

## Appendix: Restriction Tests

Following Deaton and Muellbauer (1980), symmetry and homogeneity constraints were tested using the likelihood-ratio (LR) test, which is written as,

$$T_1 = -2(\log L^R - \log L^*)$$

where  $L^R$  is the likelihood from the restricted estimation and  $L^*$  is from the unrestricted estimation.

Since the standard LR test approach provides biased results towards rejection of the null hypothesis (Meisner 1979), we use three alternative test statistics as proposed in Deaton(1972;1974) and Baldwin et al. (1983), which are presented below,

$$T_2 = T \times tr[(\hat{\Sigma}^R)^{-1}(\hat{\Sigma}^R - \hat{\Sigma}^*)]$$

$$T_3 = \frac{tr[(\hat{\Sigma}^R)^{-1}(\hat{\Sigma}^R - \hat{\Sigma}^*)] / [(n/2)(n-1)]}{tr[(\hat{\Sigma}^R)^{-1} \times \hat{\Sigma}^*] / (n-1)[T-k]}$$

$$T_4 = \frac{tr[(\hat{\Sigma}^R)^{-1}(\hat{\Sigma}^R - \hat{\Sigma}^*)]}{tr[(\hat{\Sigma}^R)^{-1} \times \hat{\Sigma}^*] / (n-1)[T-k]}$$

In all three equations,  $\hat{\Sigma}^R$  is the estimated variance-covariance matrix of the error terms from the restricted model and  $\hat{\Sigma}^*$  is from the unrestricted model;  $n$  is the number of equations,  $k$  is the number of explanatory variables and  $T$  is the total observation number for estimation.  $T_1$ ,  $T_2$  and  $T_4$  are all asymptotically distributed as  $\lambda^2[n(n-1)/2]$  under the null hypothesis and  $T_3$  is asymptotically distributed as  $F(n(n-2)/2, (n-1)[T-(n+2)])$  under the null hypothesis.

Table A1 reports test results from  $T_1$  to  $T_4$  with significance level indicated. The null hypothesis of homogeneity, symmetry, or both restrictions together holding was

rejected at the 1% confidence level in the static IAIDS model. However, for all test statistics, the null hypotheses of economic restriction holds at the 1% confidence level in the dynamic IAIDS model for the first two sample period was not rejected. For the whole sample,  $T_1$  and  $T_2$  rejected the null hypothesis if homogeneity or both homogeneity and symmetry restrictions were imposed, while  $T_3$  and  $T_4$  failed to reject these two restrictions at the 1% confidence level. Our results are consistent with previous studies using the same statistics (Deaton 1972; 1974).

These results suggest that, even following the economic theory, imposing the dynamic term of consumption habits and the adjustments of short-run disturbance to the long-run equilibrium was helpful to explain U.S. meat demand patterns, indicating the dynamic IAIDS model performs better than the IAIDS model.

Table A1 Tests of Homogeneity and Symmetry Restrictions in the Demand Model

Mode l		Unrestricted V.S. Homogeneity (3)	Unrestricted V.S. Symmetry (3)	Homogeneity V.S. Restricted (3)	Symmetry V.S. Restricted (3)	Unrestricted V.S. Restricted (6)
Jan,1989-Oct, 2003m						
Static IAIDS	T1	26.26 ***	34.74 ***	27.77***	19.29***	54.03***
	T2	21.93***	31.61***	26.61***	18.24***	47.80***
	T3	4.12***	6.06***	5.05***	3.40**	9.48***
	T4	12.37***	18.17***	15.15***	10.21**	28.43***
Dynamic IAIDS	T1	9.64**	0.68	0.9	9.86**	10.54
	T2	9.34**	0.68	0.90	9.56**	10.22
	T3	1.47	0.11	0.14	1.51	1.61
	T4	4.41	0.32	0.42	4.52	4.84
Jan, 1989-Jul,2006						
Static IAIDS	T1	28.29***	26.33***	17.14***	19.10***	45.43***
	T2	17.55***	21.17***	16.71***	17.51***	33.95***
	T3	4.99***	7.23***	4.14***	4.15***	4.26***
	T4	14.96***	21.69***	12.43***	12.44***	12.79**
Dynamic IAIDS	T1	7.87**	8.40**	3.48	2.95	11.35*
	T2	7.67	8.07	3.47	2.88	11.06*

	T3	1.87	0.14	1.90	1.90	1.92*
	T4	5.60	0.41	5.70	5.69	5.77
Jan, 1989-Dec,2010						
Static IAIDS	T1	43.93***	22.51***	12.99***	34.41***	56.92***
	T2	38.91***	21.01***	12.74***	32.56***	50.98***
	T3	7.78***	9.50***	5.42***	5.57***	5.70***
	T4	19.80***	28.49***	16.27***	16.70***	17.11***
Dynamic IAIDS	T1	16.01***	2.98	2.64	15.67***	18.65***
	T2	15.45***	2.98	2.64	15.12***	18.06***
	T3	2.78**	0.18	2.59*	2.64**	2.65**
	T4	7.67*	0.55	7.78*	7.91**	7.94
Critical values						
	df	0.1		0.05		0.01
$\lambda^2$	3	6.2513		7.8147		11.3448
	6	10.6446		12.5915		16.8118
$F$	3	2.0838		2.6049		3.782
	6	1.7741		2.0986		2.802

Note: degree of freedom of each test is listed in the parentheses