Marriage, Social Insurance and Labor Supply *

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PRELIMINARY

Abstract

This paper develops a dynamic model of marriage, labor supply, welfare participation, savings and divorce under limited commitment and uses it to understand the impact of welfare reforms, particularly the time-limited eligibility, as in the TANF program. In the model, welfare programs can affect whether marriage and divorce take place, the extent to which people work as single or as married individuals, as well as the allocation of resources within marriage. The model thus provides a framework for estimating not only the short-term effects of welfare reforms on labor supply, but also the extent to which welfare

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benefits affect family formation and the way that transfers are allocated within the family. This is particularly important because many of these benefits are ultimately designed to support the well-being of mothers and children. The limited commitment framework in our model allows us to capture the effects on existing marriages as well as marriages that will form after the reform has taken place, offering a better understanding of transitional impacts as well as longer run effects. Using variation provided by the introduction of time limits in welfare benefits eligibility following the Personal Responsibility and Work Opportunity Act of 1996 (welfare reform) and data from the Survey of Income and Program Participation between 1985 and 2011, we provide reduced form evidence of the importance of these reforms on a number of outcomes relevant to our model. We then estimate the parameters of the model using the same source of data.

Welfare programs are an important component of the institutional environment in most advanced economies. The structure of welfare programs is continuously debated and often reformed as governments seek to ensure that they achieve their insurance and redistributive function while distorting incentives as little as possible. Our focus in this paper is a specific type of reform that imposes lifetime limits on welfare benefit eligibility. Understanding the tradeoff between incentives and insurance for such programs has become of particular importance since they were implemented in the US.

In 1996, the US implemented a major welfare reform, replacing the Aid to Families with Dependent Children (AFDC) with the Temporary Assistance for Needy Families (TANF). In the new program, the states were given greater latitude in setting their own parameters for welfare but the length of period over which federal government funds (in the form of block grants) could be used to provide assistance to needy families was limited to sixty months. States could set longer limits but would cover the financial obligations with state-specific funds. About one-third of states adopted shorter time limits. The result was that the new program varied from state to state, with the number of years that it would be available for any one individual being set in a decentralized way. In addition, the new program sought to eliminate disincentives to marry or be with a partner by removing the requirement of being single to be eligible for benefits, as was the case in some states under AFDC.

In this paper, we focus on the implications of the 1996 welfare reform. Our aim is to understand how it affected women over their life cycles in broader terms. We start by estimating the impact of the reform on welfare participation, employment, asset accumulation and marital status. To do this, we use a difference-in-differences framework to exploit the fact that the new welfare rules varied by state and affected different demographic groups differently. For example, women with the youngest child close enough to 18 years old (when benefit eligibility terminates anyway) would have remained unaffected by the time limits, while women with younger kids may be affected, depending on the actions taken by their state. Within this approach we show that welfare utilization declined quite dramatically and persistently, employment of women increased, while the flow of both marriages and divorces declined. Finally, assets increased, particularly at the lower end of the wealth distribution.

The reduced form analysis is crucial for establishing that the reform indeed has important effects. However, it can neither fully reveal the dynamics of these impacts, nor reveal the rich underlying mechanisms through which policy changes take place. Finally, it does not offer a framework for performing counterfactual analyses, or for understanding changes in intrahousehold distributions and welfare effects on women.

Our next step is thus to develop a life cycle model for women with endogenous labor supply, marriage and savings. In this model, women are either single or married, which is decided endogenously; children, however, arrive at an exogenous rate estimated from the data. Marriage is characterized by limited commitment, where the outside options of both the male and the female are key determinants of both the willingness to marry and the way resources are allocated within the household. Depending on the circumstances, the Pareto weight and hence the allocation of resources changes to ensure that the marriage can continue (if at all possible). We model in some detail the budget constraint facing the household, accounting for the structure of the welfare system, including TANF and the Earned Income Tax credit (EITC). The full structure, including the budget constraint, allows us to understand the dynamics implied by the time limits and more generally to evaluate how the structure of welfare affects marriage, labor supply and the allocation of resources within the household. This latter point is important because it allows the model to address the issue of inequality and how this is affected by policy.

The literature on the effects of welfare reform is large and contentious. Excellent overviews are featured in Blank (2002) and Grogger and Karoly (2005). Experimental studies have highlighted that time limits encourage households to limit benefits utilization to "bank" their future eligibility (Grogger and Michalopoulos, 2003) and more generally are associated with reduced utilization (Swann, 2005; Mazzolari and Ragusa, 2012).

The literature on employment effects of welfare reform has primarily focused on the sample of single women (see, for instance, Keane and Wolpin (2010)). Recently, Chan (2013) indicates that time limits associated with welfare reform are an important driver of the increase of labor supply in this group. Kline and Tartari (forthcoming) examine both intensive and extensive margin labor supply responses in the context of the Connecticut Jobs First program. Limited evidence on the overall effect of welfare reform on household formation and dissolution suggests that the reform was associated with a small decline in divorces, while no effect has been found for transitions into marriage (Bitler et al., 2004).

In addition to the above references, our paper relates to a number of different strands in the literature. The theoretical framework relates both to the collective model of Chiappori (1988, 1992) and Blundell, Chiappori and Meghir (2005) and its dynamic extension by Mazzocco (2007*b*), as well as its interaction with social insurance programs (Persson, 2014). It also relates to the life cycle analyses of female labor supply and marital status (Attanasio, Low and Sanchez-Marcos, 2008; Fernández and Wong, 2014), applying the risk sharing model with limited commitment of Ligon, Thomas and Worrall (2000) and Ligon, Thomas and Worrall (2002*b*), and drawing directly from Voena (2015) by examining the implications of policy for intrahousehold allocation in a limited commitment framework. It also contributes to existing work on taxes and welfare in a static context include Heckman (1974), Burtless and Hausman (1978), Keane and Moffitt (1998), Eissa and Liebman (1995) for the US as well as Blundell, Duncan and Meghir (1998) for the UK and many others.

Our model is dynamic and as such it draws from the literature on dynamic career models such as Keane and Wolpin (1997) and subsequent models that allow for savings and labor supply in a family context such as Blundell et al. (2015). We build on this literature by endogenizing both marriage and divorce and determining within the model how intrahousehold allocations driven by the Pareto weights evolve from their initial position at the time of marriage as the economic environment changes.

In what follows we present the data and the reduced form analysis of the effects of the time limits component of the PROWORA. We then discuss our model, followed by estimation, analysis of the implications and counterfactual policy simulations. We end with concluding remarks.

1 The Data and Empirical Evidence on the Effects of Time Limits

We use waves of the Survey of Income and Program Participation spanning the 1985-2008 period.[1] We restrict the sample to individuals between 18 and 60 years old with at least one child under age 19, and who are not college graduates. We keep only the 4th monthly observations for each individual.

Table 1 summarizes the data. Women in our sample are on average 35 years old. The program participation rate (AFDC/TANF), which is overall 7% in this population, is only 2.4% for married heads of household and jumps to 17% for unmarried heads. There is a 1% annual divorce rate and 2% annual marriage rate. The employment rate for married and unmarried women is about the same at 63%.

Finally, it is noteworthy that the asset holdings in this population are not negligible, with the average being $39,000, of which $10,500 are liquid assets. The shares of our sample with positive assets and liquid assets are 77% and 47%, respectively. Since assets are an important source of self insurance, it is critical to take into account their presence: in the presence of time limits, people may decide to use their own assets to smooth out large negative income shocks, rather than exhaust their benefits eligibility upfront. Finally, in evaluating the welfare effects of the reforms, it is important to take

[1]We use wave 1985, 1986, 1987, 1988, 1990, 1991, 1992, 1993, 1996, 2001, 2004 and 2008.

Table 1: **Summary statistics**

Variable	Obs	Mean	Std. Dev.
age (female)	552,443	35.09	9.36
assets	81,966	39,043	98,535
has positive assets	81,966	0.773	0.419
liquid assets	81,966	10,590	69,338
has positive liquid assets	81,966	0.468	0.499
employed (female)	552,443	0.632	0.482
employed (female married)	355,919	0.631	0.483
employed (female unmarried)	196,524	0.634	0.482
program participation	486,794	0.069	0.254
program participation (married head)	333,956	0.024	0.152
program participation (unmarried head)	152,838	0.169	0.374
divorced/separated	441,668	0.194	0.396
divorced/separated ($married_{t-1} = 1$)	299,196	0.010	0.100
married	552,443	0.644	0.479
married ($married_{t-1} = 0$)	157,649	0.021	0.144

Notes: Data from the 1985-2011 SIPP. Sample of households in which the head is not a college graduate and which have children below the age of 19.

precautionary savings into account.

We exploit a simple strategy to examine the relationship between the introduction of time limits through welfare reform and our outcome variables of interest: welfare benefits utilization, female employment, marital status and liquid assets holdings.

1.1 Empirical strategy

The basic idea behind our descriptive empirical strategy is to compare households that, based on their demographic characteristics and their state of residence, could have been affected by time limits to households that were not affected, before and after time limits were introduced. This strategy extends prior work about time limits and benefits utilization (Grogger and Michalopoulos, 2003) to cross-state variation.

We define a variable $Treat$ which takes value 0 if the household's expected benefits have *not* changed as a result of the reform, assuming the household has never used benefits before. $Treat$ takes value 1 if a household's benefits (in terms of eligibility or amounts) have been affected in any way by the reform. Hence, $Treat$ is a function of the demographic characteristics of a household and the rules of the state the household resides.

For example, if a households's youngest child is aged 13 or above in year t and the state's lifetime limit is 60 months, the variable $Treat$ takes value 0, while if a households's youngest child is aged 12 or below in year t and the state's lifetime limit is 60 months, the variable $Treat$ takes value 1.

Also, if a households's youngest child is aged 13 in year t and the state has an intermittent limit of 24 months every 60, the variable $Treat$ takes value 1. Lastly, if a households's youngest child is aged 16 in year t and the state's time limit is an intermittent limit of 24 months every 60 months, the variable $Treat$ takes value 0, because the household would be eligible for at most 24 months both pre- and post-reform.

The estimation equation for household i with demographics d (age of the youngest child) in state s at time t takes the form:

$$y_{idst} = \alpha Treat_{ds} Post_{st} + \boldsymbol{\beta}'\mathbf{X}_{idst} + fe_{st} + fe_{ds} + fe_s + fe_t + fe_d + \epsilon_{idst}$$

where $Post_{st}$ equals 1 if state s has enacted the reform at time t and 0 otherwise. We include state, year and demographic (age of the youngest child) fixed effects, as well as state by time fixed effects to account for differential trends and state by demographic fixed effects to allow for heterogeneity across states in the way demographic groups behave. That is, this exercise can be seen as a difference-in-differences one that compares demographic groups before and after welfare reform.

Figure 1 illustrates the definition of the variable $Treat$. The horizontal axis represents the age of the youngest child in the household. The vertical axis represents the number of years of potential benefits the household can claim. The blue solid line (Pre-reform) indicates that the before the reform the household can claim benefits for as many years as the difference between 18 and the age of the youngest child. Post-reform, Michigan maintain a similar regime.

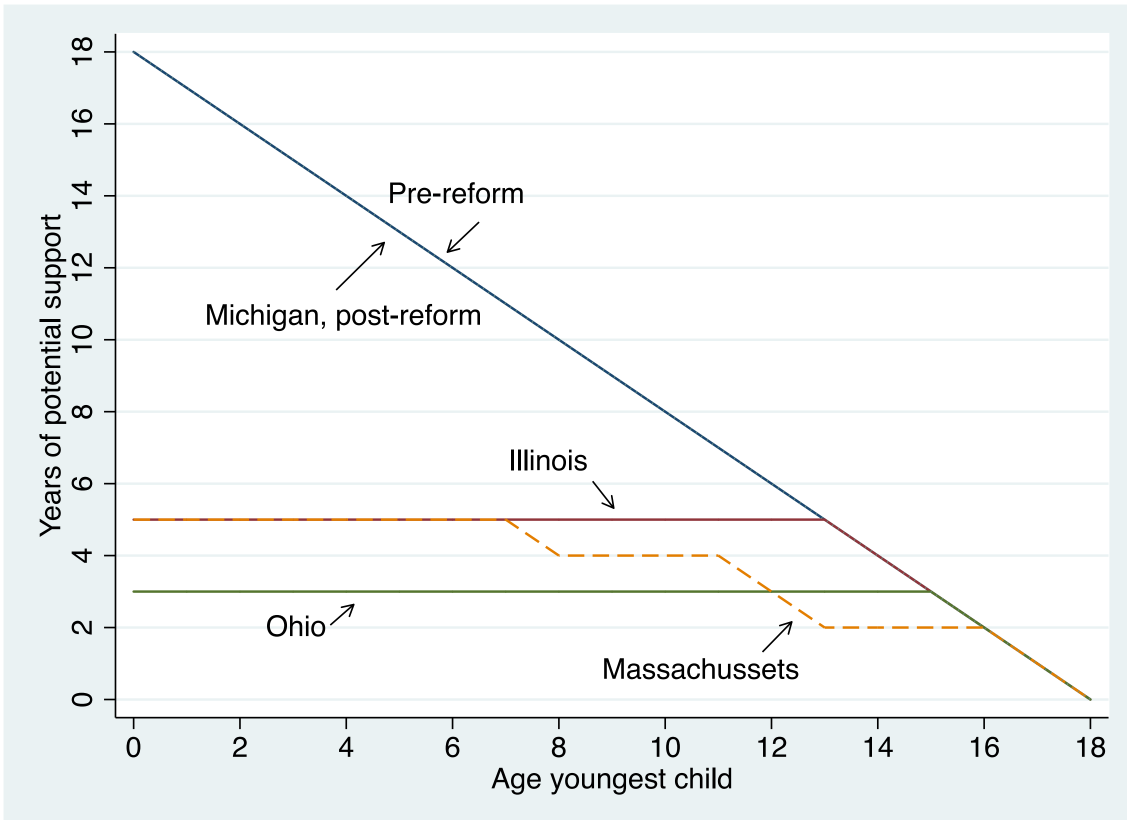
The variable $Treat$ is equal to 0 whenever the line representing the regime the household is exposed to equals the pre-reform line, and 1 otherwise.

The variable $Post_{st}$ is constructed based on the timing of the introduction of time limits reported in Mazzolari and Ragusa (2012).

To study the relationship between time limits and outcome variables over time, we allow the variable $Treat_{ds}$ to interact differently with each calendar year between the reform and 2011. Moreover, we estimate pre-reform interactions for 1992 and 1995 to rule out pre-reform trends across demographic groups.

$$y_{idst} = \sum_{\tau=1992}^{2011} \alpha_\tau Treat_{ds} \mathbf{1}\{t=\tau\}_t + \boldsymbol{\beta}' \mathbf{X}_{idst} + fe_{st} + fe_{ds} + fe_s + fe_t + fe_d + \epsilon_{idst}.$$

Figure 1: Time limits and the definition of treatment



1.2 Results

1.2.1 Benefits utilization

We start by examining changes in the utilization of AFDC and of TANF. On average, in our sample, 7% of households are claiming benefits (Table 1); among households headed by an unmarried person, the rate is close to 17%.

Households that are likely to be affected by the welfare reform based on the age of their youngest child have a 5 percentage points lower probability of claiming benefits after the introduction of time limits (Table 2, columns 1 and 2). Treated households headed by an unmarried person have 15 percentage points lower probability of claiming welfare benefits after welfare reform, while those headed by a married head have 2 percentage points lower probability of claiming such benefits.

Examining how treatment interacts with year dummies, we notice that the utilization rate among treated households begins to significantly decline in 1998, down to a permanent drop of 6 percentage points by 1999 (figure 3, panel A). It hence appears to be the case that households reduce their benefits utilization *before* 5 years from the reform, and hence before running out of their benefit eligibility. Similar time patterns are observed among the marital status subgroups.

1.2.2 Employment

The introduction of time limits is associated with a 3 percentage points (pp) increase in the employment probability of women, while the sample average employment rate is 63%. The result is driven by an 8 pp point increase in the employment of unmarried women. (table 3).

Figure 2: Program participation dynamics in the short run

(a) Everyone

(b) Unmarried head

(c) Married head

Notes: Data from the 1990-2001 SIPP. Sample of households in which the head is not a college graduate with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects, race and disability status.

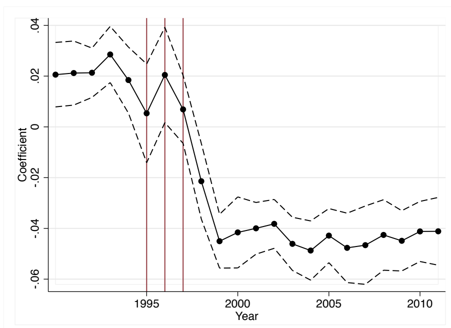
Table 2: **Benefits utilization**

VARIABLES	(1) AFDC/ TANF	(2) AFDC/ TANF	(3) AFDC/ TANF married	(4) AFDC/ TANF married	(5) AFDC/ TANF unmarried	(6) AFDC/ TANF unmarried
$Treat_{dst}Post_{st}$	-0.0507***	-0.0490***	-0.0177***	-0.0169***	-0.154***	-0.151***
	(0.00273)	(0.00269)	(0.00228)	(0.00221)	(0.00804)	(0.00772)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes	No	Yes
Disability status	No	Yes	No	Yes	No	Yes
Unemp. rate*Demog.	No	Yes	No	Yes	No	Yes
Observations	486,794	486,794	333,956	333,956	152,838	152,838
R-squared	0.123	0.149	0.047	0.066	0.174	0.196

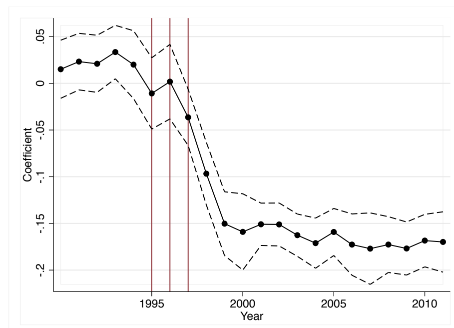
Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of households in which the head is not a college graduate with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Standard errors in parentheses, clustered at the state level.

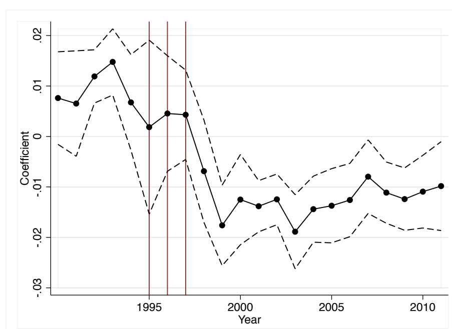
Figure 3: Program participation dynamics in the long run



(a) Everyone



(b) Unmarried head



(c) Married head

Notes: Data from the 1985-2011 SIPP. Sample of households in which the head is not a college graduate with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects, race and disability status.

Table 3: **Employment status - Women**

VARIABLES	(1) employed	(2) employed	(3) employed married	(4) employed married	(5) employed unmarried	(6) employed unmarried
$Treat_{dst}Post_{st}$	0.0317***	0.0294***	-0.000311	-0.000616	0.0808***	0.0735***
	(0.00577)	(0.00544)	(0.00629)	(0.00629)	(0.00973)	(0.00997)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes	No	Yes
Disability status	No	Yes	No	Yes	No	Yes
Unemp. rate*Demog.	No	Yes	No	Yes	No	Yes
Observations	552,443	552,443	355,919	355,919	196,524	196,524
R-squared	0.057	0.098	0.054	0.080	0.082	0.165

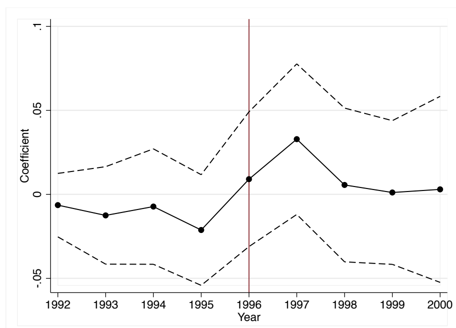
Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduates with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Standard errors in parentheses, clustered at the state level.

Figure 4: Employment probability dynamics in the short run

(a) All women

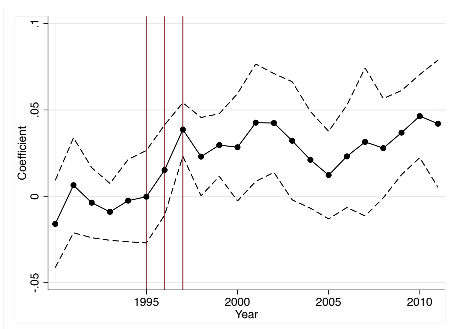
(b) Unmarried women



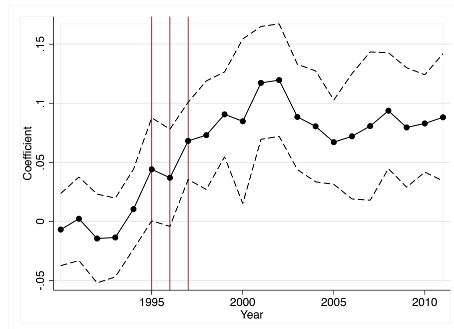
(c) Married women

Notes: Data from the 1990-2001 SIPP. Sample of non-college graduates with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects, race and disability status.

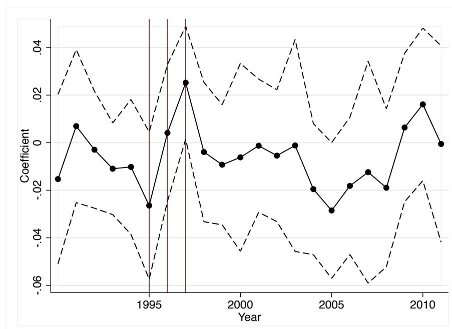
Figure 5: Employment probability dynamics in the long run



(a) All women



(b) Unmarried women



(c) Married women

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduates with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects, race and disability status.

1.2.3 Household formation and dissolution

A central motivation for welfare reform was to encourage marriage. In studying this relationship, we first consider the impact of welfare reform on the probability of being divorced or separated for women. Treated women are 3 percentage points less likely to be divorced after the introduction of time limits (table 4, columns 1 and 2). The decline is associated with a 0.2 percentage points decline in the probability of transitioning into divorce conditional on being married during the previous interview (Table 4, columns 3 and 4).

Table 4: **Divorce**

VARIABLES	(1) divorce/ separation	(2) divorce/ separation	(3) divorce/ separation	(4) divorce/ separation
$Treat_{dst}Post_{st}$	-0.0289***	-0.0279***	-0.00170**	-0.00177**
	(0.00545)	(0.00518)	(0.000709)	(0.000715)
Basic controls	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes
Disability status	No	Yes	No	Yes
Unemp. rate*Demog.	No	Yes	No	Yes
Conditional on $married_{t-1} = 0$	No	No	Yes	Yes
Observations	552,443	552,443	299,540	299,540
R-squared	0.022	0.030	0.007	0.008

Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduate women with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Robust standard errors in parentheses.

As shown in the first two columns of Table 5, there was also a 2 percentage points decline in the proportion married, related to a 0.3-0.4 pp point decline in those getting married each year as shown in the last two columnes of the same table.

Thus there seem to be more people staying together but at the same time fewer are getting married as a result of the reform.

Table 5: **Marriage**

VARIABLES	(1) married	(2) married	(3) married	(4) married
$Treat_{dst}Post_{st}$	-0.0217***	-0.0251***	-0.00308*	-0.00406**
	(0.00772)	(0.00714)	(0.00171)	(0.00175)
Basic controls	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes
Disability status	No	Yes	No	Yes
Unemp. rate*Demog.	No	No	Yes	Yes
Conditional on $married_{t-1} = 0$	No	No	Yes	Yes
Observations	552,443	552,443	157,649	157,649
R-squared	0.157	0.212	0.013	0.016

Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduate women with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Robust standard errors in parentheses.

1.2.4 Assets holdings

Overall assets show a decline which is not significant. However, when we split the sample into those married and those not we find a decline in asset holdings among those married, while unmarried women increase their asset holdings. Both effects are highly significant and even with a Bonferroni adjustment, they have a joint p-value of at most 2%. The result on single women has a straightforward interpretation: the reduction in publicly provided insurance is replaced with increased savings, as self-insurance. The married couple effect is interesting: married couples find it harder to claim benefits, so they probably do not lose much by the reform. Moreover, the reform induced a decline in the divorce probability, leading to a lower demand for insurance. Importantly, there may be important selection out of marriage for poorer household, because of the changes in marital status documented above. It is these complex effects that the structural model we develop will seek to match and interpret.

The response of liquid assets holdings is similar to that of overall assets. We observe a small increase in the probability of owning positive assets around the $2,000 eligibility threshold (table 8).

Table 6: **Assets holdings**

VARIABLES	(1) assets	(2) assets	(3) assets married	(4) assets married	(5) assets unmarried	(6) assets unmarried
$Treat_{dst} Post_{st}$	-3,113	-4,006*	-9,831***	-10,595***	5,599***	4,948**
	(2,206)	(2,228)	(3,361)	(3,502)	(1,991)	(1,967)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes	No	Yes
Disability status	No	Yes	No	Yes	No	Yes
Unemp. rate*Demog.	No	Yes	No	Yes	No	Yes
Observations	81,966	81,966	55,739	55,739	26,227	26,227
R-squared	0.061	0.075	0.063	0.074	0.063	0.075

Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

par *Notes:* Data from the 1985-2011 SIPP. Sample of non-college graduate women with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Robust standard errors in parentheses.

Table 7: **Liquid assets holdings**

VARIABLES	(1) liquid wealth	(2) liquid wealth	(3) liquid wealth married	(4) liquid wealth married	(5) liquid wealth unmarried	(6) liquid wealth unmarried
$Treat_{dst}Post_{st}$	-2,960*	-3,368*	-6,689***	-7,032***	2,382	2,151
	(1,612)	(1,756)	(2,267)	(2,438)	(1,514)	(1,540)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes	No	Yes
Disability status	No	Yes	No	Yes	No	Yes
Unemp. rate*Demog.	No	Yes	No	Yes	No	Yes
Observations	81,966	81,966	55,739	55,739	26,227	26,227
R-squared	0.020	0.025	0.026	0.030	0.030	0.033

Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

par *Notes:* Data from the 1985-2011 SIPP. Sample of non-college graduate women with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Robust standard errors in parentheses.

Table 8: **Distribution of liquid assets holdings**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	$P(A_t \geq 0)$	$P(A_t \geq 1k)$	$P(A_t \geq 2k)$	$P(A_t \geq 3k)$	$P(A_t \geq 4k)$	$P(A_t \geq 5k)$	$P(A_t \geq 6k)$
$Treat_{dst}Post_{st}$	0.0149*	0.0225***	0.0167**	0.0099	0.0020	7.97e-05	-0.0028
	(0.0085)	(0.0082)	(0.0080)	(0.0078)	(0.0073)	(0.0074)	(0.0069)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Race	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Disability status	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unemp. rate*Demog.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	81,966	81,966	81,966	81,966	81,966	81,966	81,966
R-squared	0.026	0.115	0.112	0.106	0.105	0.103	0.099

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduate women with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Robust standard errors in parentheses.

1.3 Robustness checks

1.3.1 Attrition in the SIPP sample

To address concerns regarding the high rate of attrition in the SIPP (Zabel, 1998), we limit our analysis to the first two waves for each SIPP panel. In Appendix table 13 we show that this adjustment leaves the results unaffected.

1.3.2 Exclude young children

A potential concern is that our results are driven by changes in the behavior of households with small children after welfare reform as a result of the childcare provisions in the PRWORA. Appendix table 14 shows that the results are robust to excluding households in which the youngest child is below the age of 6.

2 The model

The model, while taking into account the entire family structure, focuses primarily on the behavior of mothers, who can be single or married. Marriage and divorce are endogenous and take place at the start of the period. We begin by describing labor supply, savings and welfare participation choices that take place after the marital status decision. We then describe how marital status choices are made.

2.1 Problem of the single woman

We start by describing the problem of a single woman who has completed schooling. [2] In each period, she decides whether to work, whether to claim welfare and how much to save.

The vector of choice variables $\boldsymbol{q}_t = \{c_t^W, P_t^W, B_t\}$ includes: how much to consume (c_t^W), whether she works (P_t^W), and whether to claim welfare benefits b_t ($B_t \in \{0,1\}$) which depend on children and their age, income, assets and past utilization. In addition, she makes a choice to marry, which will depend on meeting a man and whether he will accept. The decision to marry takes place at the start of the period, before any consumption or work plan is implemented: the latter will be conditional on the marriage decision.

If she remains single, her budget constraint is given by

$$\frac{A_{t+1}^W}{1+r} = A_t^W - \frac{c_t^W}{e(k_t^a)} + (w_t^W - CC_t^a)P_t^W + B_t b_t + FS_t + EITC_t \qquad (1)$$
$$A_{t+1}^W \geq 0$$

where $e(k_t^a)$ is the equivalence scale due to the presence of children and CC_t^a is the financial cost of childcare paid if the woman works. Her wage w_t is drawn from a distribution that depends on her age and the previous period wage.

The state space for a single woman is $\boldsymbol{\Omega}_t^{Ws} = \{A_t, w_t, k_t^a, TB_t\}$, where TB_t is the number of time periods the woman has claimed the time limited

[2] Our main focus in on low-education women, because we are interested in the impacts of means-tested welfare benefits, such as TANF. An important question is how education choice is itself affected by the presence of such benefits (Blundell et al., 2015). We leave this question for further research. **?** studies women's education decisions in a dynamic collective model of the household with limited commitment.

benefit. The within-period preferences for a single woman are denoted by $u^{Ws}(c_t^W, P_t^W, B_t)$. We model three social programs: food stamps, EITC and AFDC or TANF. The first two are represented by FS_t and $EITC_t$ respectively, while AFDC or TANF by b_t. Food stamps and EITC are functions of the vector $\{k_t^a, w_t^W P_t^W, A_t, TB_t\}$, while AFDC/TANF is a function of the vector $\{k_t^a, w_t^W P_t^W, A_t, TB_t\}$. We discuss the parametrization of the various benefits programs, which interact in a complex way with one another, in the structural estimation section.

With probability λ_t, at the begining of the period the woman meets a man with characteristics $\{A^m, y_t^m\}$ (assets and exogenous earning) and together they draw an initial match quality s_t^0. In that case, they decide whether to get married, as described below. Denote the distribution of available men in period t as $G(A, y|t)$. We restrict encounters to be between a man and a woman of the same age group.[3]

We denote by $V_t^{Ws}(\mathbf{\Omega}_t^{Ws})$ the value function for a single woman at age t and $V_t^{Wm}(\mathbf{\Omega}_t^{Wm})$ the value function for a married woman at age t, which we will define below.

A single woman has the following value functions:

$$V_t^{Ws}(\mathbf{\Omega}_t^{Ws}) = max_{\boldsymbol{q}_t} \ \Big\{ \ u^{Ws}(c_t^W, P_t^W, B_t)$$
$$+\beta E_t \left[\lambda_{t+1}[(1 - M_{t+1}(\mathbf{\Omega}_{t+1}))V_{t+1}^{Ws}(\mathbf{\Omega}_{t+1}^{Ws}) + M_{t+1}(\mathbf{\Omega}_{t+1})V_{t+1}^{Wm}(\mathbf{\Omega}_{t+1}^{M})] + (1 - \lambda_{t+1})V_{t+1}^{Ws}(\mathbf{\Omega}_{t+1}^{Ws})\right] \Big\}$$

[3]In principle, this distribution is endogenous and as economic conditions change, the associated marriage market will change, with this "offer" distribution changing. In this paper we take this distribution as given and do not solve for it endogenously. This mainly affects counterfactual simulations. Note that solving for the equilibrium distribution in two dimensions is likely to be very complicated computationally.

subject to the two constraints in (1).

2.2 Problem of the single man

Men solve an analogous problem without welfare benefits and without a labor supply choice. Men's earnings follow a stochastic process described by the distribution $f^M(y_t^M|y_{t-1}^M, age)$. Children affect the man's problem only when he is married to their mother.

These assumptions determine $V^{Ms}(\mathbf{\Omega}_t^{Ms})$, the man's value function when he is single. $V_t^{Mm}(\mathbf{\Omega}_t^M)$ the value accruing to a married man. In all cases $\mathbf{\Omega}_t^j$ is the relevant state space.

His budget constraint is given by

$$\begin{aligned} \frac{A_{t+1}^M}{1+r} &= A_t^M - c_t^M + y_t^M + FS_t \\ A_{t+1}^M &\geq 0. \end{aligned} \tag{2}$$

The problem for the single male is thus defined by

$$\begin{aligned} V_t^{Ms}(\mathbf{\Omega}_t^{Ms}) = max_{c_t^M} \ &\left\{ u^{Ms}(c_t^M) + \beta E_t[\lambda_{t+1}[(1 - M_{t+1}(\mathbf{\Omega}_{t+1}))V_{t+1}^{Ms}(\mathbf{\Omega}_{t+1}^{Ms}) \right. \\ &\left. + M_{t+1}(\mathbf{\Omega}_{t+1})V_{t+1}^{Mm}(\mathbf{\Omega}_{t+1}^M)] + (1 - \lambda_{t+1})V_{t+1}^{Ms}(\mathbf{\Omega}_{t+1}^{Ms})] \right\}. \end{aligned}$$

The problem is more complex than the simple consumption smoothing and precautionary savings problem because assets affect the probability of marriage as well as the share of consumption when married.

2.3 Problem of the couple

The state variables, summarized in $\mathbf{\Omega}_t^m$, are: assets, spouses' productivity, number of periods of welfare benefits utilization, age of the child (if present) (k_t^a), the weight on each spouse's utility θ_t^H, θ_t^W (Mazzocco, 2007*a*; Voena, 2015). Given the decision to continue being married the couple solves:

$$V_t^m(\mathbf{\Omega}_t^m) = max_{\boldsymbol{q}_t} \ \left\{\theta_t^W \, u^{Wm}(c_t^W, P_t^W, B_t) + \theta_t^M \ u^{Mm}(c_t^M, B_t) + s_t \right.$$
$$\left. +\beta E_t \left[(1 - D_{t+1}(\mathbf{\Omega}_{t+1}))V_{t+1}^m(\mathbf{\Omega}_{t+1}^m) + D_{t+1}(\mathbf{\Omega}_{t+1}) \left(\theta_t^W V_{t+1}^{Ws}(\mathbf{\Omega}_{t+1}^{Ws}) + \theta_t^M V_{t+1}^{Ms}(\mathbf{\Omega}_{t+1}^{Ms})\right)\right]\right\}$$

$$\text{s.t.} \qquad \tfrac{A_{t+1}}{1+r} = A_t - x(c_t^W, c_t^M, k_t^a) + (w_t^W - CC_t^a)P_t^W + y_t^M + B_t + FS_t + EITC_t b_t$$

$$A_{t+1} \geq 0$$
$$V_{t+1}^{Wm}(\mathbf{\Omega}_{t+1}^m) \geq V_{t+1}^{Ws}(\mathbf{\Omega}_{t+1}^{Ws})$$
$$V_{t+1}^{Mm}(\mathbf{\Omega}_{t+1}^m) \geq V_{t+1}^{Ms}(\mathbf{\Omega}_{t+1}^{Ms})$$

where $\theta_t^W = \theta_{t-1}^W + \mu_t^W$ and $\theta_t^M = \theta_{t-1}^M + \mu_t^M$, with μ_t^j for $j = W, H$ representing the Lagrange multiplier on each spouse's sequential participation constraint. Also, $V_{t+1}^{Mm}(\mathbf{\Omega}_{t+1}^m), V_{t+1}^{Mm}(\mathbf{\Omega}_{t+1}^m)$ are defined recursively as each spouses' value from being married in periond $t + 1$:[4]

[4]This property derives from a formulation derived in Marcet and Marimon (2011):

$$V_t^m(\mathbf{\Omega}_t^m) = max_{\boldsymbol{q}_t} inf_{\mu_t} \ \left\{\theta_{t-1}^W \, u^{Wm}(c_t^W, P_t^W) + \theta_{t-1}^M \ u^{Mm}(c_t^M) + s_t \right.$$
$$\left. +\beta E_t \left[(1 - D_{t+1}(\mathbf{\Omega}_{t+1}))V_{t+1}^m(\mathbf{\Omega}_{t+1}^m) + D_{t+1}(\mathbf{\Omega}_{t+1}) \left(\theta_{t-1}^W V_{t+1}^{Ws}(\mathbf{\Omega}_{t+1}^{Ws}) + \theta_{t-1}^M V_{t+1}^{Ms}(\mathbf{\Omega}_{t+1}^{Ms})\right)\right]\right\}$$
$$+ \mu_t^W \cdot \left[u^{Wm}(c_t^W, h_t^W, k_t^a) + s_t + \beta E_t \left[(1 - D_{t+1})V_{t+1}^{Wm}(\mathbf{\Omega}_{t+1}^m(\mu_t)) + D_{t+1} V_{t+1}^{Ws}(\mathbf{\Omega}_{t+1}^{Ws})\right] - V_t^{Ws}(\mathbf{\Omega}_t^{Ws})\right]$$
$$+ \mu_t^M \cdot \left[u^{Mm}(c_t^M, k_t^a) + s_t + \beta E_t \left[(1 - D_{t+1})V_{t+1}^{Mm}(\mathbf{\Omega}_{t+1}^m(\mu_t)) + D_{t+1} V_{t+1}^{Ms}(\mathbf{\Omega}_{t+1}^{Ms})\right] - V_t^{Ms}(\mathbf{\Omega}_t^{Ms})\right]$$

s.t. budget constraint

$$
\begin{aligned}
&V_{t+1}^{Jm}(\mathbf{\Omega}_{t+1}^{m}) = u^{Jm}(c_{t+1}^{J*}, P_{t+1}^{J*}, B_{t+1}^{J*}) \\
&+ \beta E\left[(1 - D_{t+1}(\mathbf{\Omega}_{t+2}))V_{t+2}^{Jm}(\mathbf{\Omega}_{t+1}^{m}) + D_{t+2}(\mathbf{\Omega}_{t+2})V_{t+2}^{Js}(\mathbf{\Omega}_{t+2}^{Js})\right]
\end{aligned}
$$

for $J = W, M$.

Hence, the Pareto weights θ_t^M and θ_t^W are set to ensure that both each spouse wants to remain married at each point in time as long as there are transfers that can support that.

To capture economies of scale in marriage the individual consumptions c_t^W and c_t^M and the children's equivalence scale $e(k^a)$ imply an aggregate household expenditure of $x_t = \frac{((c_t^W)^\rho + (c_t^M)^\rho)^{\frac{1}{\rho}}}{e(k^a)}$. The extent of economies of scale is controlled by ρ and $e(k^a)$.

When married the Pareto weights remain unchanged so long as the participation constraint for each partner is satisfied. If the one partner's participation constraint is not satisfied the Pareto weight moves the minimal amount needed to satisfy it. This is consistent with the dynamic contracting literature with limited commitment, such as Kocherlakota (1996) and Ligon, Thomas and Worrall (2002*a*). If it is not feasible to satisfy both spouses' participation constraints and the intertemporal budget constraint for any allocation of resources, then divorce follows.

In our context marriage is not a pure risk sharing contract. Marriage takes place because of complementarities, love and possibly also because features of the tax and welfare system promote it. And indeed marriage can break down efficiently if the surplus becomes negative for all Pareto weights.

However, when marriage is better than the single state, overall transfers will take place that will *de facto* lead to risk sharing, exactly because this is a way to ensure that the participation constraint is satisfied for both partners, when surplus is present. Suppose, for instance, the female wage drops relative to the male one; he may end up transferring resources because single life may have become relatively more attractive to her, say because of government transfers to individuals.

2.4 Marital status transitions

2.4.1 Marriage decision

Define $\mathbf{\Omega}_t = \{\mathbf{\Omega}_t^{Ws}, \mathbf{\Omega}_t^{Ms}, \mathbf{\Omega}_t^{M}\}$, i.e. the relevant state space for a couple who have met and on which the partnering decision will depend; this will depend on each person's individual assets. At the start of the period a woman may meet a man (with probability λ_t). If this is the case they will marry if there exists a feasible allocation such that

$$M_t(\mathbf{\Omega}_t) = 1\{V_t^{Wm}(\mathbf{\Omega}_t^{M}) > V_t^{Ws}(\mathbf{\Omega}_t^{Ws})\ and\ V_t^{Mm}(\mathbf{\Omega}_t^{M}) > V_t^{Ms}(\mathbf{\Omega}_t^{Ms})\}$$

Married couples share resources in an *ex post* efficient way solving an intertemporal Pareto problem subject to participation constraints. Following the existing literature, the Pareto weights at the time of marriage (θ_1^M for the husband, θ_1^W for the wife) equates the gains from marriage between spouses. This assumption implies solving for the value of $\boldsymbol{\theta}_t$ such that:

$$V_t^{Wm}(\theta_t^W) - V_1^{Ws} = V_1^{Mm}(\theta_t^M) - V_1^{Ms}.$$

Upon divorce, assets are divided equally upon separation - hence, there is no need to keep track of individual assets during marriage. Thus once married, spouses' assets merge into one value:

$$A_t = A_t^W + A_t^M.$$

We denote by $\mathbf{\Omega}_t^M$ the state space for a married couple.

2.4.2 Divorce decision

At the start of the period, the couple decides whether to continue being married or whether to divorce. Divorce can take place unilaterally and is efficient, in the sense that if there is a positive surplus from remaining married, the appropriate transfers will take place. Thus divorce ($D_t = 1$) takes place if (and only if) the marital surplus is negative. Here this is equivalent to saying that there exists no feasible allocation and corresponding Pareto weights θ_t such that

$$V_t^{Mm}(\mathbf{\Omega}_t^m, \boldsymbol{\theta}_t) \geq V_t^{Ms}(\mathbf{\Omega}_t^{Ms}) \text{ and } V_t^{Wm}(\mathbf{\Omega}_t^m, \boldsymbol{\theta}_t) \geq V_t^{Ws}(\mathbf{\Omega}_t^{Ws})$$

where $\boldsymbol{\theta}_t$ is a vector of the two Pareto weights in period t discussed below. The value functions for being single are defined above and evaluated at the level of assets implied by the equal division of assets as defined in divorce law. Denote the value of marriage $V_t^m(\mathbf{\Omega}_t^m)$. The vector of choice variables for those remaining married, is $\boldsymbol{q}_t = \{c_t^W, c_t^M, P_t^W, B_t\}$. It includes: how much spouses consume (c_t^W and c_t^M), whether the wife works (P_t^W), whether the woman claims welfare benefits amounting to b_t ($B_t \in \{0, 1\}$).

2.5 Exogenous processes

2.5.1 Fertility

In this version of the model, children arrive exogenously, given marital status. The conditional probability of having a child is taken to be $Pr(k_t^1|M_t, t)$. The maximum number of children is 1. The probability depends on whether a male partner is present ($M = 1$) so in some sense fertility is endogenous through the marital decision.

2.5.2 Female wages and male earnings

We estimate a wage process for the female and an earnings process for the male. Since we take female employment as endogenous we also need to control for selection. However, we simplify the overall estimation problem by estimating the income processes separately and outside the model.

One interesting issue is the extent to which the reform affected the labor market and in particular human capital prices (Rothstein, 2010). Whether such general equilibrium effects are important or not depends very much on the extent to which the skills of those affected by the welfare reforms are substitutable or otherwise with respect to the rest of the population. With reasonable amounts of substitutability we do not expect important general equilibrium effects. The earnings process for men and the wage process for women take the form

$$ln(y_{it}^M) = a_0^M + a_1^M age_t^M + a_2^M + (age_t^M)^2 + f_i^M + z_{it}^M + \epsilon_{it}^M$$

$$ln(w_{it}^W) = a_0^W + a_1^W age_t^W + a_2^W (age_t^W)^2 + f_i^W + z_{it}^W + \epsilon_{it}^W$$

$$z_{it}^M = z_{i,t-1}^M + \zeta_{it}^M$$

$$z_{it}^W = z_{i,t-1}^W + \zeta_{it}^W.$$

for $j = H, M$, p_{it}^j is permanent income, which evolves as a random walk following innovation ζ_{it}^j, and ϵ_{it}^j is iid measurement error.

2.6 Timing

At the beginning of each period, uncertainty is realized. People observe their productivity realization y_t^j and childless women learn whether they have a child. If single, people meet a partner drawn from the distribution of singles and observe an initial match quality s_t^0. If they are married, they observe the realization of the match quality shock ξ_t^τ.

Based on these state variables, marital status and sharing rule are jointly decided. Conditional on a marital status, consumption, labor supply and program participation choices are made, which determine the state variables in the following period.

3 Structural Estimation

3.1 Parametrization

3.1.1 Preferences

A person's within-period utility function is

$$u(c, P, B) = \frac{\left(c \cdot e^{\psi(M,k^a)\cdot P}\right)^{1-\gamma}}{1-\gamma} - \eta B.$$

In the above, when a person works (P=1) her marginal utility consumption (c) changes, by an amount depending on whether she has a child or not. η represents the stigma cost claiming AFDC/TANF benefits. When married, men also incur a utility cost of being on welfare if their wife is claiming benefits.

3.1.2 Partner meeting process

Couples meet with probability λ_t. We parametrize λ_t to vary over time according to the following rule:

$$\lambda_t = max\{\lambda_0 + \lambda_1 \cdot t + \lambda_2 \cdot t^2, 0\}.$$

When a couple meets, it draws an initial match quality s^0 drawn from a distribution $N(0, \sigma_{s^0})$. If marriage occurs, match quality then evolves as a random walk for married couples as:

$$s_t^\tau = s_{t-1}^{\tau-1} + \xi_t^\tau$$

where τ are the years of marriage and innovations ξ^τ follow a distribution $N(0, \sigma_\xi)$. Hence, we allow the distribution of the initial match quality draw and the one of the subsequent innovations to differ.

3.1.3 Children

Children affect consumption, benefits eligibility and the opportunity cost of women's time on the labor market. We use the OECD equivalence scale to account for the cost of providing for a child.[5] We also account for child care costs in the budget constraint.

3.2 The welfare system

We model the welfare system by considering AFDC/TANF, food stamps and EITC benefits. Eligibility for these benefits is based on a combination of economic and demographic criteria.

AFDC and TANF benefits amounts are established for different household compositions and household income levels by taking an average benefit level across states, weighted by the states' population. In our model, all adult earnings determine income eligibility for TANF. In addition, we consider an asset threshold for eligibility of $2,000 (Sullivan, 2006).

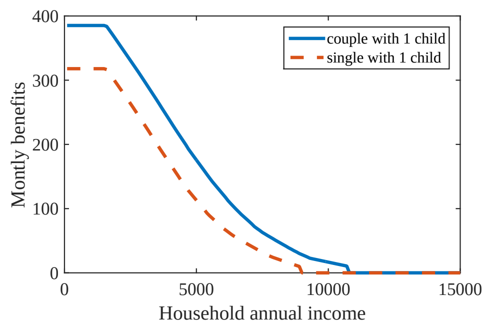
Similarly, we include food stamps by taking an average of food stamps amounts by different household compositions and household income levels across states, weighted by the states' population. Unlike TANF, food stamps are available to all households, irrespectively of the presence and of the age of the children. Eligibility and amount of food stamp benefits are determined by accounting for adult earnings and for AFDC or TANF benefits, which generate household income, as well as household assets.[6]

We compute EITC benefits based on all adult earnings and, post-reform, on an asset test.

[5] Available at `http://www.oecd.org/eco/growth/OECD-Note-EquivalenceScales.pdf`, accessed August 7, 2015.

[6] See `http://dhs.dc.gov/page/chapter-4-determining-countable-income`, accessed August 14 2015.

Figure 6: AFDC benefits and household income by marital status



(a) AFDC benefits

Notes:

3.3 Estimation of the wage processes

We use the SIPP data to estimate the earnings (men) and wage (women) processes and restrict the sample to individuals between 23 and 60 years old, dropping all college graduates and constructing a yearly panel.[7]

We drop individuals whose hourly wage is less than one half the minimum wage in some of the years she reported being working and we drop observations whose percentage growth of average hourly earnings is a missing value, if it is lower than -70% or higher than 400%.

The hourly wage variable we use corresponds to the sum of the reported earnings within a year divided by the sum of hours within that same year. Annual hours are computed as: reported weekly "usual hours of work" $\times$ the number of weeks at the job within the month $\times$ number of months the individual reported positive earnings.

[7]We take the sum of earnings and hours worked to construct the average hourly earning. For the rest of the variables, we consider the last observation within a year.

3.3.1 Men's earnings

We compute GMM estimates of the variance of the permanent component of log income (σ_ζ^2) and the variance of the measurement error (σ_ε^2), based on the following moment conditions:

$$E[\Delta u_t^2] = \sigma_\zeta^2 + 2\sigma_\varepsilon^2$$
$$E[\Delta u_t \Delta u_{t-1}] = -\sigma_\varepsilon^2$$

3.3.2 Women's wage

We first estimate the following model. Wages are:

$$\log w_{it} = \mathbf{X}_{it}'\boldsymbol{\beta} + \varepsilon_{it}.$$

Wages are observed only when the woman works ($P_{it} = 1$), which happens under the following condition:

$$P_{it} = 1 \quad \text{if} \quad \mathbf{Z}_{it}'\boldsymbol{\gamma} + \nu_{it} > 0,$$

where w_{it} is annual earnings. In $\mathbf{X}_{it}$ we include age (dummies), disability status, marital status, race, state and year dummies. In $\mathbf{Z}_{it}$ we include X_{it} and a vector of simulated welfare benefits, as described in Low and Pistaferri (2015), Appendix C. In particular, we use state, year and demographic variation in simulated AFDC, EITC and food stamps benefits for a single mother with varying number of children. The first stage is reported in table 9.

GMM estimates of the variance of the permanent component of log income (σ^2_ζ) are computed based on the following moment conditions:

$$E[\Delta u_t \mid P_t = 1, P_{t-1} = 1] = \sigma_{\zeta_W \eta} \left[\frac{\phi(\alpha_t)}{1 - \Phi(\alpha_t)} \right]$$

$$E[\Delta u_t^2 \mid P_t = 1, P_{t-1} = 1] = \sigma^2_{\zeta W} + \sigma^2_{\zeta_W \eta} \left[\frac{\phi(\alpha_t)}{1 - \Phi(\alpha_t)} \alpha_t \right] + 2\sigma^2_{\varepsilon_W}$$

$$E[\Delta u_t \Delta u_{t-1} \mid P_t = 1, P_{t-1} = 1, P_{t-2} = 1] = -\sigma^2_{\varepsilon_W}$$

Table 9: **Employment status Probit regressions - Women**

VARIABLES	(1) coeff.	(2) marg. eff.
Average AFDC payment ($100)	-0.043***	-0.014***
	(0.006)	(0.002)
Average food stamps payment ($100)	-0.183***	-0.061***
	(0.063)	(0.021)
Average EITC payment ($100)	0.172***	0.057***
	(0.054)	(0.018)
Age dummies	Yes	Yes
Number of children dummies	Yes	Yes
State dummies	Yes	Yes
Year dummies	Yes	Yes
Controls	Yes	Yes
Observations	71,339	

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduates with at least a child below age 19. The set of controls includes race and disability status. Standard errors in parentheses.

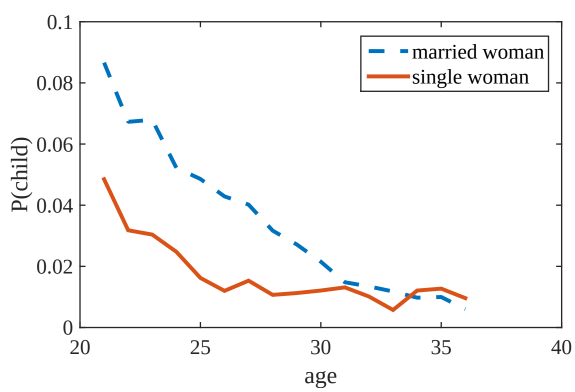
3.4 Estimation of the fertility process

We allow each household to have up to one child, and compute the transition probability from no children to one child using SIPP data. We first estimate the initial condition as the probability of a woman in period 1 (age 20) has a child of age a as $P(k_1^a > 0)$. Then, we compute the Markov process for fertility by examining transition probabilities in the SIPP data as a function of a woman's age and marital status

$$Pr(k_{t+1}^a | k_t^a = 0, M_t, age_t^f).$$

Figure 7 plots the estimated transition probabilities from having no child to having one by a woman's age and marital status in the SIPP.

Figure 7: Probability of having a first child by woman's age and marital status



Source: Data from SIPP.

3.5 Estimation of the distributions of the singles' characteristics

Computational constraints prevent us from solving for the equilibrium in the marriage market in the estimation routine. We instead use the empirical distribution of the characteristics of singles in the SIPP data. We model the joint distribution of $\{A_t^j, y_t^j\}$ by assuming that $\{ln(A_t^j), ln(y_t^j)\}$ are distributed as bivariate normals. For men, $\{ln(A_t^M), ln(y_t^M)\} \sim BVN(\boldsymbol{\mu}_t^M, \boldsymbol{\Sigma}_t^M)$ depends on the single man's age, while for women $\{ln(A_t^M), ln(y_t^M)\} \sim BVN(\boldsymbol{\mu}_{ta}^W, \boldsymbol{\Sigma}_{ta}^W)$ also depends on the age of her youngest child. We allow also for additional mass for the cases in which $A_t^j = 0$ or $y_t^j = 0$. We use the same selection correction procedure described above to estimate the distribution of single women's offer wages for those single women who do not work.

3.6 Moments estimation

We estimate the remaining parameters of model by the Method of Simulated Moments (McFadden, 1989):

$$min_{\mathbf{\Pi}}(\hat{\boldsymbol{\phi}}_{data} - \boldsymbol{\phi}_{sim}(\mathbf{\Pi}))G(\hat{\boldsymbol{\phi}}_{data} - \boldsymbol{\phi}_{sim}(\mathbf{\Pi}))'. \tag{3}$$

The vector $\mathbf{\Pi}$ contains the following parameters: the utility cost of working for unmarried women without children (ψ^{00}), the cost of working for married women without (ψ^{01}), the cost of working for married women with a child (ψ^{11}), the cost of working for unmarried women with a child (ψ^{10}), the variance of match quality at marriage ($\sigma^2_{s^0}$), the variance of innovations to match quality (σ_ξ^2), the parametrization probability of meeting partner over the life cycle ($\lambda_0, \lambda_1, \lambda_2$) and the cost of being on welfare (η).

We estimate our empirical moments $\boldsymbol{\phi}_{data}$ on the SIPP sample of women without a college degree. We focus on the 1960-'69 birth cohort pre-reform, i.e. women between age 21 and 35. We annualize data by considering the marital status, fertility, employment status and welfare participation status that women had for more than half of the calendar year. We use a diagonal matrix with the variances of the empirical moments as weighting matrix G.

Table 10 reports the empirical targeted moments and shows the resulting fit.

3.7 Estimated and pre-set parameters

Table 11 summarizes the life cycle timeline of the model. Women enter the model at age 21, men at age 23. Marriage takes place between people who are two years apart. Until age 35, a woman can conceive her (one and only) child. That implies that she can have a child below age 18, and hence be potentially eligible for welfare, until she is 53. Age 53 is also the last year in which a woman can get married. After that age, she can divorce but will remain single if the does. In addition, women between the ages of 21 and 60 decide whether or not to work and retire thereafter, living up to age 79.

3.8 Parameter estimates

The parameters are separated into three groups: those we set from sources in the literature or in the case of child care costs, directly computed from

Table 10: **Target moments**

Moment	**Data**		**Model**
	moment	**(s.e. in %)**	
% ever married at age 21	34.00%	0.936%	34.67%
% ever married at age 22	49.65%	0.951%	45.78%
% ever married at age 23	56.78%	0.927%	54.61%
% ever married at age 24	65.13%	0.809%	62.99%
% ever married at age 25	68.49%	0.713%	69.03%
% ever married at age 26	72.58%	0.686%	71.71%
% ever married at age 27	74.82%	0.718%	74.27%
% ever married at age 28	78.20%	0.706%	77.36%
% ever married at age 29	80.94%	0.619%	79.51%
% ever married at age 30	82.35%	0.635%	82.11%
% ever married at age 31	84.63%	0.668%	83.86%
% ever married at age 32	85.67%	0.686%	85.80%
% ever married at age 33	86.14%	0.760%	87.92%
% ever married at age 34	85.48%	0.915%	88.96%
% ever married at age 35	86.95%	1.020%	89.91%
% divorced at 26	10.52%	0.517%	10.30%
% divorced at 35	18.57%	1.085%	19.52%
% divorced at 26 (ever married)	15.35%	0.732%	14.92%
% divorced at 35 (ever married)	21.36%	1.214%	21.72%
% employed (married without children)	84.06%	0.669%	85.90%
% employed (unmarried without children)	74.76%	0.559%	73.54%
% employed (married with children)	57.03%	0.533%	56.89%
% employed (unmarried with children)	52.78%	0.845%	53.56%
% on AFDC (low-income, unmarried with children)	37.62%	0.868%	42.71%

Notes: SIPP data 1985-2011. Sample of women born in the 1960s and aged 21-35 without college degrees. Annualized data.

Table 11: **Life cycle timeline**

t	**woman's age**	**man's age**	**benefit elig.**	**labor supply**	**fertility**	**marriage**
1-15	21-35	23-37	Yes	Choice	Can conceive child	Can marry and divorce
16-33	36-53	38-55	Yes	Choice	Can have child below 18	Can marry and divorce
34-40	54-60	56-62	No	Choice	No children at home	Can divorce
41-59	61-79	63-81	No	Retired	No children at home	Can divorce

the CEX; those estimated by us but outside the model; and those used to fit the moments we defined in the previous section.

Table 12: Parameters of the model

Parameter	Value/source
Panel A - Parameters fixed from other sources	
Relative risk aversion (γ)	1.5
Discount factor (β)	0.98
Childcare costs (CC^a)	CEX
Economies of scale in marriage (ρ)	1.23 (Voena 2015)
Panel B - Parameters estimated outside the model	
Variance of men's unexplained earnings in period 1	0.16
Variance of women's unexplained wages in period 1	0.17
Variance of men's earnings shocks	0.025
Variance of women's wage shocks	0.045
Life cycle profile of log male earnings (a_0^M, a_1^M, a_2^M)	9.57, 0.054, -0.0012
Life cycle profile of log female wages (a_0^W, a_1^W, a_2^W)	1.92, 0.022, -0.0003
Panel C - Initial conditions	
% married at age 20	19.35%
% divorced at age 20	2.77%
Panel D - Parameters estimated by MSM	
Cost of working for singles without children (ψ^{00})	-1.8806
Cost of working for married women without children (ψ^{10})	-1.1322
Cost of working for unmarried women with a child (ψ^{01})	-1.3688
Cost of working for married women with a child (ψ^{11})	-1.6355
Variance of match quality at marriage ($\sigma^2_{s^0}$)	0.1040
Variance of innovations to match quality (σ^2_{ξ})	0.0358
Probability of meeting partner by age: $\lambda_t = max\{\lambda_0 + \lambda_1 \cdot t + \lambda_2 \cdot t^2, 0\}$	
λ_0	0.2734
λ_1	-0.0259
λ_2	0.0014
Cost of being on welfare (η)	0.0076

Both male and female earnings are subject to relatively high variance of permanent shocks with male earnings shocks having a standard deviation of 15%, while female wages 21%. Initial heterogeneity is very large with a standard deviation of initial wages for men and women of approximately 40%, implying large initial inequality in productivities. Male and female wages have a concave lifecycle profile as usual. Arrival rates of partners decline with age, but at a decreasing rate. The stigma cost of welfare benefits is high, and is identified by the women who are not claiming benefits while eligible given their income and assets. In the pre-reform period there was no intertemporal cost to claiming, and hence we can attribute not claiming to utility or other costs of claiming. In the counterfactual simulations, for the post reform period, the intertemporal tradeoff will add to this cost, which makes it important to identify it from a period where such a cost is not present.

3.9 Quantitative implications of the model

To study the quantitative implications of our model, we begin by examining how our model fits patterns in the data that a,re not explicitly targeted by the estimation.

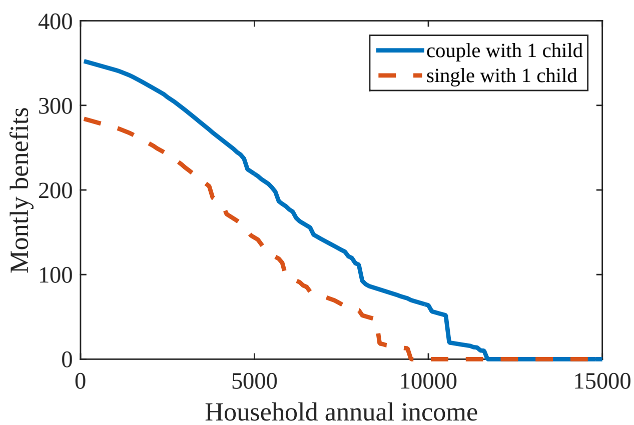
Welfare plays an important role in this model. In total, 6.1% of women aged 21 to 53 are on welfare: 20.4% for the unmarried ones, as targeted in the estimation, and 0.7% for the married women. In our data, for the cohort we use to estimate the data, these percentages are 9.6, 19.8 and 2.6 respectively. On average, welfare users in the model use benefits for 5.3 years over their life cycle.

Resources are distributed unequally in the household. The mean Pareto weight for women is about one third of the one for men ($\frac{E[\theta^H]}{E[\theta^W]} = \frac{0.23}{0.77} = 0.30$). This number is in line with estimates and calibrations from the literature on collective household models for the Unites States, the United Kingdom, and Japan (Lise and Seitz, 2011; Mazzocco, Yamaguchi and Ruiz, 2013; Voena, 2015; Lise and Yamada, 2014).

4 The impact of time limits in the estimated model

In counterfactuals exercise, we simulate the introduction of the PRWORA. We do so in two stages: first, we maintain all features of AFDC place, but impose a 5-year time limit. In a second step, we allow for TANF to differ from AFDC not only because of time limits, but also .

Figure 8: TANF benefits and household income by marital status

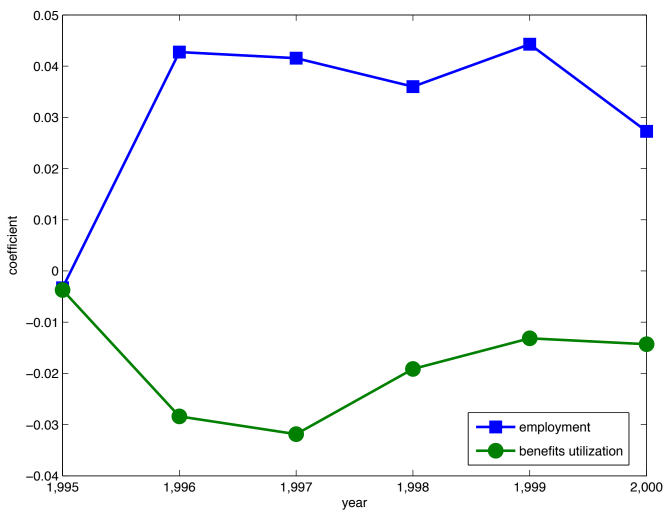


Notes: Simulated TANF monthly payments based on population-weighted state averages.

We find that we can replicate the difference-in-difference estimates for the first years after the reform (figure 9).

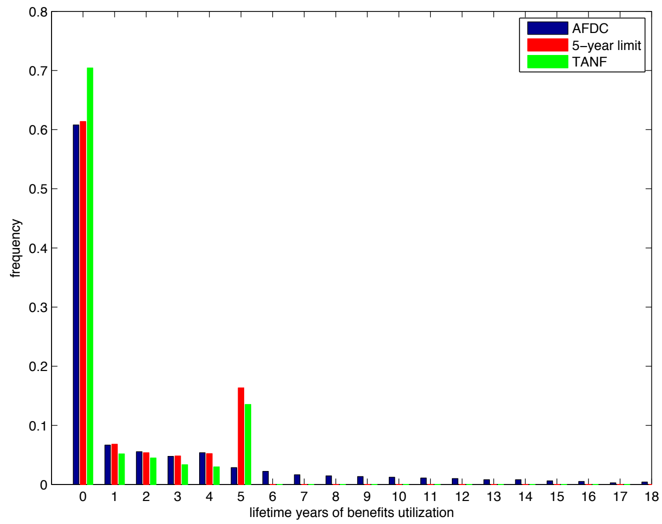
Time limits are binding for 14% of women under AFDC, and we observe significant bunching at 5 years once the limit is introduced. The bunching is lower under TANF as the requirements are stricter and fewer women ever claim benefits.

Figure 9: Difference-in-differences estimates from simulated data



Notes: Simulation from estimated model. Coefficients on regressions that compare women with child below 13 and above 13 before and after the introduction of TANF (1996).

Figure 10: Lifecycle welfare utilization by program



Notes: Simulation from estimated model.

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Appendices

Appendix A: Definition of variables

Program participation equals 1 if the individual reports to be covered by AFDC program and 0 otherwise. Later, AFDC regressions are run at the household level. We consider a family covered by AFDC if at least one member of the household reports to be covered.

Employed equals 1 if an individual reports having a job at least one week during the past month and 0 otherwise.

Assets equals the sum of total net worth (debt minus unsecured debt), home equity, real state equity, IRA and KEOGH accounts, net equity in vehicles.

Liquid assets total net worth (debt minus unsecured debt).

Married equals 1 if the individual reports being married and 0 otherwise.

Divorced/Separated equals 1 if the individual reports being separated or divorce and 0 otherwise.

Appendix B: Extra tables

Table 13: **OLS regressions with first two waves of each SIPP panel**

VARIABLES	(1) AFDC/ TANF	(2) AFDC/ TANF unmarried	(3) employed	(4) employed unmarried	(5) divorced/ separated	(6) married
$Treat_{dst}Post_{st}$	-0.0625***	-0.180***	0.0326***	0.0887***	-0.0275***	-0.0321***
	(0.00448)	(0.0102)	(0.0102)	(0.0180)	(0.00713)	(0.00895)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Race	Yes	Yes	Yes	Yes	Yes	Yes
Disability status	Yes	Yes	Yes	Yes	Yes	Yes
Unemp. rate*Demog.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	124,835	39,373	140,846	49,329	140,846	140,846
R-squared	0.139	0.215	0.098	0.170	0.031	0.208

Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of households in which the head is not a college graduate with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Standard errors in parentheses, clustered at the state level.

Table 14: **Employment status OLS regressions - Women with child above age 5**

VARIABLES	(1) employed	(2) employed	(3) employed married	(4) employed married	(5) employed unmarried	(6) employed unmarried
$Treat_{dst}Post_{st}$	0.0183***	0.0151***	-0.000788	-0.00187	0.0477***	0.0396***
	(0.00551)	(0.00526)	(0.00638)	(0.00640)	(0.0104)	(0.00972)
Basic controls	Yes	Yes	Yes	Yes	Yes	Yes
Race	No	Yes	No	Yes	No	Yes
Disability status	No	Yes	No	Yes	No	Yes
Unemp. rate*Demog.	No	Yes	No	Yes	No	Yes
Observations	314,897	314,897	196,985	196,985	117,912	117,912
R-squared	0.063	0.125	0.064	0.107	0.083	0.192

Standard errors in parentheses clustered at the state level
*** p<0.01, ** p<0.05, * p<0.1

Notes: Data from the 1985-2011 SIPP. Sample of non-college graduates with at least a child below age 19. The full set of controls includes age dummies, education dummies, number of children dummies, year-by-month fixed effects, state fixed effects, demographics fixed effects, state-by-demographics fixed effects, state-by-year fixed effects. Standard errors in parentheses, clustered at the state level.