Modeling Employment Dynamics with State Dependence and Unobserved Heterogeneity

Supplementary Materials

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Appendix A: Monte Carlo Simulations I

Monte Carlo simulations are used to illustrate the poor numerical properties of the Maximum Likelihood estimator of the parameters of a dynamic mixed multinomial logit model in which there are unobserved individual characteristics that affect payoffs in only one year and have distributions containing unknown parameters which do not appear elsewhere in the distribution of unobservables. Further Monte Carlo simulations show that reliable parameter estimates are obtained if additional structure is imposed on the unobservables.

To maintain consistency, attention is restricted to the three state model of employment dynamics described in the main text, however similar results were obtained for static models and for models with more than three alternatives. The following specification of payoffs is adopted for $t = 3, ..., T$

$$\begin{aligned} V^f(\Omega_{i,t-1}, X_{i,t}, \varrho_{i,f,t}) - V^n(\Omega_{i,t-1}, X_{i,t}, \varrho_{i,n,t}) &= \gamma_{f,f-1}Y_{i,f,t-1} + \gamma_{f,p-1}Y_{i,p,t-1} + \gamma_{f,f-2}Y_{i,f,t-2} \\ &+\gamma_{f,p-2}Y_{i,p,t-2} + \beta_{f,0} + \beta_{f,1}X1_{i,t} + \beta_{f,2}X2_{i,t} + \eta_{i,f,t} + \xi_{i,f,t}, \quad (1a) \\ V^p(\Omega_{i,t-1}, X_{i,t}, \varrho_{i,p,t}) - V^n(\Omega_{i,t-1}, X_{i,t}, \varrho_{i,n,t}) &= \gamma_{p,f-1}Y_{i,f,t-1} + \gamma_{p,p-1}Y_{i,p,t-1} + \gamma_{p,f-2}Y_{i,f,t-2} \\ &+\gamma_{p,p-2}Y_{i,p,t-2} + \beta_{p,0} + \beta_{p,1}X1_{i,t} + \beta_{p,2}X2_{i,t} + \eta_{i,p,t} + \xi_{i,p,t}. \quad (1b) \end{aligned}$$

In the above $Y_{i,j,t}$ is an indicator of individual i being in employment state j at time t, and $X1_{i,t}$ and $X2_{i,t}$ are individual specific variables, constructed to be mutually independent, independent over time and individuals and to have standard normal distributions. Individuals' employment outcomes at $t = 1$ and $t = 2$ are determined randomly and are constructed to be independent of the unobservables that drive subsequent employment outcomes, thus allowing the initial conditions to be ignored. The unobservables $\xi_{i,j,t} = \epsilon_{i,j,t} - \epsilon_{i,n,t}$ for $j = f, p$, and $\epsilon_{i,j,t}$ for $j = f, p, n$ are assumed to be mutually independent, independent over time, independent over individuals and to have type I extreme value distributions. The first component of the unobservables $(\eta_{i,f,t}, \eta_{i,p,t})$ is assumed to be formed as follows

$$\eta_{i,f,t} = \nu_{i,f} + \textstyle\sum_{t=3}^{T} \pi_{i,f,t} I_t \quad \text{for} \quad t = 3, ..., T, \quad (2a)$$
$$\eta_{i,p,t} = \nu_{i,p} + \textstyle\sum_{t=3}^{T} \pi_{i,p,t} I_t \quad \text{for} \quad t = 3, ..., T, \quad (2b)$$

where $(\nu_{i,f}, \nu_{i,p})' \sim N(0, \Sigma)$, I_t for $t = 3, ..., T$ are time dummies and $(\pi_{i,f,t}, \pi_{i,p,t})$ for $t = 3, ..., T$ are random coefficients that are independent over time and individuals with $(\pi_{i,f,t}, \pi_{i,p,t})' \sim N(0, \Xi^t)$ for $t = 3, ..., T$. This specification of the unobservables allows the employment state-specific intercepts to include time invariant individual effects and additionally, via the random coefficients on the time dummies, allows the time-varying components of the unobservables to be correlated over choice alternative and hetroskedastic. When estimating this model, normalizations are imposed on $\Xi^t_{1,1}$ for $t = 3, ..., T$. Without such normalizations, scale identification relies on the slight difference in the shapes of the logistic and normal distributions (see Walker *et al.*, 2007). However, as explained in Section 3.3, even following these normalizations identification remains reliant on the functional form of the distribution of the unobservables. Excluding the random coefficients on the time dummies leads to a model which is nonparametrically identified provided that $T \geq 4$.

Monte Carlo simulations are conducted, first excluding random coefficients on the time dummies and then allowing random coefficient on the time dummies. For each of these two Monte Carlo simulations, the sample size is fixed at 3,000 individuals and we use $T = 4$. For each of the two specifications, 200 data sets were generated and Maximum Simulated Likelihood estimates obtained for each data set. The results are summarized in Table 1. In the simulations in which random

Parameter	Truth	Random Coef. on Time Dummies Excluded			Random Coef. on Time Dummies Permitted		
		E(parameter)	E(σ)	σ(parameter)	E(parameter)	E(σ)	σ(parameter)
$\gamma_{f,f-2}$	1	0.99	0.14	0.14	0.96	0.17	0.15
$\gamma_{f,p-2}$	0.5	0.48	0.14	0.13	0.49	0.22	0.25
$\gamma_{f,f-1}$	2	2.02	0.15	0.15	2.12	0.20	0.22
$\gamma_{f,p-1}$	1	1.00	0.14	0.14	1.11	0.32	0.45
$\beta_{f,0}$	-1	-1.00	0.17	0.18	-1.03	0.51	0.68
$\beta_{f,1}$	-0.8	-0.80	0.09	0.09	-0.78	0.23	0.31
$\beta_{f,2}$	0.5	0.50	0.07	0.07	0.48	0.14	0.18
$\gamma_{p,f-2}$	0.5	0.51	0.12	0.11	0.34	0.63	0.56
$\gamma_{p,p-2}$	1	0.99	0.13	0.11	1.71	2.19	1.76
$\gamma_{p,f-1}$	1	1.02	0.14	0.12	0.91	0.68	0.51
$\gamma_{p,p-1}$	2	2.01	0.12	0.13	3.60	4.63	3.82
$\beta_{p,0}$	0.5	0.50	0.13	0.13	0.41	0.49	0.43
$\beta_{p,1}$	1	1.01	0.08	0.08	2.59	4.63	3.85
$\beta_{p,2}$	-0.5	-0.51	0.06	0.06	-1.39	2.58	2.18
$\Sigma_{1,1}$	1	1.01	0.40	0.39	0.97	0.57	0.56
$\Sigma_{2,1}$	0.5	0.51	0.27	0.27	0.49	1.15	0.82
$\Sigma_{2,2}$	1	1.06	0.33	0.33	11.81	63.40	40.72
$\Xi^3_{1,1}$	4 [Fixed]	-	-	-	4	-	-
$\Xi^3_{2,1}$	1	-	-	-	-0.83	7.46	7.70
$\Xi^3_{2,2}$	2	-	-	-	59.19	314.23	171.98
$\Xi^4_{1,1}$	4 [Fixed]	-	-	-	4	-	-
$\Xi^4_{2,1}$	1	-	-	-	-0.40	6.46	6.10
$\Xi^4_{2,2}$	2	-	-	-	57.53	313.81	178.98
Average Iterations			4.18			38.41	
Maximum Iterations			10			200	

Notes: E(parameter) is the mean parameter estimate, E(σ) is the mean estimated standard error and σ(parameter) is the standard deviation of the parameter estimates over the 200 Monte Carlo replications. Maximum Simulated Likelihood estimation used 5,000 antithetic draws. The number of iterations was limited to 200.

Table 1: Monte Carlo simulations illustrating the empirical properties of the Maximum Likelihood estimator of the parameters of a dynamic mixed multinomial logit model with and without random coefficients on time dummies.

coefficients on time dummies are excluded, average parameter estimates correspond closely to their true values. Similarly, average standard errors are almost identical to the standard deviation of the parameter estimates. Convergence was obtained in all of the 200 Monte Carlo replications, and took an average of 4.18 iterations starting from the true parameter values. In contrast, the Monte Carlo results for the specification in which random coefficients on the time dummies are permitted reveal major problems. In many cases, the average coefficients on the explanatory variables differ substantially from their true values, and average standard errors bear little resemblance to the standard deviation of the parameter estimates. The estimates of the parameters of the covariance matrices reveal even greater problems: in many cases average variances are several times larger than their true values and average standard errors are huge. Furthermore, in around 10% of the Monte Carlo replications, convergence was not obtained within the first 200 iterations. The results of these Monte Carlo simulation are consistent with the findings of Keane (1992), who conducts a similar set of Monte Carlo simulations in a cross-sectional multinomial choice setting.

Appendix B: Monte Carlo Simulations II

Two further Monte Carlo simulations are conducted in order to establish the empirical properties of the Maximum Simulated Likelihood estimator in the context of dynamic mixed multinomial logit models in which the observed components of payoffs are as described by Equations (1a) and (1b) and the unobservables are as in Specifications V and VI, detailed in Section 3.4 of the main text (note that for the purpose of limiting the number of parameters in the Monte Carlo simulations we exclude correlated random effects but continue to allow time invariant employment state-specific intercepts). For each specification of unobservables, 200 data sets were generated, each with the same sample size, attrition pattern and distribution of the initial conditions as observed in the BHPS sample. In order to explore the how the simulation bias varies with R, the number of antithetic draws to evaluate the likelihood function, all simulations are conduced using R =500, 2,000 and 5,000.

Tables 2-3 summarize the coefficient estimates. For Specification V, which permits random coefficients but excludes autocorrelated unobservables, there is a close correspondence between the average coefficient estimates and the true values, and the average standard errors are close to the standard deviation of the parameter estimates. This is true for $R = 500$ as well as for higher values of R. However, when $R = 500$ there is evidence of biases in some of the parameters appearing in the distribution of the unobservables. In particular, some of the estimates of the variances of the random coefficients appear to be biased downwards. These biases are substantially reduced when R is increased to 2,000 and all but eliminated by using $R = 5,000$. The results for Specification VI, which features autocorrelated unobservables in addition to random coefficients, show that there are small biases, specifically up to 6% of the true parameter values, in the coefficient estimates when $R = 5,000$ is used. Similarly, with $R = 5,000$, there are downwards biases in many of the variance parameters appearing in the distribution of the unobservables. For both sets of parameters, lower values of R are associated with substantially larger biases.

Tables 6 and 7 show the impulse response functions for Specifications V and VI respectively, evaluated at the estimated parameter values and at the true parameter values. As described in Section 5.2 of the main text, the impulse response functions show the estimated dynamic response of labor supply to exogeneous shocks that move non-employed women into either full-time or part-time work. The shocks themselves last only one year and therefore behavior subsequent to the shock is affected only via the intertemporal dependencies present in labor supply behavior. For Specification V, which excludes autocorrelated unobservables, the estimated impulse response function obtained using 500 antithetic draws is never more than 0.4 of a percentage point away from the true impulse response function. Therefore, moderately large biases in the parameter estimates translate into very small biases in the estimated impulse response function. Increasing the number of antithetic draws to 2,000 tends to reduce the difference between the estimated and true impulse response functions, while a further increase to 5,000 antithetic draws leads to an additional, albeit small, decreased in the difference between the estimated and true impulse response functions.

The Monte Carlo simulations for Specification VI, which additionally includes autocorrelated unobservables, show that relying on only 500 antithetic draws for the Maximum Likelihood Estimation leads to an impulse response function that diverges by up to 2.2 percentage points from the true impulse response function. For example, an employment shock that temporarily moves non-employed women into full-time work decreases the rate of non-employment by 11.65 percentage points one year after the shock while the corresponding estimated effect is 13.84 percentage points. Increasing the number of antithetic draws to 2,000 approximately halves the magnitude of the difference between the estimated and true impulse response functions. A further increase to 5,000 antithetic draws leads to an additional reduction in the bias of the estimated impulse response function. However, even using 5,000 antithetic draws, which would generally be considered a large number of draws, there are some biases in the estimated impulse response functions, although such biases are tolerably small; using $R = 5,000$, the maximum bias in the estimated impulse response function is only 0.6 of a percentage point, and in relative terms the biases are around 3-6% of the corresponding true quantity.

VARIABLE	TRUTH		$R = 500$		$R = 2,000$		$R = 5,000$	
	f	p	f	p	f	p	f	p
$Y_{i,f,t-2}$	1.00	0.50	0.98 (0.11)[0.15]	0.47 (0.12)[0.10]	0.97 (0.12)[0.14]	0.47 (0.12)[0.13]	0.98 (0.13)[0.12]	0.48 (0.12)[0.12]
$Y_{i,p,t-2}$	0.50	1.00	0.46 (0.10)[0.12]	0.95 (0.14)[0.09]	0.49 (0.11)[0.11]	0.98 (0.11)[0.10]	0.49 (0.12)[0.11]	0.99 (0.11)[0.10]
$Y_{i,f,t-1}$	2.00	1.00	1.94 (0.12)[0.14]	0.94 (0.13)[0.11]	1.97 (0.13)[0.15]	0.98 (0.13)[0.14]	2.00 (0.14)[0.15]	1.00 (0.13)[0.15]
$Y_{i,p,t-1}$	1.00	2.00	0.97 (0.10)[0.16]	1.93 (0.15)[0.10]	0.99 (0.12)[0.13]	1.98 (0.11)[0.12]	1.00 (0.12)[0.13]	1.99 (0.12)[0.13]
$X1_{i,t}$	-0.80	1.00	-0.78 (0.04)[0.05]	0.97 (0.04)[0.04]	-0.79 (0.05)[0.05]	1.00 (0.05)[0.05]	-0.79 (0.05)[0.05]	1.01 (0.05)[0.05]
$X2_{i,t}$	0.50	-0.50	0.48 (0.04)[0.04]	-0.49 (0.04)[0.04]	0.50 (0.04)[0.04]	-0.50 (0.04)[0.04]	0.50 (0.04)[0.04]	-0.50 (0.04)[0.04]
INTERCEPT	-1.00	0.50	-1.01 (0.14)[0.14]	0.48 (0.11)[0.12]	-1.01 (0.15)[0.16]	0.49 (0.13)[0.14]	-1.00 (0.16)[0.15]	0.50 (0.13)[0.12]

Notes: Average standard errors are given in round brackets and the standard deviation of the parameter estimates is given in square brackets. Estimates of the parameters on the initial conditions are omitted. Columns headed f contain the coefficient describing payoffs from full-time employment and columns headed p contain the coefficients describing payoffs from part-time employment. Results are based on 200 Monte Carlo replications.

Table 2: Results of Monte Carlo simulations for Specification V: Estimates of coefficients in the observed component of payoffs.

VARIABLE	TRUTH		$R = 500$		$R = 2,000$		$R = 5,000$	
	f	p	f	p	f	p	f	p
$Y_{i,f,t-2}$	1.00	0.50	0.96 (0.10)[0.12]	0.48 (0.10)[0.12]	0.95 (0.12)[0.13]	0.48 (0.11)[0.12]	0.98 (0.12)[0.15]	0.49 (0.12)[0.14]
$Y_{i,p,t-2}$	0.50	1.00	0.44 (0.09)[0.11]	0.92 (0.09)[0.11]	0.47 (0.11)[0.11]	0.96 (0.10)[0.10]	0.48 (0.11)[0.13]	0.97 (0.11)[0.12]
$Y_{i,f,t-1}$	2.00	1.00	1.98 (0.11)[0.13]	1.01 (0.10)[0.12]	1.97 (0.13)[0.14]	1.00 (0.12)[0.12]	2.00 (0.14)[0.15]	1.00 (0.13)[0.14]
$Y_{i,p,t-1}$	1.00	2.00	0.99 (0.10)[0.12]	1.96 (0.09)[0.12]	1.00 (0.11)[0.13]	1.97 (0.11)[0.13]	1.00 (0.12)[0.13]	1.98 (0.12)[0.13]
$X1_{i,t}$	-0.80	1.00	-0.70 (0.04)[0.05]	0.94 (0.04)[0.05]	-0.75 (0.05)[0.07]	0.96 (0.05)[0.05]	-0.76 (0.06)[0.07]	0.98 (0.05)[0.06]
$X2_{i,t}$	0.50	-0.50	0.43 (0.04)[0.04]	-0.47 (0.04)[0.04]	0.46 (0.04)[0.05]	-0.48 (0.04)[0.04]	0.48 (0.04)[0.05]	-0.49 (0.04)[0.04]
INTERCEPT	-1.00	0.50	-1.02 (0.14)[0.15]	0.26 (0.13)[0.15]	-1.00 (0.16)[0.19]	0.37 (0.14)[0.15]	-0.99 (0.18)[0.19]	0.44 (0.15)[0.16]

Notes: See Table 2.

Table 3: Results of Monte Carlo simulations for Specification VI: Estimates of coefficients in the observed component of payoffs.

	TRUTH		$R = 500$		$R = 2,000$		$R = 5,000$	
$\Sigma_{Intercept\ 1}$	1	.	0.95 (0.19)[0.44]	.	0.99 (0.26)[0.38]	.	0.99 (0.30)[0.40]	.
	0.5	1	0.45 (0.13)[0.29]	0.92 (0.17)[0.33]	0.49 (0.19)[0.27]	0.99 (0.23)[0.33]	0.50 (0.22)[0.29]	1.00 (0.27)[0.31]
$\Sigma_{Y_{i,f,t-2}}$	1	.	0.72 (0.26)[0.42]	.	0.83 (0.32)[0.38]	.	0.95 (0.36)[0.39]	.
	0.5	1	0.28 (0.19)[0.32]	0.72 (0.24)[0.40]	0.35 (0.26)[0.33]	0.85 (0.32)[0.42]	0.44 (0.30)[0.33]	0.92 (0.37)[0.40]
$\Sigma_{Y_{i,p,t-2}}$	1	.	0.66 (0.23)[0.43]	.	0.87 (0.32)[0.33]	.	0.98 (0.35)[0.38]	.
	0.5	1	0.28 (0.17)[0.28]	0.78 (0.20)[0.29]	0.42 (0.23)[0.26]	0.92 (0.25)[0.29]	0.48 (0.25)[0.26]	0.97 (0.27)[0.28]
$\Sigma_{Y_{i,f,t-1}}$	1	.	0.69 (0.25)[0.46]	.	0.91 (0.34)[0.49]	.	0.98 (0.39)[0.41]	.
	0.5	1	0.28 (0.20)[0.35]	0.72 (0.25)[0.40]	0.42 (0.28)[0.38]	0.91 (0.35)[0.43]	0.50 (0.33)[0.39]	1.00 (0.40)[0.47]
$\Sigma_{Y_{i,p,t-1}}$	1	.	0.68 (0.24)[0.45]	.	0.89 (0.32)[0.39]	.	0.96 (0.36)[0.37]	.
	0.5	1	0.30 (0.17)[0.33]	0.79 (0.21)[0.32]	0.42 (0.24)[0.27]	0.93 (0.26)[0.32]	0.49 (0.26)[0.28]	1.00 (0.28)[0.29]
$\Sigma_{X1_{i,t}}$	1	.	0.89 (0.12)[0.13]	.	0.95 (0.13)[0.13]	.	0.96 (0.13)[0.14]	.
	0.5	1	0.42 (0.08)[0.09]	0.88 (0.10)[0.12]	0.47 (0.09)[0.09]	0.97 (0.11)[0.12]	0.47 (0.09)[0.10]	0.99 (0.12)[0.12]
$\Sigma_{X2_{i,t}}$	1	.	0.88 (0.11)[0.14]	.	0.97 (0.13)[0.13]	.	0.99 (0.13)[0.13]	.
	0.5	1	0.42 (0.08)[0.08]	0.89 (0.09)[0.10]	0.47 (0.09)[0.09]	0.97 (0.11)[0.11]	0.49 (0.09)[0.08]	0.99 (0.11)[0.11]

Notes: Average standard errors are given in round brackets and the standard deviation of the parameter estimates is given in square brackets. Results are based on 200 Monte Carlo replications.

Table 4: Results of Monte Carlo simulations for Specification V: Estimates of parameters in the distribution of unobservables.

	TRUTH		$R = 500$		$R = 2,000$		$R = 5,000$	
$\Sigma_{Intercept\ 1}$	1	.	0.79 (0.17)[0.49]	.	0.79 (0.24)[0.53]	.	0.82 (0.31)[0.53]	.
	0.5	1	0.37 (0.13)[0.32]	0.68 (0.16)[0.41]	0.39 (0.18)[0.35]	0.71 (0.24)[0.47]	0.41 (0.23)[0.35]	0.76 (0.31)[0.49]
$\Sigma_{Y_{i,f,t-2}}$	1	.	0.53 (0.21)[0.38]	.	0.79 (0.31)[0.36]	.	0.89 (0.35)[0.43]	.
	0.5	1	0.24 (0.16)[0.32]	0.68 (0.23)[0.40]	0.35 (0.25)[0.31]	0.80 (0.31)[0.42]	0.45 (0.30)[0.38]	0.94 (0.37)[0.47]
$\Sigma_{Y_{i,p,t-2}}$	1	.	0.53 (0.20)[0.37]	.	0.77 (0.30)[0.44]	.	0.43 (0.25)[0.29]	.
	0.5	1	0.23 (0.15)[0.24]	0.65 (0.18)[0.28]	0.37 (0.22)[0.30]	0.85 (0.25)[0.28]	0.91 (0.28)[0.31]	0.85 (0.37)[0.43]
$\Sigma_{Y_{i,f,t-1}}$	1	.	0.48 (0.21)[0.35]	.	0.71 (0.30)[0.43]	.	0.83 (0.34)[0.43]	.
	0.5	1	0.17 (0.17)[0.28]	0.54 (0.23)[0.37]	0.29 (0.25)[0.37]	0.75 (0.32)[0.48]	0.41 (0.25)[0.33]	0.90 (0.29)[0.34]
$\Sigma_{Y_{i,p,t-1}}$	1	.	0.43 (0.19)[0.36]	.	0.73 (0.30)[0.43]	.	0.90 (0.14)[0.15]	.
	0.5	1	0.17 (0.14)[0.27]	0.64 (0.19)[0.30]	0.37 (0.22)[0.32]	0.84 (0.26)[0.35]	0.45 (0.09)[0.10]	0.94 (0.12)[0.13]
$\Sigma_{x_{i,1,t}}$	1	.	0.71 (0.10)[0.12]	.	0.84 (0.13)[0.12]	.	0.91 (0.13)[0.14]	.
	0.5	1	0.36 (0.07)[0.08]	0.80 (0.09)[0.11]	0.42 (0.08)[0.09]	0.88 (0.11)[0.12]	0.45 (0.09)[0.10]	0.94 (0.12)[0.13]
$\Sigma_{x_{i,2,t}}$	1	.	0.71 (0.10)[0.10]	.	0.85 (0.12)[0.12]	.	0.99 (0.62)[0.75]	.
	0.5	1	0.35 (0.07)[0.08]	0.77 (0.09)[0.10]	0.42 (0.08)[0.08]	0.88 (0.11)[0.09]	0.45 (0.50)[0.54]	0.98 (0.63)[0.64]
ρ_f	0.7		0.80 (0.08)[0.23]		0.75 (0.08)[0.21]		0.74 (0.09)[0.13]	
ρ_p	0.8		0.90 (0.03)[0.07]		0.87 (0.04)[0.08]		0.83 (0.05)[0.09]	
$\Sigma_{\zeta 1,1}$	2		0.67 (0.10)[0.26]		1.30 (0.36)[0.74]		1.56 (0.48)[0.68]	
$\Sigma_{\zeta 2,1}$	0.7		0.65 (0.18)[0.50]		0.67 (0.10)[0.22]		0.68 (0.11)[0.19]	
$\Sigma_{\zeta 2,2}$	2		1.10 (0.22)[0.55]		1.63 (0.36)[0.60]		1.87 (0.45)[0.61]	

Notes: See Table 4.

Table 5: Results of Monte Carlo simulations for Specification VI: Estimates of parameters in the distribution of unobservables.

Employment State	Years since Employment Shock										
	1	2	3	4	5	6	7	8	9	10	11
	True dynamic responses										
	Non-employed moved into full-time work at $t = 2$										
Full-time	14.93	10.87	3.94	3.36	1.77	1.42	0.88	0.71	0.49	0.41	0.32
Part-time	-3.41	-4.60	-2.17	-2.32	-1.34	-1.14	-0.73	-0.61	-0.42	-0.36	-0.27
Non-employment	-11.51	-6.27	-1.77	-1.04	-0.43	-0.28	-0.15	-0.10	-0.06	-0.05	-0.05
	Non-employed moved into part-time work at $t = 2$										
Full-time	-3.56	-3.41	-1.47	-1.66	-0.90	-0.77	-0.45	-0.39	-0.29	-0.23	-0.18
Part-time	16.43	10.84	3.67	3.12	1.53	1.17	0.68	0.54	0.38	0.31	0.23
Non-employment	-12.87	-7.43	-2.20	-1.46	-0.63	-0.41	-0.23	-0.15	-0.09	-0.08	-0.05
	Estimated Dynamic responses $R = 500$										
	Non-employed moved into full-time work at $t = 2$										
Full-time	15.31	11.08	4.05	3.29	1.74	1.35	0.84	0.66	0.47	0.38	0.29
Part-time	-3.49	-4.56	-2.11	-2.24	-1.27	-1.10	-0.70	-0.58	-0.41	-0.35	-0.27
Non-employment	-11.82	-6.52	-1.94	-1.05	-0.46	-0.25	-0.14	-0.08	-0.05	-0.04	-0.02
	Non-employed moved into part-time work at $t = 2$										
Full-time	-3.28	-3.25	-1.36	-1.56	-0.83	-0.72	-0.43	-0.37	-0.27	-0.22	-0.16
Part-time	16.46	10.88	3.72	3.02	1.49	1.14	0.67	0.53	0.36	0.30	0.20
Non-employment	-13.18	-7.63	-2.36	-1.46	-0.66	-0.42	-0.23	-0.16	-0.09	-0.07	-0.04
	Estimated Dynamic responses $R = 2,000$										
	Non-employed moved into full-time work at $t = 2$										
Full-time	14.98	10.90	3.97	3.36	1.77	1.41	0.87	0.70	0.48	0.40	0.29
Part-time	-3.37	-4.59	-2.14	-2.34	-1.33	-1.14	-0.73	-0.62	-0.43	-0.37	-0.27
Non-employment	-11.61	-6.31	-1.83	-1.01	-0.45	-0.27	-0.14	-0.08	-0.05	-0.03	-0.02
	Non-employed moved into part-time work at $t = 2$										
Full-time	-3.47	-3.31	-1.41	-1.59	-0.85	-0.72	-0.44	-0.37	-0.28	-0.23	-0.17
Part-time	16.47	10.80	3.68	3.03	1.49	1.14	0.66	0.53	0.36	0.30	0.21
Non-employment	-13.00	-7.49	-2.26	-1.44	-0.63	-0.42	-0.22	-0.15	-0.09	-0.06	-0.04
	Estimated Dynamic responses $R = 5,000$										
	Non-employed moved into full-time work at $t = 2$										
Full-time	14.98	10.89	3.94	3.34	1.78	1.42	0.88	0.71	0.49	0.42	0.32
Part-time	-3.41	-4.61	-2.13	-2.30	-1.33	-1.13	-0.73	-0.61	-0.43	-0.37	-0.28
Non-employment	-11.57	-6.28	-1.81	-1.03	-0.45	-0.28	-0.15	-0.10	-0.06	-0.05	-0.04
	Non-employed moved into part-time work at $t = 2$										
Full-time	-3.52	-3.32	-1.42	-1.61	-0.86	-0.75	-0.44	-0.39	-0.29	-0.23	-0.18
Part-time	16.41	10.78	3.66	3.07	1.50	1.16	0.68	0.54	0.38	0.31	0.24
Non-employment	-12.90	-7.46	-2.24	-1.46	-0.64	-0.41	-0.23	-0.15	-0.09	-0.08	-0.05

Notes: Based on 200 Monte Carlo replications. All figures are percentage point changes for women affected by the employment shock.

Table 6: True and Estimated Impulse Response functions for Specification V using R=500, 2,000 and 5,000.

Employment State	Years since Employment Shock 1	2	3	4	5	6	7	8	9	10	11
True dynamic responses											
	Non-employed moved to full-time work at $t = 2$										
Full-time	14.40	10.25	3.45	2.96	1.48	1.23	0.71	0.55	0.38	0.31	0.25
Part-time	-2.75	-3.59	-1.55	-1.79	-1.03	-0.96	-0.64	-0.48	-0.36	-0.28	-0.21
Non-employment	-11.65	-6.66	-1.92	-1.18	-0.45	-0.27	-0.07	-0.07	-0.02	-0.03	-0.04
	Non-employed moved to part-time work at $t = 2$										
Full-time	-3.10	-2.07	-1.35	-1.40	-0.75	-0.62	-0.41	-0.33	-0.23	-0.16	-0.12
Part-time	16.00	10.98	3.76	3.09	1.47	1.04	0.63	0.45	0.28	0.23	0.18
Non-employment	-12.90	-7.91	-2.41	-1.69	-0.72	-0.43	-0.21	-0.12	-0.05	-0.07	-0.06
Estimated Dynamic responses $R = 500$											
	Non-employed moved to full-time work at $t = 2$										
Full-time	16.16	11.34	4.21	3.16	1.65	1.23	0.77	0.59	0.40	0.30	0.23
Part-time	-2.32	-3.34	-1.53	-1.71	-0.96	-0.84	-0.54	-0.45	-0.32	-0.24	-0.18
Non-employment	-13.84	-8.00	-2.68	-1.44	-0.69	-0.39	-0.23	-0.14	-0.08	-0.06	-0.05
	Non-employed moved to part-time work at $t = 2$										
Full-time	-2.88	-2.91	-1.22	-1.36	-0.72	-0.63	-0.37	-0.31	-0.22	-0.18	-0.13
Part-time	17.66	11.66	4.18	3.17	1.60	1.16	0.68	0.51	0.35	0.28	0.19
Non-employment	-14.78	-8.75	-2.97	-1.81	-0.88	-0.53	-0.32	-0.20	-0.13	-0.09	-0.06
Estimated Dynamic responses $R = 2,000$											
	Non-employed moved to full-time work at $t = 2$										
Full-time	15.16	10.57	3.84	3.06	1.60	1.21	0.73	0.57	0.37	0.32	0.23
Part-time	-2.53	-3.36	-1.53	-1.77	-1.00	-0.87	-0.55	-0.47	-0.31	-0.27	-0.19
Non-employment	-12.62	-7.21	-2.31	-1.29	-0.60	-0.35	-0.19	-0.11	-0.07	-0.05	-0.04
	Non-employed moved to part-time work at $t = 2$										
Full-time	-3.11	-2.92	-1.22	-1.40	-0.76	-0.64	-0.39	-0.32	-0.22	-0.18	-0.14
Part-time	16.88	11.26	3.96	3.13	1.55	1.14	0.67	0.49	0.34	0.26	0.19
Non-employment	-13.77	-8.34	-2.73	-1.73	-0.79	-0.50	-0.28	-0.18	-0.11	-0.08	-0.05
Estimated Dynamic responses $R = 5,000$											
	Non-employed moved to full-time work at $t = 2$										
Full-time	14.89	10.57	3.77	3.06	1.56	1.20	0.73	0.56	0.38	0.31	0.22
Part-time	-2.65	-3.55	-1.57	-1.79	-0.99	-0.86	-0.55	-0.46	-0.31	-0.26	-0.19
Non-employment	-12.24	-7.02	-2.20	-1.27	-0.57	-0.34	-0.18	-0.10	-0.07	-0.05	-0.03
	Non-employed moved to part-time work at $t = 2$										
Full-time	-3.08	-2.88	-1.23	-1.39	-0.74	-0.64	-0.39	-0.32	-0.23	-0.18	-0.14
Part-time	16.48	11.01	3.84	3.08	1.51	1.13	0.65	0.49	0.34	0.26	0.19
Non-employment	-13.40	-8.14	-2.61	-1.69	-0.77	-0.49	-0.27	-0.17	-0.11	-0.07	-0.05

Notes: See Table 6.

Table 7: True and Estimated Impulse response functions for Specification VI using R=500, 2,000 and 5,000.

Appendix C: Further Empirical Analysis

In this appendix, we present the results of further empirical analysis. Specifically, in Appendix C.1 we explore the robustness of our results to alternative empirical specifications. Meanwhile, in Appendix C.2 we investigate the impact of allowing correlated random effects on the estimated impulse response functions and on our estimates of the labor supply response to the birth of a child. Throughout this discussion, we refer to the specification of the payoffs, including the choice of explanatory variables, adopted in the main text as the "preferred specification".

C.1 Robustness Checks

Our preferred specification allows a correlation between the employment state-specific intercepts and the individual's observed time varying characteristics, specifically children and unearned income, via the correlated random effects. However, we maintain a strict exogeneity assumption. Fornally, we assume that the unobservables $(\{\xi_{i,j,t}, \varsigma_{i,j,t}\}_{t=3}^{T}, \omega_{i,j}, \pi_{i,j}, \psi_{i,j}, \widetilde{\nu}_{i,j})$ occur independently of $X_{i,s}$ and IC_i for all i, $j = f, p$ and $t, s = 3, ..., T$. In this appendix we explore the robustness of our empirical results to this strict exogeneity assumption. In particular, one may be concerned that there exist unobserved individual characteristics that affect both fertility and labor supply behavior, and which are not captured fully by the inclusion of the individual-specific time averages of the child-related variables, i.e., the correlated random effects. The same agrement may be constructed concerning unearned income. The presence of such variables would lead to bias in the coefficients on the child and unearned income variables and may also impact on the estimated impulse response functions and on other quantities that summarize the dynamic aspects of labor supply behavior.

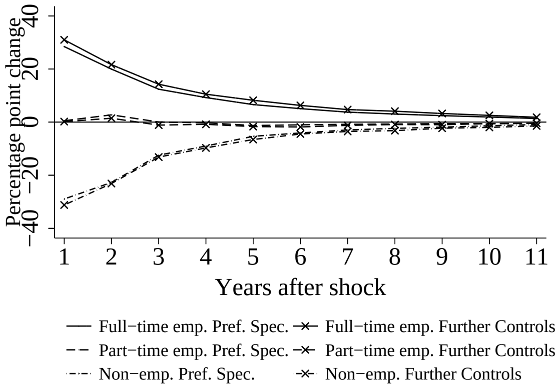
Against this backdrop, we reestimate our dynamic mixed multinomial logit model, including further controls for variables that may affect fertility and/or unearned income as well as labor supply behavior. Henceforth, we refer to this model as the "further controls" model. The further controls model is obtained by adding to the explanatory variables included in the preferred specification additional variables that measure religions denomination (two indicator variables - the first indicating catholic and the second indicating protestant) and also variables that describe the woman's attitude towards work and family (two indicator variables - the first indicating that the woman agrees with the statement "all in all, family life suffers when the woman has a full-time job" and the second indicating that woman agrees with the statement "both husband and wife should both contribute to the household income"). This variables were selected as further controls because they are plausible proxy variables for unobservables that may impact on both fertility and/or unearned income and labor supply behavior.

Figure 1 illustrates the impulse response functions obtained from the preferred specification and from the further controls model, in both cases using the Specification IV of the unobservable, as described in Section 3.4 of the main text. We see a very close correspondence between the estimated impulse response functions obtained from the preferred specification and the further controls model. This results is true for the sample average and for women with young children. Figure 2 shows that our estimates of labor supply dynamics following the birth of a child are also robust to adding further controls to the preferred specification.

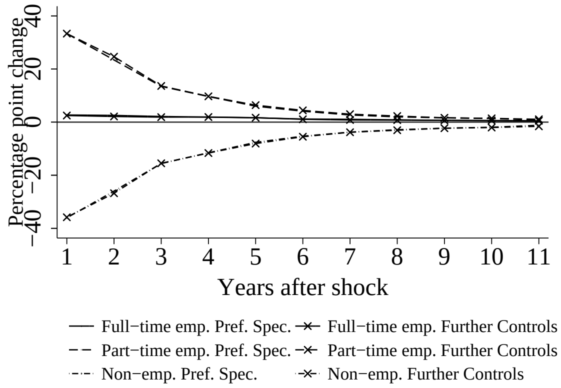
In Table 8 and Table 9 we explore the robustness of our conclusions concerning the specification of the unobservables to the inclusion of further control variables. We focus here on comparisons between Specifications II (time invariant random intercepts), IV (time invariant random intercepts and random coefficients); V (time invariant random intercepts and autocorrelation); and VI (time invariant random intercepts, random coefficients and autocorrelation). As for the preferred specification, we find that the further controls model implies higher own state dependencies in full-time employment when autocorrelation and random coefficients are permitted as compared to when only time invariant random intercepts are allowed. Similarly, according to both the preferred specification and the further controls model, the estimated own state dependencies for part-time employment are similar for Specifications II, IV and V of the unobservables, while Specification VI of the unobservables implies somewhat lower own state dependence in part-time employment. The cross state dependencies implied by the preferred specification and further controls model also show a close correspondence.

As a second robustness check we estimate a version of our dynamic labor supply model in which payoffs are reduced form in the potentially endogenous variables, specifically children and unearned income. In this model, henceforth referred to as the "reduced form" model, the observed component of payoffs are determined by education, age, common time effects and previous employment outcomes, but measures of fertility, and unearned income and excluded. We view the variables that are included in the reduced form model as potential determinants of fertility and unearned income, as well as possible drivers of labor supply behavior. This approach is discussed in the context of fertility by, for example, Mincer (1963) and Moffitt (1984). The reduced form approach allows us to extract entirely from concerns surrounding the possible endogeneity of fertility and unearned income, but has the obvious cost of precluding an analysis of the effects of child-related variables and unearned income on labor supply dynamics.

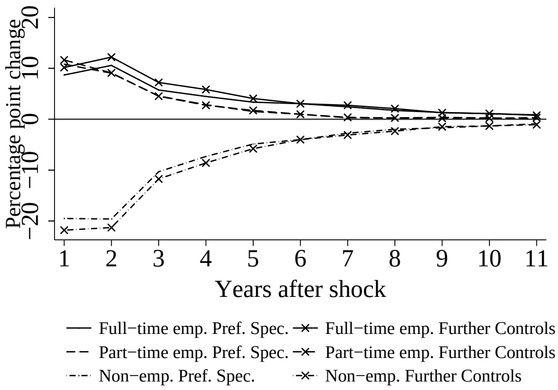
Table 3 shows that the estimated impulse response functions, which summarize how labor supply behavior responds to temporary employment shocks, obtained from the preferred specification and from the reduced form specification are rather similar. One relatively minor exception is that the reduced form model suggests a larger degree of own state dependence in full-time employment than does our preferred specification. However, given the markedly different nature of the explanatory variables included in the preferred specification and in the reduced form model, this difference may be considered satisfactorily small. Moreover, we do not find any such difference when the look at labor supply behavior following an employment shock that temporarily places non-employed women in part-time employment. Finally, we note that Table 8 and Table 9 show that our results concerning the impact of the specification of the unobservables on conclusions concerning the dynamics of labor supply behavior also continue of apply when we use the reduced form model.



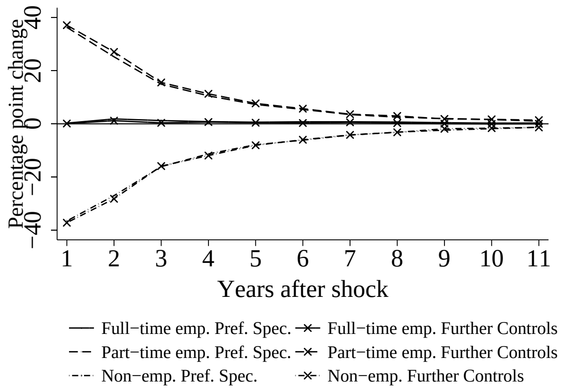
(a) Temporary shock moves non-employed women into full-time work: All women non-employed at $t = 0$.



(b) Temporary shock moves non-employed women into part-time work: All women non-employed at $t = 0$.



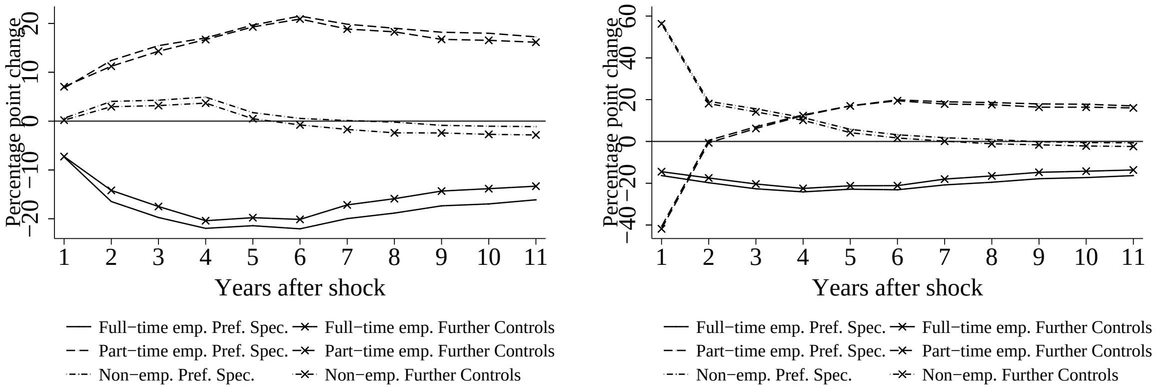
(c) Temporary shock moves non-employed women into full-time work: Women with young children non-employed at $t = 0$.



(d) Temporary shock moves non-employed women into part-time work: Women with young children non-employed at $t = 0$.

Notes: "Women with young children" refers to the women who gave birth to a child one year after the shock (i.e., at $t = 1$).

Figure 1: Robustness checks 1: Impulse response functions obtained from Specification VI estimated with explanatory variables as in the preferred specification and with further controls for family values and religious denomination.

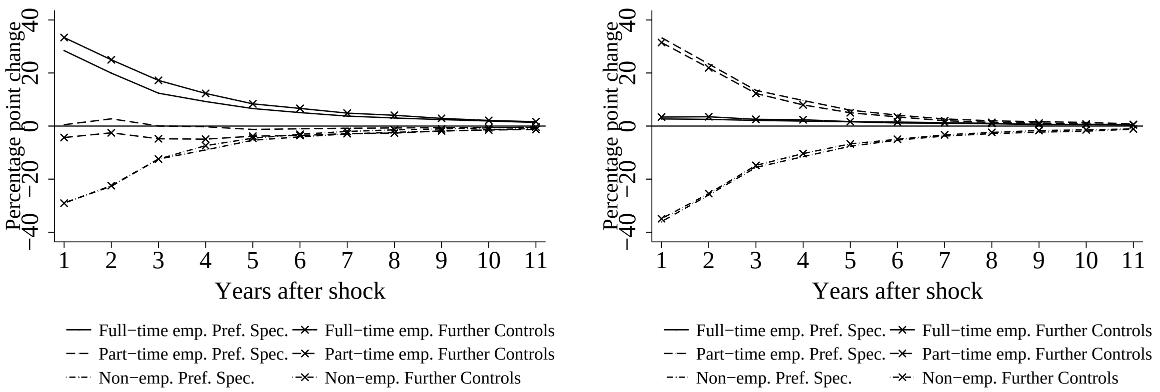


(a) Effect of having a child at $t = 1$ - High unobserved preference for full-time work.

(b) Effect of having a child at $t = 1$ - Low unobserved preference for full-time work.

Notes: High and low unobservables refer to the 90^{th} and 10^{th} percentiles of the distribution of unobservables. Other unobservables are drawn from the appropriate conditional distribution. Effects were estimated by averaging over the sample distribution of all observed individual characteristics, except children.

Figure 2: Robustness checks 3: Heterogeneity in labor supply dynamics after child birth from Specification VI estimated with explanatory variables as in the preferred specification and with further controls for family values and religious denomination.



(a) Temporary shock moves non-employed women into full-time work: All women non-employed at $t = 0$.

(b) Temporary shock moves non-employed women into part-time work: All women non-employed at $t = 0$.

Notes: See Figure 1.

Figure 3: Robustness checks 2: Impulse response functions obtained from Specification VI estimated with explanatory variables as in the preferred specification and via a model that is reduced form in children and unearned income.

Model	Years since Employment Shock										
	1	2	3	4	5	6	7	8	9	10	11
	Effect on Full-time Employment (Percentage Points)										
Sp. II: Preferred	20.63	15.90	9.81	7.67	5.59	3.86	2.49	1.63	1.12	0.76	0.46
Sp. II: Further Controls	21.54	15.19	9.71	7.27	5.54	4.22	2.79	1.83	1.63	1.07	0.66
Sp. II: Reduced Form	25.10	21.80	14.53	11.64	8.59	6.66	5.23	3.56	2.59	1.98	1.47
Sp. IV: Preferred	28.91	20.83	14.89	10.72	8.03	6.15	4.37	3.25	2.79	2.08	1.83
Sp. IV: Further Controls	26.88	18.9	11.43	7.83	5.39	4.17	2.69	1.98	1.47	0.91	0.86
Sp. IV: Reduced Form	30.28	23.93	16.26	10.42	7.52	5.44	3.96	2.59	2.34	1.73	1.22
Sp. V: Preferred	22.41	16.87	10.06	7.88	6.00	4.88	3.76	2.34	1.88	1.58	1.32
Sp. V: Further Controls	24.39	18.45	11.38	8.69	6.81	5.64	4.01	2.85	2.39	2.08	1.52
Sp. V: Reduced Form	26.32	21.65	14.38	10.87	8.13	6.30	4.62	3.86	2.79	1.88	1.47
Sp. VI: Preferred	28.46	19.97	12.40	9.25	6.61	5.08	3.76	3.05	2.44	1.93	1.37
Sp. VI: Further Controls	31.00	21.65	14.28	10.52	8.23	6.30	4.73	4.12	3.25	2.54	1.83
Sp. VI: Reduced Form	33.38	25.00	17.23	12.30	8.38	6.66	4.88	4.07	2.90	2.13	1.63
	Effect on Part-time Employment (Percentage Points)										
Sp. II: Preferred	7.57	8.28	4.42	2.85	0.97	1.17	0.86	0.61	0.46	0.51	0.41
Sp. II: Further Controls	8.54	8.99	4.52	2.44	1.42	1.32	0.91	0.46	0.61	0.41	0.36
Sp. II: Reduced Form	0.97	-0.56	-2.59	-2.59	-3.00	-2.39	-2.34	-1.42	-1.32	-1.27	-0.97
Sp. IV: Preferred	5.69	9.10	3.56	3.25	1.37	0.91	0.36	0.36	-0.15	-0.05	-0.41
Sp. IV: Further Controls	3.66	6.05	2.69	2.74	1.37	1.17	0.76	0.86	0.86	0.56	0.15
Sp. IV: Reduced Form	-3.46	-0.15	-4.22	-3.30	-3.46	-2.85	-2.24	-1.27	-1.32	-1.12	-1.02
Sp. V: Preferred	8.03	7.27	4.17	1.47	0.30	0.25	-0.30	-0.05	-0.10	-0.20	-0.25
Sp. V: Further Controls	7.47	6.10	3.30	1.37	-0.15	-0.36	-0.41	-0.46	-0.25	-0.25	-0.36
Sp. V: Reduced Form	0.76	-0.56	-2.34	-2.44	-2.74	-2.59	-2.08	-2.13	-1.78	-1.22	-0.91
Sp. VI: Preferred	0.51	2.74	0.05	-0.25	-1.27	-1.02	-0.81	-0.71	-0.56	-0.56	-0.46
Sp. VI: Further Controls	0.20	1.47	-1.12	-0.81	-1.68	-1.83	-1.22	-0.91	-0.97	-0.56	-0.41
Sp. VI: Reduced Form	-4.32	-2.54	-4.78	-4.93	-3.81	-3.56	-2.85	-2.64	-1.83	-1.47	-1.27
	Effect on Non-employment (Percentage Points)										
Sp. II: Preferred	-28.20	-24.19	-14.23	-10.52	-6.55	-5.03	-3.35	-2.24	-1.58	-1.27	-0.86
Sp. II: Further Controls	-30.08	-24.19	-14.23	-9.71	-6.96	-5.54	-3.71	-2.29	-2.24	-1.47	-1.02
Sp. II: Reduced Form	-26.07	-21.24	-11.94	-9.04	-5.59	-4.27	-2.90	-2.13	-1.27	-0.71	-0.51
Sp. IV: Preferred	-34.60	-29.93	-18.45	-13.97	-9.40	-7.06	-4.73	-3.61	-2.64	-2.03	-1.42
Sp. IV: Further Controls	-30.54	-24.95	-14.13	-10.57	-6.76	-5.34	-3.46	-2.85	-2.34	-1.47	-1.02
Sp. IV: Reduced Form	-26.83	-23.78	-12.04	-7.11	-4.07	-2.59	-1.73	-1.32	-1.02	-0.61	-0.20
Sp. V: Preferred	-30.44	-24.14	-14.23	-9.35	-6.30	-5.13	-3.46	-2.29	-1.78	-1.37	-1.07
Sp. V: Further Controls	-31.86	-24.54	-14.68	-10.06	-6.66	-5.28	-3.61	-2.39	-2.13	-1.83	-1.17
Sp. V: Reduced Form	-27.08	-21.09	-12.04	-8.43	-5.39	-3.71	-2.54	-1.73	-1.02	-0.66	-0.56
Sp. VI: Preferred	-28.96	-22.71	-12.45	-8.99	-5.34	-4.07	-2.95	-2.34	-1.88	-1.37	-0.91
Sp. VI: Further Controls	-31.20	-23.12	-13.16	-9.71	-6.55	-4.47	-3.51	-3.20	-2.29	-1.98	-1.42
Sp. VI: Reduced Form	-29.07	-22.46	-12.45	-7.37	-4.57	-3.10	-2.03	-1.42	-1.07	-0.66	-0.36

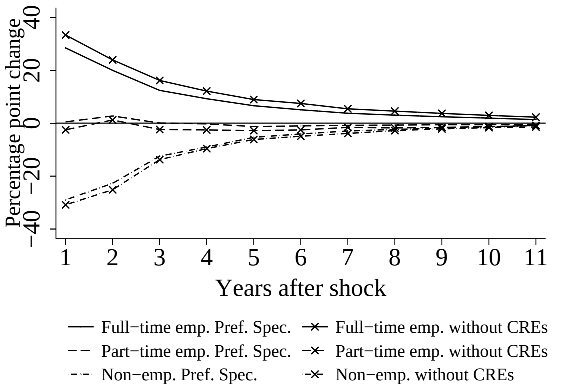
Table 8: Impulse response functions for a temporary shock that moves non-employed women into full-time work. Results are presented for Specifications II, IV, V and VI of the unobservables and estimated: using the preferred specification of the explanatory variables; with further controls for family values and religious denomination; and via a reduced form specification of the explanatory variables.

Model	Years since Employment Shock										
	1	2	3	4	5	6	7	8	9	10	11
Effect on Full-time Employment (Percentage Points)											
Sp. II: Preferred	2.59	2.64	2.49	2.54	1.78	1.42	1.07	0.86	0.71	0.41	0.10
Sp. II: Further Controls	2.74	2.69	2.18	1.88	1.63	1.32	0.86	0.81	1.22	0.61	0.25
Sp. II: Reduced Form	3.40	4.42	3.35	3.25	2.13	1.98	1.73	1.37	0.91	0.51	0.30
Sp. IV: Preferred	3.35	2.44	3.00	2.29	2.08	1.52	1.32	0.97	0.76	0.76	0.61
Sp. IV: Further Controls	2.54	2.44	2.18	1.93	1.58	1.47	1.32	1.12	0.71	0.61	0.46
Sp. IV: Reduced Form	3.20	3.20	3.00	2.13	1.78	1.37	1.02	0.76	0.66	0.46	0.51
Sp. V: Preferred	1.98	1.93	1.98	1.83	1.47	0.97	0.86	0.36	0.15	0.20	0.30
Sp. V: Further Controls	2.64	2.18	2.18	1.88	1.42	1.27	0.91	0.61	0.56	0.41	0.51
Sp. V: Reduced Form	3.56	4.17	3.46	2.69	1.98	1.73	1.27	1.27	0.76	0.41	0.20
Sp. VI: Preferred	2.69	2.54	2.13	1.88	1.63	1.17	1.07	0.86	0.66	0.56	0.36
Sp. VI: Further Controls	2.49	2.13	1.88	1.93	1.68	1.07	0.81	0.76	0.66	0.61	0.51
Sp. VI: Reduced Form	3.40	3.51	2.54	2.39	1.68	1.52	1.27	1.02	0.56	0.66	0.61
Effect on Part-time Employment (Percentage Points)											
Sp. II: Preferred	38.57	27.85	16.26	10.77	6.55	4.67	3.05	2.18	1.63	1.32	1.02
Sp. II: Further Controls	39.58	28.56	16.72	10.72	7.16	4.67	3.30	2.03	1.32	1.07	0.76
Sp. II: Reduced Form	36.33	25.61	14.28	9.10	5.69	3.20	1.88	0.91	0.61	0.46	0.51
Sp. IV: Preferred	39.28	29.67	17.43	12.55	8.59	5.84	3.20	2.64	2.03	1.12	0.56
Sp. IV: Further Controls	35.82	26.32	14.89	9.91	6.40	4.22	2.44	2.03	1.83	1.07	0.56
Sp. IV: Reduced Form	32.11	24.09	11.84	8.38	4.57	3.05	1.83	1.02	0.51	0.25	-0.05
Sp. V: Preferred	39.63	28.91	17.73	11.53	7.83	6.30	4.17	3.30	2.54	2.13	1.58
Sp. V: Further Controls	39.33	28.91	17.68	11.64	8.38	5.74	3.86	3.00	2.29	1.78	1.02
Sp. V: Reduced Form	35.92	25.56	14.63	9.30	6.61	4.17	2.95	1.78	1.22	1.07	1.02
Sp. VI: Preferred	33.33	23.42	13.47	9.65	6.00	4.12	2.69	1.98	1.63	1.37	0.81
Sp. VI: Further Controls	33.33	24.64	13.62	9.71	6.40	4.42	3.00	2.29	1.63	1.42	1.07
Sp. VI: Reduced Form	31.50	21.95	12.30	7.98	5.03	3.46	2.03	1.37	1.12	0.76	0.46
Effect on Non-employment (Percentage Points)											
Sp. II: Preferred	-41.16	-30.49	-18.75	-13.31	-8.33	-6.10	-4.12	-3.05	-2.34	-1.73	-1.12
Sp. II: Further Controls	-42.33	-31.25	-18.90	-12.60	-8.79	-6.00	-4.17	-2.85	-2.54	-1.68	-1.02
Sp. II: Reduced Form	-39.74	-30.03	-17.63	-12.35	-7.83	-5.18	-3.61	-2.29	-1.52	-0.97	-0.81
Sp. IV: Preferred	-42.63	-32.11	-20.43	-14.84	-10.67	-7.37	-4.52	-3.61	-2.79	-1.88	-1.17
Sp. IV: Further Controls	-38.36	-28.76	-17.07	-11.84	-7.98	-5.69	-3.76	-3.15	-2.54	-1.68	-1.02
Sp. IV: Reduced Form	-35.32	-27.29	-14.84	-10.52	-6.35	-4.42	-2.85	-1.78	-1.17	-0.71	-0.46
Sp. V: Preferred	-41.62	-30.84	-19.72	-13.36	-9.30	-7.27	-5.03	-3.66	-2.69	-2.34	-1.88
Sp. V: Further Controls	-41.97	-31.10	-19.87	-13.52	-9.81	-7.01	-4.78	-3.61	-2.85	-2.18	-1.52
Sp. V: Reduced Form	-39.48	-29.73	-18.09	-11.99	-8.59	-5.89	-4.22	-3.05	-1.98	-1.47	-1.22
Sp. VI: Preferred	-36.03	-25.97	-15.60	-11.53	-7.62	-5.28	-3.76	-2.85	-2.29	-1.93	-1.17
Sp. VI: Further Controls	-35.82	-26.78	-15.50	-11.64	-8.08	-5.49	-3.81	-3.05	-2.29	-2.03	-1.58
Sp. VI: Reduced Form	-34.91	-25.46	-14.84	-10.37	-6.71	-4.98	-3.30	-2.39	-1.68	-1.42	-1.07

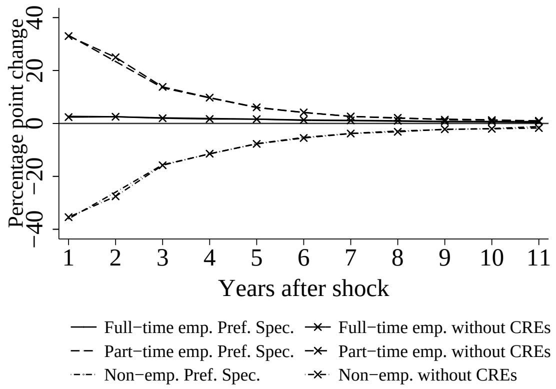
Table 9: Impulse response functions for a temporary shock that moves non-employed women into part-time work. Results are presented for Specifications II, IV, V and VI of the unobservables and estimated: using the preferred specification of the explanatory variables; with further controls for family values and religious denomination; and via a reduced form specification of the explanatory variables.

C.2 Role of the Correlated Random Effects

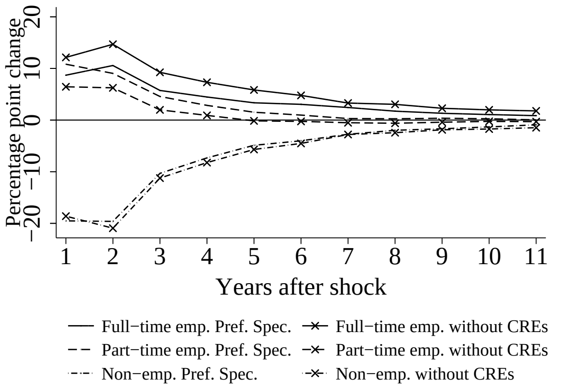
Finally, we investigate the impact of allowing correlated random effects. Figure 4 shows the estimated impulse response functions and estimated labor supply responses to the birth of a child, based on the preferred specification and on an alternative specification in which correlated random effects are excluded. In both cases, we use Specification VI of the unobservables, as described in Section 3.4 of the main text. We find that labor supply behavior following a temporary shock that moves non-employed women into full-time work is somewhat sensitive to the inclusion of correlated random effects. In particular, the omission of correlated random effects leads to an overstatement of the own state dependence in full-time employment. In addition, we find that estimates of labor supply behavior following the birth of a child are also dependent on whether or not correlated random effects are permitted. Specifically, the omission of correlated random effects leads to an understatement of the rate of part-time employment and an overstatement of the rate of full-time employment following the birth of a child, with the sensitivity to the inclusion of correlated random effects being larger for women with a high unobserved preference for full-time work in the event that they have a young child than for women with an low unobserved preference for full-time work in the event that they have a young child.



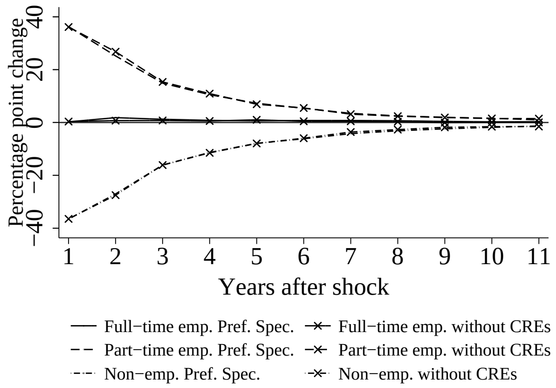
(a) Temporary shock moves non-employed women into full-time work: All women non-employed at $t = 0$.



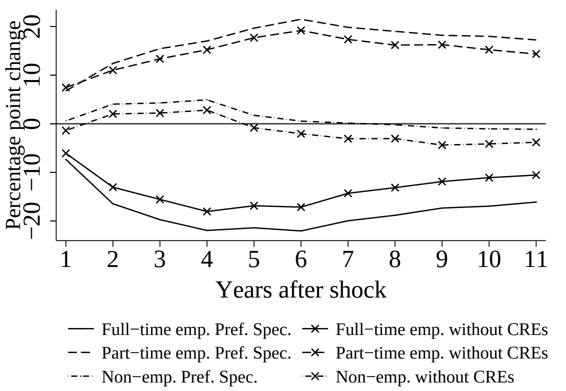
(b) Temporary shock moves non-employed women into part-time work: All women non-employed at $t = 0$.



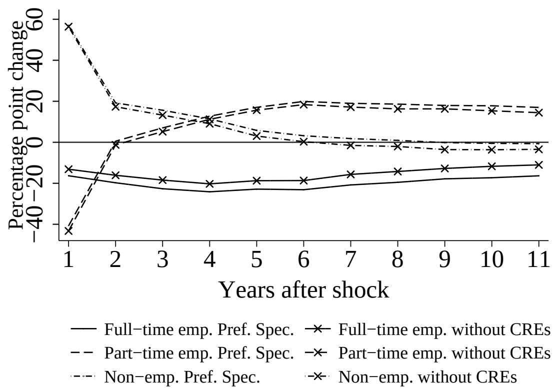
(c) Temporary shock moves non-employed women into full-time work: Women with young children non-employed at $t = 0$.



(d) Temporary shock moves non-employed women into part-time work: Women with young children non-employed at $t = 0$



(e) Effect of having a child at $t = 1$ - High unobserved preference for full-time work.



(f) Effect of having a child at $t = 1$ - Low unobserved preference for full-time work.

Notes: See Figure 1 and Figure 3.

Figure 4: Behavioral effect of allowing correlated random effects (CREs).

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