Estimated Model Results

The expected net return variables for dry peas and lentils have the expected positive signs and are both statistically significant at the 5-percent significance level in the dry pea and lentil acreage share equations (table 8). Estimated results confirm that spring wheat (including durum) is the primary competing crop for dry peas and lentils, and the cross effects, to the extent that they are measurable, are statistically significant. This finding confirms the hypothesis that most of the acreage expansion for dry peas and lentils in North Dakota and Montana in recent years, starting in 2003, took place at the expense of spring wheat acreage. Some theoretical constraints, such as the symmetry between the beta coefficient of the expected net return for barley in the lentil share equation (b_{23}) and the coefficient of the expected net return for

Table 8
Estimated regression coefficients in the acreage share equations[1]

	Acreage share planted to--			
Item	Dry peas	Lentils	Spring wheat	Barley
Intercept	3.1299 (0.8069)***	1.0607 (0.5116)**	19.2341 (3.6606)***	21.5967 (3.3378)***
NRT_1	0.0143 (0.0069)**	--	--	-0.0008 (0.0069)
NRT_2	- -	0.0140 (0.0049)**	-0.0861 (0.0210)***	0.0388 (0.0258)
NRT_3	-0.0135 (n.a.)[2]	-0.0140 (0.0053)**	0.1750 (n.a.)[3]	-0.0889 (0.0210)***
NRT_4	-0.0008 (0.0069)	--	-0.0889 (0.0210)***	0.0509 (0.0412)
$S_{i, t-1}$	0.4240 (0.0974)***	0.8799 (0.1035)***	0.4757 (0.0697)***	0.5974 (0.0757)***
D^1	-1.9462 (0.8379)**	-1.3120 (0.6278)**	21.1670 (2.8620)***	-18.0232 (2.9094)***
D_2	-2.3631 (0.6723)***	-1.1804 (0.5941)*	24.9116 (2.7717)***	-14.2200 (2.4629)***
D_3	1.8126 (0.8274)**	-0.6248 (0.6739)	13.9840 (2.6964)***	-12.3579 (2.9528)***

n.a. = Not applicable.

[1]Figures in parentheses below the parameter estimates are standard errors. A single, double, or triple asterisk denotes significantly different from zero at 10%, 5%, or 1% significance level.

[2]A restricted coefficient that is consistent with a cross-price acreage elasticity of -0.501 for lentils with respect to spring wheat price obtained from this study, which is not subject to the test of null hypothesis.

[3]A restricted coefficient that is consistent with a supply price elasticity of 0.291 for U.S. spring wheat (Lin), which is also not subject to the test of null hypothesis.

lentils in the spring wheat share equation (b_{32}), are not imposed in the estimation because of their statistical insignificance after testing.

Due to a very high degree of multicollinearity between the expected spring wheat and barley net returns (with a correlation coefficient of 0.929), the beta coefficient of the expected spring wheat net return in the dry pea acreage share equation is restricted at -0.0135, consistent with a cross-price acreage elasticity of -0.501 for lentil acreage with respect to the spring wheat price obtained from this study. This "extraneous estimation" approach assumes that the cross-price elasticity of -0.501 for lentil acreage response is applicable to that for dry peas, that is, the cross-price acreage elasticity for dry pea acreage with respect to the spring wheat price is also -0.501 (Maddala; Greene; Lin and Dismukes, p.77). Similarly, the beta coefficient of expected spring wheat net returns in the spring wheat acreage share equation is restricted at 0.175, consistent with a U.S. spring wheat supply price elasticity of 0.291(Lin, p. 24; Lin et al., p.18). Based on the estimated results, lentils and barley are found to be important competing crops for spring wheat, while spring wheat is the most important competing crop for barley in these major dry pea and lentil producing areas.

Multicollinearity between the expected spring wheat and barley net returns causes the beta coefficient of the expected net return for barley to be statistically insignificant (prior to the imposition of the restriction) in the dry pea acreage share equation. Similarly, it also causes the beta coefficient of the expected net return for spring wheat to be insignificant in the spring wheat acreage share equation. The extraneous information used to restrict specific beta coeffcients, either taken directly from this study or previous work, is based on pooled time-series and cross-section (individual States) data, consistent with the nature of pooled data employed in this study. As a result, comparability is maintained after imposing the restrictions. In cases where no relevant extraneous information is readily available, some expected net return variables (e.g., the expected net return for dry peas in the spring wheat share equation) are omitted to avoid a wrong sign or statistical insignificance problem.

The acreage own-price elasticity is estimated at 0.281 for dry peas and 0.624 for lentils, based on procedures described in Lin et al.[14] There are no published estimates of supply elasticities for dry peas and lentils that can be compared with results of this study. The greater acreage price elasticity for lentils than for dry peas is probably due to several factors. First, lentils rely more on export markets, which have been subject to wider fluctuations in recent years, due, for instance, to bad lentil crops in Canada and drought-affected dry pea crops in Spain. In contrast, dry peas have a small feed outlet and can be more responsive to variation in export markets. Second, due to the small base of lentil acreage, its percent of increase in response to a 1-percent change in the expected grower price is likely higher than that for other crops.

The statistical significance of the coefficient of the expected spring wheat net return in the lentil (and possibly dry pea) acreage equation suggests strong competition between spring wheat (including durum) and these pulse crops. Based on procedures discussed in Lin et al., the cross-price acreage elasticity of lentils with respect to the spring wheat price is estimated at -0.501,

[14]Concerns have been raised about whether the supply response to expected market price will be different under the marketing loan program than with no program. In other words, did the introduction of the 2002 Farm Act cause structural change in farmers' supply response? Results from previous studies, such as Lin et al. and McDonald and Sumner, are that farmers' acreage response to market price under a planting flexibility policy environment (such as the one under the 1996 Farm Act) or a free market was greater than under farm programs with various planting restrictions (such as during 1991-95). However, this difference is likely to be much smaller in this study than in McDonald and Sumner, because farm programs during the study period of 1997/98 to 2005/06 virtually offered producers complete planting flexibility. The marketing loan program offers producers downside price risk protection through truncation (from below) of the commodity price distribution, which could alter the expected grower price but is unlikely to cause structural change in the supply relations. Also, an unconventional approach, such as the one in the McDonald and Sumner study, is not feasible because it requires detailed data on the total costs of production and marginal cost functions for dry peas and lentils State-by-State, which is only available every other year in the Pacific Northwest region.

meaning that a 1-percent decrease in the expected price of spring wheat would lead to an increase of 0.501 percent in lentil plantings.

The beta coefficients of the lagged dependent variable suggest that producers of dry peas and lentils in the major producing States showed lagged responses to market signals and marketing loan programs. Producers of dry peas responded to these production incentives faster than lentil producers. The slower acreage response for lentils might reflect a greater inertia among lentil producers because of the lack of a feed market and greater reliance on the export market (both commercial and food aid), which is subject to wider fluctuations.[15]

[15]Although both dry peas and lentils rely heavily on PL-480 purchases by the Federal Government, lentils are more dependent on this outlet.