88417	0.83959	1.15082	1.50934	0.84546	45.7668	22.4908
Mother:								
Age	33.66	31.77	40.41	38.19	31.26	30.16	38.41	37.39
(std. dev.)	6.0202	5.1372	5.4107	5.0156	6.8529	6.3745	5.7859	5.6299
Educ.	12.94	13.3	13.09	12.84	11.64	12.12	12.38	12.29
(std. dev.)	2.9024	2.319	2.6619	2.474	2.4041	2.4449	2.4859	2.3981
Hours	22.22	18.81	27.45	21.9	22.52	13.78	30.53	17.95
(std. dev.)	18.668	18.1925	17.3386	18.1763	19.6754	18.4688	17.6865	19.371
Wage	11.97	11.63	12.35	11.76	9.71	11.99	10.92	12.81
(std. dev.)	8.7898	7.0344	9.89	7.6254	10.2849	6.9128	7.4095	14.6334
Father:								
Age	35.93	34.28	42.67	40.83	.	.	.	.
(std. dev.)	6.8999	5.7613	6.5831	5.9225	.	.	.	.
Educ.	13.11	13.36	13.42	12.93	.	.	.	.
(std. dev.)	3.2667	2.4845	3.1827	2.7371	.	.	.	.
Hours	43.25	37.37	42.59	37.54	.	.	.	.
(std. dev.)	14.145	17.5579	15.0057	18.009	.	.	.	.
Wage	16.83	16.08	18.52	17.54	.	.	.	.
(std. dev.)	13.461	8.4992	12.6978	12.363	.	.	.	.

*Sample observations unweighted; percentages reflect household weights.

SOURCES: Luxembourg Income Study, 1994

The observed patterns of social policy so far do not imply that U.S. policy favors single parents at the expense of married: it may be simply that married parents, having higher incomes, are much less likely to apply for welfare. This point is addressed in Table 3, which displays the coefficients implied by regressing social transfer income for each country on household characteristics. The sample here is restricted to those families who report that more than 10% of their income is from transfers.

TABLE 2: Social Policy Regression Results

		Linear		Quadratic	
Variable	Statistic	USA	Canada	USA	Canada
Intercept	Estimate	3065.77	11563.18	4830.94	12844.12
	t	6.62	25.18	4.77	9.95
Kids	Estimate	786.6	391.99	4.4	-590.15
	t	13.96	6.61	0.02	-3.44
Kids Sq.	Estimate			101.76	134.32
	t			4.59	6.22
Earning	Estimate	-0.04	-0.07	-0.13	-0.2
	t	-7.79	-18.33	-15.17	-24.61
Earning Sq.	Estimate			9.37E-07	1.368E-06
	t			.	.
Single Mom	Estimate	629.18	300.97	-87.44	-867.74
	t	3.43	1.45	-0.46	-4.12
Age	Estimate	1068.4	389.83	395.76	575.26
	t	9.93	3.39	1.36	1.68
Age Sq.	Estimate			260.11	-47.44
	t			2.68	-0.42
Mom's Education	Estimate	72.99	-126.27	194.68	78.35
	t	33.81	33	1.16	0.37
Mom's Ed. Sq	Estimate			-3.55	-5.1
	t			-0.47	-0.58
Number of Observations		14772	9974	11037	7613

**Dependent variable = total public transfers received*

SOURCE: Author s calculations from Luxembourg Income Study

These results make a number of points about the difference between the two countries. First, it is clear that the Canadian system is much more generous than the U.S. system. The coefficients for the linear model imply that a 30 year old single mother with no children and no earnings receives 41.7% of the Canadian payment in the U.S., a figure that rises to 57.6% as the number of children increases to 3. Note that the sample construction already excludes parents with no children. This calculation also implies the second point, which is that under the U.S. system, payments per child are higher. Third, Canada seems to penalize earnings much more than in the U.S., 20% versus 13%, according to the quadratic model, much less according to the linear model. These numbers are small relative to official tax rates reported in Hoynes (1996), but the selection process implies that as earnings increase, those people who remain on welfare will tend to be those with the highest transfers, thus understating the average decline in transfers. Thus it is not surprising to see that earnings of single parents are much higher in the U.S. than in Canada.

Finally, the linear specification shows that being single results in a significantly higher transfer in the U.S., and a marginally higher transfer in Canada. However these effects are reversed in the quadratic model, which shows no effect of being single in the U.S., and significantly lower transfers for single women in Canada. While it may appear puzzling that single status has so little effect in the U.S., this can also be explained by the fact that the postulated effect of being single on welfare transfers is not on the size of the transfer but on eligibility for welfare. To test this, it is necessary to run a similar regression on the entire sample, not just those families with transfer income. The results are shown in Table 3, which reveals that, as expected, being a single mother in the U.S. results in a much larger gain in transfer income ($1472) than it does in Canada ($906).

Thus the data, even at this cursory level of analysis, reflect the basic patterns that motivate this paper: marital instability appears much more common in the U.S. and the social policy of the U.S. seems much more targeted towards single mothers than married parents.

3. The Model

The model is derived from that of Greenwood, Guner, and Knowles (2000). The economy is populated by overlapping generations that live two periods as children and two as adults. Each of the these age groups is equally divided between a continuum of males and one of females. Each adult is endowed with one unit of time. Let x denote the type (productivity) of an adult female, and z denote the type (productivity) of an adult male. Assume that x and z are contained in the sets $\mathcal{X} = \{x_1, x_2, \ldots, x_S\}$ and $\mathcal{Z} = \{z_1, z_2, \ldots, z_S\}$. Moreover, let the distribution of t-years old single females and males who are in the marriage market be given by $\Phi_t(x)$ and $\Omega_t(z)$ respectively.

On becoming a young adult, an agent learns his/her productivity in the labor market and meets a potential spouse of the same cohort. At this point, the productivity of each potential partner is common knowledge, as is the quality of their match. If both parties agree, a marriage ensues; otherwise both remain single. At the end of the first period, people learn

their next-period productivities and if married, that of their spouse and their match quality; then, both partners either agree to stay together or divorce ensues. At this time, agents who remained unmarried while young meet new potential partners and can choose to marry. There is no remarriage for divorced agents.

A newly matched couple, young or old, draws its match quality from the following distribution:

$$\Pr\left[\gamma = \gamma_i\right] = \Gamma(\gamma_i).$$

For a married young couple, the match quality in the second period depends on the initial draw:

$$\Pr\left[\gamma' = \gamma_j \mid \gamma = \gamma_i\right] = \Lambda(\gamma_j \mid \gamma_i).$$

After the matching decisions of the first period, young married couples and young single adult females decide how many children to have, how much labor each spouse should supply, and how much of the mother's time and family income should be spent on education the children[1]. Children are not differentiated by sex until they become adults. Let k denote the number of children; we assume that $k \in \mathcal{K} = \{0, 1, ..., K\}$. We also assume that if their parents get divorced, children stay with their mothers. Whether married or single, males allocate their time between leisure and labor, while that of women is allocated across labor, leisure and the nurture of the children.

Education of the children is an increasing, deterministic function of parental spending on education d and the nurture time of the mother t :

$$e = Q\left(t, d\right).$$

Labor income per unit time is determined by the realization of the productivity shocks and by labor supply; a woman's labor income is xl and that of a man is zn. Consumption in a household is a public good with congestion. Hence, per-member consumption of a family

[1]Including father's time allocation to children's education would have been too burdensome computationally. Empirical studies suggest mother's time are more important for children in the U.S.

with income level Y that has a adults and k kids is given by

$$c = \frac{1}{(a+bk)^{\sigma}} Y.$$

In the first period of adult life, the probability of each productivity realization depends on the education received during childhood

$$\begin{aligned} \Pr\left[x = x_i \mid e\right] &= \Pi^x\left(x_i, e\right) \\ \Pr\left[z = z_i \mid e\right] &= \Pi^z\left(z_i, e\right) \end{aligned}$$

where $\Pi^x\left(x_i, e\right)$ and $\Pi^z\left(z_i, e\right)$ are stochastically increasing in e, in the sense of first-order stochastic dominance and $e = e_{-1} + e_{-2}$ is the total human capital investment that a child receives during his/her childhood.

The productivity in the second period of adult life does not depend directly on childhood education, but rather on the initial productivity draw

$$\begin{aligned} \Pr\left[z' = z_j \mid x = x_i\right] &= \Delta^x\left(x_i, x_j\right) \\ \Pr\left[z' = z_j \mid z = z_i\right] &= \Delta^z\left(z_i, z_j\right). \end{aligned}$$

Females have the following utility function:

$$F\left(c, \ell, e\right) = \begin{cases} \nu^c\left(c\right) + \nu^{\ell}\left(\ell\right) + \nu^e\left(e\right) - \gamma, & \text{if married} \\ \nu^c\left(c\right) + \nu^{\ell}\left(\ell\right) + \nu^e\left(e\right), & \text{if single} \end{cases},$$

where c is consumption, ℓ is leisure, e is the human capital investment on children,and γ is the quality of match in a marriage. Females allocate l units of their time for market work and t units of their time for childcare. Similarly, the utility function for males is given by:

$$M\left(c, \ell, e\right) = \begin{cases} u^c\left(c\right) + u^{\ell}\left(\ell\right) + u^e\left(e\right) - \gamma, & \text{if married} \\ u^c\left(c\right) + u^{\ell}\left(\ell\right), & \text{if single} \end{cases}.$$

Note that a single (or divorced) male does not care about the human capital investment of children. Males simply allocate n units of their time to market work.

Finally, each household can received welfare payments in the economy. Welfare payments that a household can receive depend on the family type and number of children in the

household. Let $w_g(k)$, w_b, and $w_m(k)$ be the welfare payments for a single female, for a single male and for a married couple respectively. A household with no labor earnings is eligible to receive these amounts. As labor income increases however, welfare payments are reduced at rate r. Hence, for a single female of type x who has k kids and works l units in the market, total income is given by $w_g(k) + xl(1-r)$. This formulation creates a threshold income level beyond which a household is not qualified for welfare. These welfare payments are financed by lump-sum taxation.

4. Equilibrium

The equilibria of this model must satisfy two conditions: optimality of the agent's decision rules given the household states and the probability distribution over future states, and consistency of the probability distributions with individual decision rules. These conditions are characterized formally in Greenwood, Guner, and Knowles (1999). Here, we summarize briefly some properties of the optimal decisions and the steady-state equilibrium.

What is the value of getting married for a young female in this economy? If she gets married with her current match, she will not be able to have another draw next period in the marriage market. Hence, her decision will depend on the distribution of possible mates in the next period marriage market. Imagine now 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. 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, $B_1(z)$. So, 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.

In order to understand how $G_1(x)$ is determined, consider the lifetime value of being

single for a female of type x who chooses to be on welfare:

$$\begin{aligned} G_1(x) &= \max_{c,e,d,l,t,k} \{F(c,e,k,1-l-t) + \beta E\{W_2(x',z',\gamma',k)I_2(x',z',\gamma',k) \\ &\quad +G_2(x',k)[1-I_2(x',z',\gamma',k)]\}, \end{aligned}$$

subject to $c = [1+bk]^{-\sigma}\max\{w_g(k) + (1-r)xl - d, xl - d - \tau\}$ and $e = Q(t,d)$. 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.

A married couple reaches its decisions by Nash bargaining. The decision problem facing a young married couple indexed by (x,z,γ) and who do not choose to be on welfare is given by:

$$\begin{aligned} &\max_{c,e,k,l,t,n} \{F(c,e,k,1-l-t) + \beta E[W_2(x',z',\gamma',k)I_2(x',z',\gamma',k) \\ &+G_2(x',k)[1-I_2(x',z',\gamma',k)] - G_1(x)\} \\ &\times\{M(c,e,k,1-n) + \beta E[H_2(x',z',\gamma',k)I_2(x',z',\gamma',k) \\ &+B_2(z',k)I_2(x',z',\gamma',k)] - B_1(z)\}, \end{aligned}$$

subject to $c = [2+bk]^{-\sigma}[xl + zn - \tau - d] - \gamma$ and $e = Q(t,d)$. 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.

How does the equilibrium of this economy look like? In order to compute a young single female's decisions one needs to know the availability of males in the future. That is, G_1 depends on the distribution of singles males next period 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 G_1, B_1, W_1 and H_1. These in turn depend on the matching probability functions, $\Phi_t(x_i)$ and $\Omega_t(z_i)$ for each age group t that give the probabilities a man will meet a woman of type x_i and that a woman will meet a man of type z_i, respectively. In the steady-state equilibirium of the model, there will be a distribution of agents across states, a collection of marital and household decision

rules, and matching probability functions that satisfy the following consistency conditions: the decision rules are optimal, taking the other elements as given, the matching probabilities are generated by these decisions, and the distribution of agents is in turn generated by the decision rules and matching probabilities.

We solve this fixed-point problem by assuming an initial tax rate, an initial distribution of agents across states in each age of adulthood, and a family of matching probability functions. We then compute the optimal decisions for agents in each state: $(x_i\ , z_j, \gamma_h)$ if young, and $(x_i\ , z_j, \gamma_h, k_j)$ if old. Hence we first compute their period utilities conditional on each possible marital decision, and then their marriage decisions. Given these rules, we then work out the implied distributions of agents in the following generation, which in turn imply a new set of matching probabilities. At this point, we check the government budget constraint, and adjust taxes to balance the government budget. We repeat the process, using the new decision rules, distributions and mathcing probabilities, until the process converges to a stationary distribution.

5. Calibration

The first step in the simulation analysis is to parameterize the model to match the most relevant observables regarding the Canadian income distribution by family structure, and the distribution of children by parent's marital status. In addition, since fertility plays a key role in the model, we match the Canadian wage-fertility relation, controlling for age.

Although many of the parameter values are impossible to observe or infer directly from data, the model, given a set of parameters, generates a number of empirically verifiable relations; in this section the model's parameters are chosen so as obtain a close match between the data and the model's steady-state along these dimensions.

Table 3: Log Hourly Wage Distributions

	US		Canada	
	Men	Women	Men	Women
Mean	2.62	2.25	2.65	2.29
Std.	0.67	0.68	0.63	0.67

SOURCES: Luxembourg Income Study, 1994

First, the productivity distribution is chosen to match the moments of the log-wage distribution observed in the datasets for each country across all households. These moments are shown in Table 3. In our simulations,

$$x \in X = \{x_1, x_2, ..., x_{11}\} \text{ and } z \in Z = \{z_1, z_2, ..., z_{11}\},$$

where the grid is chosen around the mean of log wages for females and for males for Canada, 2.29 and 2.65 respectively as reported in Table 3.

Several others parameters were chosen to be consistent with empirical evidence. In the benchmark calibration, people can choose to have kids from the following set $k \in \{1, 2, 3, 4, 5\}$. The discount rate is given by $\beta = 0.67$ which corresponds to a 4% interest rate for ten years. Economies of scale in household consumption is given by $c = [a + 0.4k]^{-0.5}Y$ where b and σ are within the range of estimates reported in Cutler and Katz (1992).

In order to calibrate our welfare parameters, we used Canadian data on welfare payments. According to the National Welfare Council (2000), a single mother in British Columbia, Ontario, and Quebec receives about 48% of the average income of single mothers as welfare income. We set $w_g(k) = 1.3$ which is about 48% of average income for single females in the economy. Then we used the ratio of welfare payments for single mothers to that for single males and married to set $w_b = 0.65$ and $w_m(k) = 1.8$. We do not have a good measure of r, and set it to be $r = 0.5$.

We have much less information about several other parameters They were chosen to create an economy which have characteristics similar to the Canadian economy, as reported in Table 1: Match quality values and their stochastic structure are given by

$$\begin{aligned} \gamma &\in \{0, 1.395\} \text{ with } \Pr[\gamma = 0] = \Pr[\gamma = 1.395] = 0.5 \\ \text{and } \Pr[\gamma' &= 0|\gamma = 0] = \Pr[\gamma' = 1.395|\gamma = 1.395] = 0.5 \end{aligned}$$

The momentary utility functions are parametrized according to

$$F(c, e, k, 1 - l - t) \equiv \frac{c^{0.5}}{0.5} + \frac{k^{0.205}}{0.205}\frac{e^{0.23}}{0.23} + 3.0\frac{(1 - l - t - 0.05k)}{0.35}^{0.35}.$$

$$M(c, e, k, 1 - n) \equiv \frac{c^{0.5}}{0.5} + \frac{k^{0.205}}{0.205}\frac{e^{33}}{0.33} + 3.0\frac{(1 - n - 0.0325k)}{0.35}^{0.35},$$

Child quality is produced according to

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

When a young girl grows up, she draws a productivity level, x, from a (discretized) lognormal distribution with mean

$$\Pi^x(x_i, e) \sim \log N(\log[15.5(e_{-2} + e_{-1})^{0.5}], 0.4),$$

and standard deviation 0.40. 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 the same equation but with the constant 4.13 added to the term inside the brackets. When old, a female's productivity will move to x', which is lognormally distributed with mean $2.229[1.0 - 0.70] + 0.70 \ln x$ and standard deviation 0.5. A male's productivity evolves to $z' \sim \ln N(2.64[1.0 - 0.70] + 0.70 \ln z, 0.5)$.

6. Results

The steady-state equilibrium of the benchmark,model generates several statistics that we can compare to Canadian data. Table 4 compares the living arrangements of children in the model and in the Canadian data. About 17% of younger children and about 15% of older children live with single parents. The parameters of the model were picked to make these numbers as close as possible to the ones in Canadian data. Incomes differ significantly by marital status both in the data and in the model. Table 4 shows the distribution of income by family type in the model. On average, a single mother earns about 23% of the income of a married couple when she is young and about 21% of income of a married couple when she is old. These numbers are close to what we observe in the data: 24% and 32% respectively.The key differences are that (1) the model does not match the higher average earnings of single-parent families in the second period, and (2) the model generates a higher fertility differential between single and married parents. The dependence of fertility on income generated by the

model is shown in Figure 1; low income families tend to have more children than high income families.

TABLE 4: Results of Benchmark Model

	Married Parents				**Single Parents**			
	Period 0		Period 1		Period 0		Period 1	
	Model	Canada	Model	Canada	Model	Canada	Model	Canada
Family:								
% of Kids	83.30	82.69	84.91	84.76	16.70	17.31	15.09	15.24
Fam. Earnings	1.00	1.00	1.00	1.10	0.23	0.24	0.21	0.32
Transfers/Income (%)	7.00	10.64	7.30	9.49	49.90	83.70	52.60	59.65
Fertility	1.92	2.03	NA	2.64	2.71	1.91	NA	2.32
Mother:								
Labor	0.28	31.77	0.27	38.19	0.1	30.16	0.1	37.39
Education	1.00	1.00	1.00	1.16	0.87	0.73	0.87	0.95
Father:								
Labor	0.56	34.28	0.56	40.83				
Education	1.43	1.99	1.43	2.00				

On average, as is shown in Table 4, a single female gets about 50% of her income from welfare when young and about 53% from welfare when old. Married couples are much less dependent on welfare: they get about 7% of their income from welfare. People are somewhat more dependent on welfare in the data than in the model. A young single female gets about 84% of her income from welfare when young and 60% of it from welfare when old. Married couples get about 11% of their income from welfare when young and 9.5% of it from welfare when old.

The shortcomings of the model in fitting the data are probably inevitable, given the simplicity of the model. In particular, we do not have any human capital effect of being on welfare (i.e not working), hence people's productivities do not depreciate. In the data such effects must play some role. Further, our model assumes random matching among agents, but in reality matching is less random: the correlation of education among spouses in the U.S. is on the order of 0.6. This effect may well serve to increase income inequality beyond the effects that are incorporated into the model.

7. Policy Experiments

Given that the model can reproduce the basic features of the Canadian data discussed above, it is possible to infer from policy simulations rough estimates of the order of magnitude of the importance of the type of policy differences between the U.S. and Canada that we discussed in the introduction. In particular, our motivating question was to what extent such differences could explain the higher proportion of single-parent children in the U.S. The basic policy differences are: 1) eligibility of married women and single men, 2) dependence of transfers on the number of children, and 3) average level of transfers. In this section, we modify the benchmark model by introducing these differences sequentially into the social policy.

TABLE 5: Welfare Experiments

	Married Parents				**Single Parents**			
	Period 0		Period 1		Period 0		Period 1	
	Model	US	Model	US	Model	US	Model	US
US Policy 1								
% of Kids	78.8	76.88	82.5	74.68	21.2	23.12	17.5	25.32
Fam. Earnings	1.00	1.00	0.99	1.15	0.21	0.24	0.19	0.37
US Policy 2								
% of Kids	62.98	76.88	72.41	74.68	37.02	23.12	27.59	25.32
Fam. Earnings	1.00	1.00	0.97	1.15	0.19	0.24	0.18	0.37
US Policy 3								
% of Kids	71.36	76.88	79.01	74.68	28.64	23.12	20.99	25.32
Fam. Earnings	1.00	1.00	0.98	1.15	0.21	0.24	0.20	0.37

The results of this policy experiments are reported in Table 5 together with the data for the U.S. economy. In Policy 1, we simply suppose that Canada stops providing welfare payments to married people and single males. As Table 5 demonstrates there are two main effects: First, with the new policy there are more kids with single parents. Second, the income gap between single mothers and married families is wider. In Policy 2, we make welfare payments for single mothers dependent on the number of kids; in particular we set $w_g(k) = 0.65 + 0.325k$.

Under this policy, a single female with 2 kids receives the same welfare payments as was the case with Policy 1. The effects of this policy are dramatic: the number of kids with single mothers and the income gap between single mothers and married couples widen significantly.

Indeed, the average number of kids with single mothers jumps to about 32% in the model in contrast to 23% for the U.S. economy.

The U.S. welfare payments, however, are not as generous as the Canadian ones. In Policy 3, we reduce the welfare payments to reflect the average AFDC and food stamps payments in the U.S. We set $w_g(k) = 0.5 + 0.025k$, where a single mother with 2 kids received about 10% of average income as welfare payments. In this final experiment the average number of kids with single mothers is about 24.8%, a number very close to 24.2% for the U.S. economy. The model creates, however, much more single mothers for the first period and much less for the second than the U.S. case.

8. Effectiveness of Social Policy

In this section we revisit the economies studied in the previous two sections, in order to find out which social policies are most effective in making poor children better off, and reducing inequality. In Table 6, we show the average education level of children by their percentile rank in the income distribution. What is striking in these results is that the Canadian policy is much more effective than the U.S. Policy 3, which is the policy that most closely resembles AFDC, and that most of the disadvantage of AFDC comes from the subsidy to fertility (Policy 2). The restriction of welfare to unmarried women does not have much impact on children's education.

TABLE 6: Human Capital Investment in Children

Economy	Household Income Quantile				
	1st	2nd	3d	4th	5th
Benchmark	0.5116	0.7667	0.8648	0.9605	1.1927
US Policy 1	0.5102	0.7657	0.8691	0.9606	1.1958
US Policy 2	0.3738	0.6208	0.7939	0.8959	1.1053
US Policy 3	0.4351	0.7302	0.8404	0.9295	1.1600

Table 7 shows that the implications for income inequality are not as clear-cut. While the Benchmark policy minimises the inequality between married and single households, it is actually Policy 1, the restriction of transfers to the unmarried, that minimises the ratio of income of the highest-income households to that of the poorest. The policy that maximises

inequality is Policy 2, which is a generous version of the AFDC policy, with rewards for extra fertility.

TABLE 7: Income Inequality

	Married /Single	5th Quantile /1st Quantile
Benchmark	4.6624	4.5472
US Policy 1	5.0972	4.3499
US Policy 2	5.4930	6.3599
US Policy 3	4.9149	5.1325

In Table 8, it is clear that the Canadian policy is most effective in generating equality of opportunity, at least in terms of family structure. This table shows the probabilities of each marital outcome for the children, given the marital outcome of their parents. Children of single parents in the benchmark economy are much less likely to become single parents than they would be under the alternative policies.Single-parent children are still twice as likely as children from stable families to become single parents themselves, but under Policy 3 for example, they would be more than 3 times as likely.

Table 8: Intergenerational Persistence of Marital Outcomes

	children				*children*			
parents	mm	ms	sm	ss	mm	ms	sm	ss
	Benchmark				**Policy 1**			
mm	0.79	0.10	0.09	0.02	0.77	0.10	0.09	0.03
ms	0.73	0.12	0.12	0.03	0.70	0.12	0.12	0.05
sm	0.73	0.12	0.12	0.03	0.69	0.13	0.13	0.05
ss	0.64	0.16	0.16	0.04	0.54	0.17	0.19	0.10
	Policy 2				**Policy 3**			
mm	0.70	0.11	0.12	0.06	0.77	0.09	0.10	0.04
ms	0.61	0.14	0.15	0.10	0.69	0.11	0.13	0.07
sm	0.59	0.15	0.16	0.11	0.67	0.12	0.13	0.08
ss	0.45	0.19	0.20	0.16	0.50	0.17	0.19	0.14

The tax rate implied by the Canadian policy, 1.9%, is 22.5 % higher than the tax required to pay for Policy 3. Thus if inequality or children's education are the predominant concerns of social policy, then it is clear that the Canadian policy is better suited than the U.S. policy to address this. However it may be that the average income under the U.S. policy is sufficiently higher so as to outweigh this advantage.

In the final table below, we show the relation between the percentile rank of the household and their utilities in the steady-state economies under different policies. These rankings are the same for men and women. The table shows that the richest quintile has highest utility under the policy that excludes married people from welfare (Policy 2), while the poorest households are best off under the Canadian (Benchmark) policy. The other policies are never the second choice of these households; in particular, Policy 3, which most resembles the former U.S. policy, is ranked third by all households.

TABLE 9a: Utility Distribution --- Females

	Household Income Quantile				
	1st	2nd	3d	4th	5th
Benchmark	34.5296	35.2209	35.7788	36.4147	37.4925
US Policy 1	34.4228	35.2662	35.8139	36.4578	37.5255
US Policy 2	34.0680	35.1003	35.3911	36.0029	37.0570
US Policy 3	34.0718	34.9346	35.4773	36.1967	37.2451

TABLE 9b: Utility Distribution --- Males

	Household Income Quantile				
	1st	2nd	3d	4th	5th
Benchmark	22.4574	25.4422	26.5039	27.4542	29.0867
US Policy 1	22.1076	25.4780	26.5253	27.4764	29.1232
US Policy 2	21.0153	24.1307	25.8449	26.8489	28.4991
US Policy 3	21.7534	25.1944	26.2798	27.2167	28.8817

9. Conclusion

In this paper we asked to what extent the higher rate of single-parent children in the U.S. was a long run response to the differences in the social transfer regimes in the two countries.

To answer this question, we constructed an equilibrium model of the interaction between family structure and social policy. The theory was drawn from Greenwood, Guner, and Knowles (1999); the basic premise was that family structure decisions are not only dependent on the human capital of the parents, but in turn helps to determine the human capital of the children. In the model, marriage and divorce decisions depend on the outside options of both partners, which in turn depend on the decisions of all other adults, because these determine the probability distribution of potential spouses.

We calibrated this model to the Canadian economy on the basis of an empirical analysis of

household survey data drawn from the Survey of Consumer Finances, 1994. The parameters of the calibrated model were chosen so as to generate the following features of the data: the distribution of children across dual and single-parent households, the earnings differential between single and dual parents, a replacement rate of average fertility, and a pattern of lower fertility for higher-income households. The social policy was set to resemble an average Canadian welfare policy. The steady-state equilibrium that resulted from simulating this economy we termed the "benchmark" version of the model.

The main result of this paper is that when the social policy in the above benchmark economy is replaced by one that resembles the AFDC policy in the U.S., the fraction of children with single parents does indeed increase significantly. If we consider only the average proportion of children, then almost all of the difference between the two countries is explained by this change in social policy alone. We identify three critical differences between the two approaches to social policy: compared to the Canadian policy, the AFDC policy tends to excludes married parents, makes payments more dependent on fertility, and has lower average levels of payments.

We find that the first of these differences alone is sufficient to generate the difference in proportion of children from single parents; when married couples are excluded from the social policy in the benchmark economy, the proportion of children from single marriages rose from 16% to 19%, whereas the actual figure for the U.S. data is 24%. Imposing on this hybrid social policy the further condition that transfer payments increase in the mother's fertility resulted in an even larger increase in the average rate of single-parenthood, to 32%, but this declined to 24.8% when the size of the average transfer was reduced to the U.S. level. From these experiments we conclude that the magnitude of the differences in social policy between the two countries is indeed sufficient, over the long run, to generate the observed differences in rates of single-parent children.

A closer look at family structure differences does reveal an interesting discrepancy between our results and the U.S. data; our model predicts that the AFDC-style policy would result in much higher rates of single-parent families among young children than among older

children. In our model, welfare parents are more likely to marry in the second period, and marriages among the young are more stable than in the data.

Obviously there are other differences between the two countries that may account for these differences or that may interact with policy differences to produce effects entirely different from what we predict here. But the previous evidence on the effects of policy seems consistent with our basic hypotheses. Thus, Meng and Charette (1994) finds that increasing welfare benefits in Canada during the 1980s resulted in higher participation rates in welfare by single mothers.

Our results suggest that the Canadian policy is more effective than the U.S. in helping poor children and in reducing the level of income inequality among households. However the U.S. policy is less costly, and results in higher average income.

Although the emphasis of the analysis has been on differences in welfare policy, it is worth noting that the model is also amenable to the analysis of other types of policy that affect or respond to family structure, such as alimony, child-support and other divorce-contingent transfers. Eastman (1992) discusses a number of possible transfer schemes designed to insure women against divorce and to reduce the risk of opportunistic termination of marriages. Such schemes clearly have significant equilibrium implications for family structure, labor supply and human capital investment, and can easily be inserted into variations on the model presented here.

Finally, there have been significant changes in social policies on both sides of the border in the 90's. A major change in U.S. was the introduction of lifetime time limits on welfare recepiency by TANF. The welfare reform in Canada wasn't as clear-cut as it was in U.S., although the welfare system became "leaner and meaner" during the last decade (see National Council of Welfare (1997)). Because our analysis is confined to steady-states, we cannot draw from it any predictions regarding the immediate effects of such changes, but Greenwood, Guner, and Knowles (2000) show that when a similar theory is used to model the transition path between social policies, it turns out that the effects of AFDC on fertility and investment in children's human capital induces substantial inertia in the economy; the rate of single

parents declines in response to policy changes only after a long period of time. This suggests that the type of simulation-based analysis developed here may be essential for the design of social policy, as it may take many years for the effects of real-life policies to become evident.

References

Aiyagari, S. R., J. Greenwood, and N. Guner (2000): "On the State of the Union," *Journal of Political Economy*, 108(2), 213–244.

Allen, D. W. (1993): "Welfare and the Family: The Canadian Experience," *Journal of Labor Economics*, 11(1)pt. 2, S201–23.

Blank, R. M., and M. J. Hanratty (1993): "Responding to Need: A Comparison of Social Safety Nets in Canada and the United States," in *Small Differences That Matter: Labor Markets and Income Maintenance in Canada and the United States*, ed. by D. Card, and R. B. Freeman, pp. 191–232. University of Chicago Press, Chicago.

Corak, M., and A. Heisz (1999): "Intergenerational Earnings and Income Mobility of Canadian Men: Evidence from Longitudinal Income Tax Data," *Journal of Human Resources*, (3), 504–33.

Eastman, S. (1992): "Improving Outcomes for Divorced Women," *Canadian Public Policy*, 18(3), 318–26.

Greenwood, J., N. Guner, and J. Knowles (1999): "More on Marriage, Fertility and the Distribution of Income," University of Pennsylvania CARESS Working 99-05.

——— (2000): "Women on Welfare," *American Economic Review*, 90(Papers and Proceedings).

Hoynes, H. W. (1996): "Work, Welfare and Family Structure: What Have We Learned?," NBER Working Paper No. W5644.

McLanahan, S., and G. Sandefur (1994): *Growing Up with a Single Parent: What Hurst, What Helps*. Harvard University Press, Cambridge, MA and London,UK.

Meng, R., and M. Charette (1994): "The Determinants of Welfare Participation of Female Heads of Households in Canada," *Canadian Journal of Economics*, (2), 290–306.

Moffitt, R. A. (1997): "The Effect of Welfare on Marriage and Fertility: What do We Know and What do we Need to Know?," Institute for Research on Poverty Working Paper No. 1153-97.

Picot, G., and J. Myles (1996): "Social Transfers, Changing Family Structure and Low Income Among Children," *Canadian Public Policy*, pp. 244–267.

Pulkingham, J. (1995): "Investigating the Financial Circumstances of Separated and Divorced Parents: Implications for Family-Law Reform," *Canadian Public Policy*, 21(1), 1–19.

Regalia, F., and V. Rios-Rull (1999): "What Accounts for the Increase in Single Households and the Stability in Fertility?," Mimeo, Universitat Pompeu Fabra.

Stokey, N. L. (1996): "Shirtsleeves to Shirtsleeves: The Economics of Social Mobility," Discussion paper, Nancy L. Schwartz Lecture, 1996.

Figure 1
Benchmark Fertility