End Notes

1. In reality, however, insurance premiums include a loading factor to cover the insurance company's administrative expenses and return on invested capital (Borch, 1989, p. 13). See Goodwin and Smith (1995) for a more detailed discussion of loading factor.

2. If risk type is *observable* (perfect/full information) and insurance is *not costless*, then the insurance would be fairly priced, so that $\pi = (1+k_0)\{k_1 + p(d + k_2)\}$, where k_0 is a cost proportional to the net premium necessitated by commission payments to insurance agents and ceded reinsurance charges, k_1 is the fixed cost of bookkeeping, k_2 is the cost of processing a claim, d is the amount of loss, and p is the probability of loss (Puelz and Snow, 1994).

3. Although the model is developed for two states of nature, the analysis applies equally well to more than two states. See Ehrlich and Becker (1972) for proof.

4. In economic theory, marginal utility of income or wealth is often used to measure the degree of risk aversion, which determines the willingness to pay for insurance protection (Varian, 1992, p. 189). However, this measure is not without ambiguities. As Ehrlich and Becker (1972) note, inferences about attitudes towards risk cannot be made independently of existing market opportunities.

5. One of the reviewers indicated that CRC specifies upper and lower bounds on the price guarantees, which is known as the Price Liability Limit (PLL). With PLL, the indemnity function is given by:
$I = MAX\{0, (y^g \max(P^g, \min(P^m, P^g + PLL)) - y^a \min(P^m, P^m + PLL))\}$. Since we did not have data on PLL, we used the simplified version of the indemnity function given in equation 12. The reviewer also agrees that the simplified version used in our study may not affect results for Iowa corn and soybeans.

6. Each parcel of land that is insured independently of other parcels is called a "unit." One farmer may have several insured units. Premium and indemnity payments are based on the insured unit-level risks and losses.

7. We implicitly assume that producers have equal knowledge of all products considered for analysis. However, that assumption may be weak because of differences in release dates and implementation strategies. For example, RA was released late in the 1997 season, while CRC may have been misrepresented in terms of the coverage truly offered under the CRC contract. Since it is difficult to control for such qualitative differences, it may be useful to test the 1998 and 1999 data as a follow-up to this study. In addition, lenders and insurance firms may also have a significant affect on the demand for crop insurance, which is not addressed in this report.

8. Instead of estimating one set of parameters for one logit function, as in a logistic regression for a dichotomous response variable, GPL models estimate sets of parameters for multiple logit functions. The CATMOD procedure in SAS is a convenient way to perform the generalized logistic regression when the model contains qualitative variables (Stokes et al., 1998).

9. Because CAT provides only minimal protection, it may be the best representation of self-insurance as a choice. Since data for non-participants are not available, Iowa farmers with CAT coverage alone may be the best representation of farmers who did not buy any crop insurance.

10. Just and Weninger (1999) fail to reject normality tests for yield distribution of Kansas farm-level wheat, corn, and sorghum yield data. In a recent study, Just et al. (1999) assume a normal distribution for corn yield histories. We recognize that several studies, including Buccola (1986), Moss and Shonkwiler (1993), Nelson and Preckel (1989), and Taylor (1990), reject the normality assumption. However, there seems to be no consensus among these studies regarding skewness of the distributions. If, indeed, the underlying yield and revenue distributions are non-normal, the quality of our results are unlikely to change.

11. Y^p and R^p are similar to variables measuring the probability of accidents used in Dionne, Gourieroux, and Vanasse (1998). Chiappori and Salanie (2000) criticize Puelz and Snow (1994) for their choice of variable to represent risk type. Puelz and Snow use a dummy variable, RT_i, that equals 1 if an individual had an accident and 0 otherwise. Chiappori and Salanie argue that this procedure to measure risk introduces a measurement error because the estimates are biased toward zero. Chiappori and Salanie also criticize Puelz and Snow for failing to account for missing variables and possible heterogeneity in the insurance pool. The data used in this study are for Iowa corn, which represents fairly homogeneous growing conditions.

12. Halbrook and Stafford (1971) indicate that the average weighted marginal propensity to consume for the general population is between 0.87 and 0.90. Consequently, the estimated marginal propensity to save would range from 0.10 to 0.13.

13. In earlier drafts, we experimented and estimated simultaneously equations 18, 20, and 21, treating the demand for insurance products as a continuous variable. Treating discrete choice of insurance products as a continuous variable is not desirable because the ensuing parameter estimates would be inefficient, and standard errors would be biased (Greene, p. 873, 1997; Long, p. 38, 1997). In addition, it imposes hierarchy among the products, when in fact there is none. This study treats the demand for insurance product as a discrete choice. The two-step procedure adopted in this report assumes that the decision on the choice of insurance product is made first, and on the coverage level later. Furthermore, we observe that the estimated parameters of the "fully" simultaneous system are in agreement regarding the statistical significance and the sign of parameters present in this report, although numerical differences exist among the two sets. Since our main objectives are an inquiry into the crop insurance market's functionality under asymmetric information and an investigation of the presence of separating equilibrium, market signaling and adverse selection, the two-stage estimation procedure seems more appropriate.

14. Note that a linear premium-coverage schedule does not necessarily constitute signaling since all farmers pay the same rate at the margin (indicated by constant slope). While low-risk producers select lower coverage, they are not compensated for doing so by paying a lower average premium for their insurance coverage (Rothschild and Stiglitz, 1976; Schmalensee, 1984).

15. The competitive premium rates and the measure of risk types developed in this study are based on individual insurance records for 1997 and 10-year farm yield records. Since we primarily aim to identify individual farmers' risk types, the short span of yield records might be sufficient, even though it excludes the full range of weather effects. Although weather variations are important determinants of yields, they provide little insights for assessing individual farmers' risk types within a given geographical area. In general, the impact of extreme weather events, such as droughts, extreme temperatures, or floods, are not specific to individual farms but to geographically extensive areas (Miranda and Glauber 1997).

16. A Wald test is a statistic that takes the form of a squared ratio of one estimate to its standard error; it follows an approximate chi-square distribution when the sample size is sufficiently large (Long, 1997; Stokes et al., 1998). The advantage of the Wald test over the Likelihood Ratio test is that the Wald test only requires estimating a single model. Thus, it is easier to apply when there are many variables to test. The practical weakness of the Likelihood Ratio test is that the full model must be estimated and then k-restricted models estimated corresponding to excluding each of the x_ks'.

17. This does not support the conventional argument that risk aversion decreases with wealth, and therefore high-income individuals self-insure and buy limited market insurance (Chiappori and Salanie, 2000; Makki and Miranda, 1999). In crop insurance, however, that assumption could be challenged, given that the program is highly subsidized by the Government.

18. RMA calculates the premium rates for each crop in each county for farmers who buy 65 percent coverage and whose normal production level is about equal to the average production in the county. Rates are subsequently adjusted to the loss-experience in that area, farmer's average crop yields (relative to county average yield), and for different coverage levels (GAO, 1999). The actual premium rates charged to farmers do not include any administrative or underwriting costs. Since we assume zero transactions costs, the estimated competitive rates reflect "pure premiums," and may, therefore, underestimate the actuarially fair-premiums.