

Appendix C from Guvenen et al., “The Nature of Countercyclical Income Risk”

(JPE, vol. 122, no. 3, p. 621)

Details of the Parametric Estimation in Section VII

This appendix describes the method of simulated moments (MSM) estimation of the parameters of the income process described in Section VII. Our empirical targets are the detrended values of (i) the mean, (ii) P90, (iii) P50, and (iv) P10 of 1-, 3-, and 5-year log earnings changes between 1979 and 2011, which add up to 372 moments. Specifically, we estimate the mean and selected percentiles of $y_{it} - y_{i,t-k}$ for the US data for $t = 1978 + k, \dots, 2011$ and $k = 1, 3, 5$, where y_{it} is subject to the selection criteria discussed in Section II. During our sample period, there are secular trends in some of these statistics—in particular, in P90 and P10. Thus, we detrend each data series so as not to confound cyclical and secular changes by fitting a linear time trend and rescaling the residuals by the sample average of that series. The resulting data moments are reported in table C1.

Let m_n be one of these data moments, where $n = 1, \dots, N$, with $N = 372$, and let $d_n(\theta, X_r)$ be the corresponding model moment that is simulated for a given vector of parameters, θ , and a given vector of random variables X_r . When computing the model moments, we simulate the model R times and average $d_n(\theta, X_r)$ over these runs, that is,

$$d_n^R(\theta) = \frac{1}{R} \left[\sum_{r=1}^R d_n(\theta, X_r) \right],$$

which helps smooth the objective surface. We used $R = 4$.

In each run r , we simulate the entire earnings histories of 1,500 individuals in each cohort, who enter the labor market at age 25 and retire at age 60. To ensure a stationary age distribution, the first and last cohorts enter the labor market in 1944 and 2010, respectively. For the cohorts who entered the labor market before 1978, we specify the following years as recession years: 1945, 1949, 1953, 1957, 1960, 1970, 1974, and 1975. With the exception of 1975, these are the same recession years as in Storesletten et al. (2004). Each individual is assumed to enter the labor market in year t with initial condition $z_{i,t-1} = 0$.

We minimize the “scaled” deviation between each data target and the corresponding simulated model moment. Specifically, define

$$F_n(\theta) = \frac{d_n^R(\theta) - m_n}{|m_n| + \gamma_n},$$

where γ_n is an adjustment factor. When $\gamma_n = 0$ and m_n is positive, F_n is simply the percentage deviation between data and model moments. This measure becomes problematic when the data moment is very close to zero, which is the case for the mean and the P50 moments. In this case, we choose γ_n such that the denominator is, on average, equal to the sample average of the P90 moment, so that each data series receives similar weights in the estimation. Then the MSM estimator is the solution to

$$\min_{\theta} F(\theta)' WF(\theta), \tag{C1}$$

where $F(\theta) = [F_1(\theta), \dots, F_N(\theta)]$. We set W to be an identity matrix (since F_n already contains appropriately scaled moments). We employ a global optimization routine to perform the minimization in (C1) described in further detail in Guvenen (2013). The local minimization stage is performed with the derivative-free least-squares algorithm of Zhang, Conn, and Scheinberg (2010).

Table C1. Data Used for Estimation in Section VII

YEAR	MEAN			SKEWNESS			P10			P50			P90		
	1-Year	3-Year	5-Year	1-Year	3-Year	5-Year	1-Year	3-Year	5-Year	1-Year	3-Year	5-Year	1-Year	3-Year	5-Year
1978	.98	-.15	-1.54	-.16	-.24	-.36	-46.39	-69.59	-87.52	.77	1.46	3.36	46.31	62.73	68.72
1979	-3.23	-3.66	2.76	-.37	-.45	-.42	-49.10	-73.65	-73.22	-.78	1.13	6.04	34.88	54.41	70.72
1980	1.90	-.14	9.32	-.32	-.56	-.32	-38.88	-67.76	-62.34	1.62	4.26	10.08	48.43	58.80	79.97
1981	-3.36	3.35	10.64	-.60	-.47	-.30	-57.07	-62.33	-64.87	1.23	6.03	11.45	37.18	64.27	86.60
1982	.49	10.23	14.72	-.53	-.18	-.17	-45.22	-50.52	-56.77	2.00	8.27	12.87	42.79	75.64	90.46
1983	6.44	13.46	17.85	-.17	-.09	-.07	-33.51	-48.73	-52.54	3.42	9.60	13.21	57.64	86.17	100.85
1984	4.33	8.97	11.70	-.09	-.14	-.12	-39.52	-55.11	-59.04	2.99	7.51	9.40	53.15	74.97	87.01
1985	3.61	8.43	8.86	-.30	-.20	-.29	-43.58	-55.45	-63.33	3.09	6.35	8.54	52.97	77.72	81.91
1986	1.72	4.97	5.06	-.25	-.21	-.27	-46.88	-60.98	-72.87	1.90	3.97	6.09	48.50	70.37	79.45
1987	3.80	4.56	6.92	-.20	-.36	-.26	-39.25	-58.33	-67.35	1.60	4.51	7.46	54.53	67.60	81.09
1988	.57	.62	6.37	-.30	-.39	-.28	-46.23	-69.29	-72.78	.99	3.31	7.49	45.38	62.97	83.40
1989	1.02	3.31	7.19	-.53	-.37	-.36	-43.42	-62.57	-64.60	2.08	5.30	9.14	43.15	65.12	74.95
1990	-1.33	5.13	9.60	-.37	-.22	-.21	-49.13	-60.22	-60.62	.72	5.11	9.58	40.58	71.87	79.67
1991	2.96	7.75	14.14	-.31	-.29	-.18	-41.98	-53.99	-55.27	2.74	7.20	12.30	49.34	70.16	87.56
1992	3.32	8.34	17.14	-.28	-.26	-.08	-43.32	-53.75	-52.67	2.00	7.07	13.76	56.02	73.03	94.84
1993	2.00	8.97	20.79	-.38	-.22	.00	-47.38	-57.41	-51.86	2.67	7.91	16.71	47.37	74.94	100.87
1994	3.85	13.55	23.52	-.22	-.02	.06	-36.43	-43.24	-41.27	2.60	9.64	18.08	48.12	80.05	101.18
1995	3.89	16.74	24.18	-.27	.04	.04	-36.38	-39.19	-41.43	2.89	12.10	18.93	47.26	83.81	101.94
1996	6.39	17.37	23.11	-.05	.04	-.02	-33.35	-38.83	-45.68	4.02	12.76	18.47	52.51	84.25	104.04
1997	7.08	15.43	15.58	-.10	-.07	-.33	-34.01	-43.28	-59.54	4.97	12.02	15.43	53.98	81.62	91.43
1998	4.46	10.96	10.23	-.21	-.22	-.44	-38.40	-53.03	-68.05	3.61	9.32	11.96	49.28	79.55	85.59
1999	4.38	5.02	8.03	-.20	-.52	-.48	-37.79	-62.62	-67.08	3.32	7.13	10.43	49.22	68.16	78.09
2000	1.98	1.80	5.55	-.39	-.63	-.49	-45.24	-68.25	-67.90	2.37	5.46	7.98	49.58	64.76	74.10
2001	-2.31	1.68	6.46	-.74	-.53	-.37	-57.81	-69.97	-69.74	1.85	5.33	8.10	41.02	62.49	77.55
2002	.61	5.55	10.84	-.39	-.20	-.14	-48.40	-58.48	-61.26	1.68	4.97	9.14	47.38	69.87	86.55
2003	2.23	8.10	9.64	-.27	-.09	-.10	-45.38	-55.43	-65.42	2.31	5.80	8.14	48.91	75.69	86.63
2004	2.20	8.48	2.81	-.21	-.11	-.31	-40.23	-51.78	-76.88	1.10	5.69	5.29	48.16	75.71	76.57
2005	3.39	5.80	3.00	-.17	-.18	-.31	-38.85	-57.00	-74.61	2.18	4.98	5.45	48.90	70.55	74.62
2006	2.53	-2.49	2.43	-.24	-.48	-.26	-41.27	-75.75	-72.69	2.03	2.43	4.30	47.96	59.49	73.01
2007	-.93	-2.97		-.34	-.46		-48.03	-74.01		.53	1.44		42.80	57.07	
2008	-6.41	.41		-.89	-.36		-62.53	-63.86		.12	2.20		35.12	60.45	
2009	1.48			-.25			-42.15			1.02			46.58		
2010	3.46			-.03			-36.76			1.10			50.36		

NOTE.—Entries for mean, P10, P50, and P90 have been multiplied by 100.

Additional References

- Gottschalk, P., and M. Huynh. 2010. "Are Earnings Inequality and Mobility Overstated? The Impact of Non-classical Measurement Error." *Rev. Econ. and Statis.* 92 (2): 302–15.
- Guvenen, F. 2013. "Quantitative Economics with Heterogeneity: An A-to-Z Guidebook." Manuscript, Univ. Minnesota.
- Zhang, H., A. R. Conn, and K. Scheinberg. 2010. "A Derivative-Free Algorithm for Least-Squares Minimization." *SIAM J. Optimization* 20 (6): 3555–76.