AJAE APPENDIX FOR

"JOINT ESTIMATION OF RISK PREFERENCES AND TECHNOLOGY:

FLEXIBLE UTILITY OR FUTILITY?"

Sergio H. Lence

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Estimation of the Probability Density Function of Initial Wealth

The initial wealth pdf (6) is estimated using the balanced panel employed by Hart and Lence (2004), which contains annual initial wealth observations for 317 Iowa farms over the period 1991 through 1998. Since monetary data in the simulation model are scaled by setting unconditional mean prices equal to unity, the 2350 strictly positive initial wealth observations in the panel are multiplied by the ratio 7/73788 to obtain scaled initial wealth values. In the scaling ratio, the numerator 7 equals the approximate median costs (i.e., $median(\boldsymbol{r}\ \boldsymbol{x}^*)$) for the CRRA simulations (which do not depend on initial wealth data), whereas the denominator 73788 is the median operating expense (i.e., the real-world data analog of $median(\boldsymbol{r}\ \boldsymbol{x}^*)$) for the strictly positive initial wealth observations.

A strictly positive lower bound $\underline{W}_0$ is necessary to conduct DRRA simulations, as HARA utility (3) requires $\gamma_0 + W_0 > 0$, and DRRA entails $\gamma_0 < 0$. For the DRRA scenario, we fix $\gamma_1 = 1$ to clearly differentiate it from its CRRA counterpart and to provide a useful benchmark (see "Calibration" subsection), and set γ_0 at the value that yields a mean value of $R(W_0)$ equal to 3 for the estimated $Beta(\cdot)$ pdf for W_0. Since such γ_0 value must satisfy the restriction $\underline{W}_0 > -\gamma_0$, we simultaneously calculate $\underline{W}_0$ and γ_0 by means of the following iterative procedure:

Step 1. Set iteration counter at $j = 1$.

Step 2. Obtain a sample of $2350 - 2\,j$ observations with lower bound $\underline{W}_0^{(j)}$ and upper bound $\overline{W}_0^{(j)}$, by discarding the smallest j and the largest j observations on scaled initial wealth (so that the sample median stays constant).

Step 3. Use the sample from Step 2 to estimate the standard beta pdf $Beta(\cdot)^{(j)}$ via maximum likelihood, by means of the "betafit" function in MATLAB version 7.0.4.365.

Step 4. Given $Beta(\cdot)^{(j)}$, $\underline{W}_0^{(j)}$, and $\overline{W}_0^{(j)}$, calculate $R^{(j)} = mean[R(W_0)|\gamma_0^{(j)} = 0.5 - \underline{W}_0^{(j)}, \gamma_1 = 1]$.

Step 5. If $R^{(j)} > 3$ (note that $R^{(j)} < R^{(j-1)}\ \forall\ j$), stop and fix $\underline{W}_0 = \underline{W}_0^{(j)}$, $\overline{W}_0 = \overline{W}_0^{(j)}$, $Beta(\cdot) = Beta(\cdot)^{(j)}$, and $\gamma_0 = \gamma_0^{(j)}$. Otherwise, set $j = j + 1$ and go back to Step 2.

In the present sample, iterations stop at j = 720. It should be clear that the only way to stop at a smaller j while having a mean value of $R(W_0) = 3$ is by adopting a DRRA parameterization more similar to the CRRA scenario (i.e., by setting the DRRA [γ_0, γ_1] closer to [0, 3]).

Estimation of the Probability Density Function of Output Shocks

The probability distribution of $\tilde{e}_y$ is derived from Hart and Lence's (2004) balanced panel, which has annual corn yields for 407 Iowa farms from 1991 through 1998. For each farm, standardized yields are calculated by dividing actual yields by the farm's average yield. Standardized yields are then pooled across all farms to obtain a sample of 3256 observations used to obtain the vector [$e_{y,0.5}$, $e_{y,1.5}$, ..., $e_{y,98.5}$, $e_{y,99.5}$], where $e_{y,q}$ is the qth quantile of standardized yields. The probability distribution of $\tilde{e}_y$ for the medium-variance scenario consists of [$e_{y,0.5}$, $e_{y,1.5}$, ..., $e_{y,98.5}$, $e_{y,99.5}$], with probabilities $[\pi^M_{y,0.5}, \pi^M_{y,1.5}, ..., \pi^M_{y,98.5}, \pi^M_{y,99.5}]$ = [0.01, 0.01, ..., 0.01, 0.01].

For the low- and high-variance scenarios, Prelec's (1998) probability weighting function is used to assign the probabilities $\pi^L_{y,q}$ and $\pi^H_{y,q}$ corresponding to $e_{y,q}$. For the low-variance case, the distribution of $\tilde{e}_y$ is given by $e_{y,q}$ with probability $\pi^L_{y,q} \equiv \pi(q + 0.5; \phi^L_1, \phi^L_2) - \pi(q - 0.5; \phi^L_1, \phi^L_2)$ for $\pi(q; \phi_1, \phi_2) \equiv exp\{-[-ln(q/100)/\phi_1]^{1/\phi_2}\}$, $[\phi^L_1, \phi^L_2]$ = [1.02, 0.51], and q = 0.5, 1.5, ..., 98.5, 99.5. Values for ϕ^L_1 and ϕ^L_2 are derived by trial-and-error, so as to yield the same mean but a standard deviation 50% smaller than the standard deviation under the medium-variance scenario. Analogously, the distribution of $\tilde{e}_y$ under the high-variance scenario is $e_{y,q}$, with probabilities $\pi^H_{y,q} \equiv \pi(q + 0.5; \phi^H_1, \phi^H_2) - \pi(q - 0.5; \phi^H_1, \phi^H_2)$ for $[\phi^H_1, \phi^H_2]$ = [0.93, 1.73].

Note that $\pi^M_{y,q} = \pi(q + 0.5; \phi^M_1, \phi^M_2) - \pi(q - 0.5; \phi^M_1, \phi^M_2)$ for $[\phi^M_1, \phi^M_2]$ = [1, 1]. Compared to the medium-variance probabilities $\pi^M_{y,q}$, the low-variance (high-variance) probabilities shift weight from the extremes (middle) of vector [$e_{y,0.5}$, $e_{y,1.5}$, ..., $e_{y,98.5}$, $e_{y,99.5}$] to its middle (extremes), so as to reduce (increase) the standard deviation by 50%, while maintaining the mean unchanged at 1.

Estimation of the Probability Density Function of Output Prices

Expression (7) is an approximation based on the regression estimates reported in table A1.

References

Hart, C. E., and S. H. Lence. 2004. “Financial Constraints and Farm Investment: A Bayesian Examination.” *Journal of Business and Economic Statistics* 22:51-63.

Prelec, D. 1998. “The Probability Weighting Function.” *Econometrica* 66:497-528.

Table A1. Price Regressions for Corn

Data	Regression	Regression Std. Error	R^2
U.S. aggregate data, 1970-2005	$ln(p_t) = \underset{(11)}{47} - \underset{(0.0061)}{0.0248}\, t + \underset{(0.13)}{0.48}\, ln(p_{t-1}) - \underset{(0.26)}{0.85}\, ln(e_{y,t}) + e_{p,t}$	0.156	0.914
Farm-level yield data, 1991-1998	$ln(p_t) = \underset{(2.1)}{36.4} - \underset{(0.0011)}{0.0197}\, t + \underset{(0.024)}{0.303}\, ln(p_{t-1}) - \underset{(0.011)}{0.248}\, ln(e_{y,f,t}) + e_{p,f,t}$	0.135	0.266

Note: Variable p_t is the U.S. season-average corn price received by farmers in marketing year t based on monthly prices weighted by monthly marketings (source: U.S. Department of Agriculture), deflated by the corresponding U.S. Consumer Price Index, all items, U.S. city average, not seasonally adjusted (1982-84 = 100) (source: Bureau of Labor Statistics). Variable $lne_{y,t}$ is the ordinary least-squares residual of the regression of $ln(yield_t)$ on a constant and t, where $yield_t$ is the U.S. yield per acre in marketing year t (source: U.S. Department of Agriculture). Variable $e_{y,f,t}$ is farm f's crop yield in marketing year t divided by farm f's average crop yield over 1991-1998 (source: Hart and Lence 2004 dataset). Each regression comprises 35 observation for the U.S. aggregate data, and 3,200 observations for the farm-level yield data.