

# **Halo Effects of U.S. Grain Export Promotion Programs**

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# Introduction

- **Background:**

Foreign Market Development - FMD (1955) and Market Access Program - MAP (1985) are partnership programs between FAS/USDA and non-profit private sector commodity and regional associations.

MAP – short-term promotion for branded, high value and processed products

FMD – long-term promotion for generic or/and bulk products

- **Money allocation:**

FMD – a statutory baseline total allocation of \$34 million a year

MAP – increasing over the life of the Farm Bill, reaching \$200 million in 2006

In 2004

MAP for rice – nearly \$3 million (2.37% of total program allocation)

FMD for rice – almost \$1.7 million (4.97% of total program allocation)

- **Trend:**

U.S. rice exports decreasing in market share :

1980's - 20% , 1990's - 14% , and 2000's - 12%.

The proportion of money allocated for the U.S. rice industry - *USA Rice Federation (USARF)* and *USA Rice Producer Association (USRPA)* - has declined over time.



# Introduction

- Most previous studies have focused on the “*direct effects*” of export promotion for a specific commodity on that commodity’s exports
- Two types of spill-over effects examined here:
  - “*Positive externalities or halo effects*” export promotion of one commodity increases export demand of other U.S commodities.
  - “*International public good or free-riding effect*” export promotion by one country positively effect other countries export demand.
- Ignoring these cross effects may bias results of promotion and only partially measure full promotion impact.



# Objectives

- Examine own and cross effects of U.S. export promotion for U.S. and non-U.S. grains focusing on :

whether *halo effect* for U.S. commodities exists

whether U.S. grain export promotion has *public goods characteristics*

- Evaluate effectiveness of US grain export promotion programs using direct and total benefit-cost ratios



# Previous Research

## ○ **Richards and Patterson (1998)**

- U.S. export promotions on *apples, almonds, wine and grapes*
- Used dynamic dual model (1984-95)
- All estimated elasticities (both direct and cross) were statistically significant
- Majority of elasticities indicated a halo effect
- Cross elasticities in some cases were as large as direct effects

## ○ **Richard, Ispelen, and Kagan (1997)**

- *U.S. apple* export promotion in Singapore and UK
- A two-stage analysis : LES/AIDS system
- Promotion elasticity for U.S. apples in Singapore modestly positive
- Free-riding effect of export promotion in Singapore caused US lost market share to other countries

# Methodology

- Data: annual time-series data 1975-2005
  - Grains include rice, sorghum, and wheat
  - 6 commodities: U.S. and non-U.S. rice, sorghum, and wheat
  - Price and export value data from FAO
  - Annual export promotion expenditures for rice, wheat and sorghum including government and private contributions obtained from FAS
  - US. Grain Council develops export markets for U.S. barley, corn, and sorghum. We use these expenditures as a proxy for U.S. sorghum export promotion.
  - Export promotion for non-U.S. countries was not available.

# Methodology (con.)

- Model : a dynamic LA/AIDS model using the seemingly unrelated regression (SUR) method.

$$w_{it} = \alpha_i + \sum_{j=1}^6 \gamma_{ij} \ln p_{jt} + \beta_i [\ln M_t - \sum_{i=1}^6 w_{it} \ln p_{it}] + \theta_i RPRM_t + \delta_i WPRM_t + \phi_i SPROM_t + \tau_i T_t + \psi_i w_{it-1} + \varepsilon_{it}$$

Adding up, homogeneity and Slutsky symmetry restrictions were imposed

$$\sum_{i=1}^6 \alpha_i = 1; \quad \sum_{i=1}^6 \gamma_{ij} = 0; \quad \text{and} \quad \sum_{i=1}^6 \beta_i = 0$$

$$\sum_{j=1}^6 \gamma_{ij} = 0 \quad , \quad \text{for } i = 1, 2, \dots, n$$

$$\gamma_{ij} = \gamma_{ji} \quad , \quad \text{for all } i \neq j$$

Where

$i = 1, 2, 3, 4, 5, 6$  which correspond to U.S. rice, non-U.S. rice, U.S. wheat, non-U.S. wheat, U.S. sorghum and non-U.S. sorghum

$w_{it}$  = the conditional budget share of total expenditure allocated to the  $i^{th}$  good =  $p_{it}q_{it}/M_t$

$p_{jt}$  = the nominal price of  $j^{th}$  good within the group

$M_t$  = the nominal total expenditure which includes U.S. and non-U.S. rice, wheat and sorghum exports

$w_{it} \ln p_{it}$  = Stone's price index (Blanciforti and Green (1983a))

$RPRM_t, WPRM_t, SPROM_t$  = annual rice, wheat and grain export promotion expenditures

$T$  = trend term

$w_{it-1}$  = a lagged  $i^{th}$  market share



# Econometric Tests

## ○ Endogeneity

### **Wu-Hausman test for U.S. and non-U.S. wheat price**

The coefficient of residual from U.S. wheat price equation was not statistically significant in all 6 equations with p-value 0.55, 0.5, 0.35, 0.47, 0.23, and 0.52 respectively indicating no endogeneity. For non-U.S. wheat price, the p-values were 0.65, 0.25, 0.59, 0.29, 0.23, and 0.63 respectively.

## ○ Autocorrelation

**Durbin-h** (estimated without AR processes) values of U.S. and non-U.S. rice and wheat were -5.32, 4.73, -6.54 and 2.6, indicating autocorrelation.

### **Bresuch-Godfrey's serial autocorrelation test**

identified statistically significant first-order autocorrelation in non-U.S. rice, U.S. wheat, non-U.S. wheat equations

Therefore, LA/AIDS model is estimated with AR(1) process.

## ○ Heteroskedasticity

### **White's test**

P-values of six equations were 0.44, 0.87, 0.43, 0.206, 0.39 and 0.46 respectively. Thus, all equations failed to reject the null hypothesis that there is no heteroskedasticity.

# Econometric Results

Equations	Coefficients				Adj. R <sup>2</sup>	Durbin-h
	Intercept	Expenditure	Trend	$W_{it-1}$		
	$\alpha_i$	$\beta_i$	$\tau_i$	$\psi_i$		
U.S.Rice	0.51*	-0.04***	-0.002**	0.096	0.69	-0.77
Non-U.S.Rice	1.47	-0.12**	0.004*	0.54***	0.81	1.63
U.S. Wheat	-1.26	0.02	-0.005**	0.53***	0.61	-1.62
Non-U.S.Wheat	-0.29	0.099*	0.002	0.38***	0.42	0.77
U.S. Sorghum	-0.09	0.005	-0.0009**	0.45***	0.43	-0.02
Non-U.S.Sorghum	0.04	0.016*	0.0002	0.28*	0.81	0.4

# Econometric Results

Equations	Promotion Elasticity			Expenditure Elasticity
	U.S. Rice $R_i$	U.S.Wheat $W_i$	U.S.Sorghum $S_i$	$\eta_i$
U.S.Rice	0.186 ***	0.138	-0.174***	0.197 ***
Non-U.S.Rice	-0.178 *	-0.202 **	0.154	-0.259 **
U.S. Wheat	0.052	0.287 *	-0.033	1.065
Non-U.S.Wheat	0.052 *	-0.059	-0.057 *	1.214 *
U.S. Sorghum	-0.115 **	0.082	0.148 **	1.105
Non-U.S.Sorghum	-0.298 *	-1.12 **	0.04	2.200*

- U.S. grain export promotion has a positive and significant direct effect on U.S. grain export for rice, wheat and sorghum.

- There are no halo effect of U.S grain export promotion on other U.S. grains.

- There are anti-halo effects of competing country grain exports. No international free riding.

# Benefit-Cost Analysis

- Gross value transformation ( $V$ )

$$V_{it}^s = \hat{w}_{it} M_t, \text{ where } \hat{w}_{it} = \text{estimated market share ; } s = \text{scenario 1 (historic level) and scenario 2(50\% off)}$$

- Net value transformation ( $v$ )

A net value  $v = V_{it}^s * (p_{it} - c_{it}) / p_{it}$ , where

- $i$  = rice, wheat, and sorghum ;
- $t$  = 1990-2005 ;
- $(p_{it} - c_{it}) / p_{it}$  = a net margin factor
- $p_{it}$  = the unit price and
- $c_{it}$  = the unit cost of grain  $i$ .

- A measure of the direct benefit-cost ratio ( $DBCR$ ): in each specific industry

$$DBCR_{it} = (v_{it}^1 - v_{it}^2) / (EPCOST_{it}^1 - EPCOST_{it}^2)$$

- A measure of the total benefit-cost ratio ( $TBCR$ ) : over all impact of a specific export promotion (direct and cross effect) on the entire three U.S. grain industries

$$TBCR_{it} = (\sum_{j=1}^3 v_{jt}^1 - v_{jt}^2) / (\sum_{j=1}^3 EPCOST_{jt}^1 - EPCOST_{jt}^2)$$

# Results

- A direct benefit-cost ratio (DBCR) on average over period 1990-2005 for each grain is higher than one.
  - Wheat = 26.10
  - Rice = 5.34
  - Sorghum = 5.18
- A total benefit-cost ratio (TBCR) on average over period 1990-2005 for each grain
  - Wheat = 30.10 (halo effect)
  - Rice = 5.46 (halo effect)
  - Sorghum = -0.72 (anti-halo effect)
- Indirect effects on U.S. grain demand on rice, wheat, and sorghum export promotion were not found to have a statistically significant positive, i.e., halo effect.
- U.S. grain export promotion was found to have an anti-halo effect on competing country grain exports. Hence, there is no international free-riding off of U.S. grain export promotion.



# Summary

Purpose: Examine own and cross effects of U.S. export promotion for U.S. and non-U.S. grains (rice, wheat, and sorghum):

- 1) whether *a halo effect* for U.S. commodities exists.
- 2) whether U.S. grain export promotion has *public goods characteristics* in an international market.

Results:

- 1) There are direct effects for all three US grains
- 2) No halo effect
- 3) Anti halo effect of US grain promotion on non-US grains

# Previous Researches (con.) in essay 2

**Table 1:** Results of economic impact studies on U.S. export promotion using an integrated framework.

	US horticultures	US apples
<b>Study</b>	Richards and Patterson (1998)	Richard, Ispelen, and Kagan (1997)
<b>US export promotion in:</b>	Mexico, Sweden, Norway, Finland, the United Kingdom, France, Germany, Malaysia, Singapore, the Philippines, and Japan.	Singapore and the United Kingdom
<b>Period</b>	1984-95 pooled with country-level data	1962-93
<b>Model</b>	A dynamic dual model	Import demand, LES/AIDS demand systems
<b>Estimated own promotion elasticities</b>	Apples = SR:5.0*, LR:23.949* Almonds = SR: 0.052*, LR:0.387* Wines= SR:2.096*, LR: 2.736* Grapes=SR: 0.467*, LR: 0.778*	Singapore=0.055* UK=0.016*
<b>Estimated cross promotion elasticities</b>	<p><b>Apples:</b> Almonds = SR: 0.221*, LR:-2.31* Wines = SR:0.603*, LR: -0.369* Grapes = SR:0.362*, LR: 5.414*</p> <p><b>Almonds:</b> Apples = SR:1.028*, LR: 3.775* Wines = SR: -0.062*, LR: 0.027* Grapes = SR: 0.706*, LR: 4.898*</p> <p><b>Wines:</b> Apple = SR: 1.128*, LR:14.133* Almonds = SR: 0.045*, LR:-1.769* Grapes = SR:0.853*, LR:80.848</p> <p><b>Grapes:</b> Apples = SR:0.647*, LR:-4.258* Almonds = SR:0.029*, LR:0.198* Wines = SR:0.067*, LR:0.019*</p>	<p><b>Singapore:</b> Australia = -0.011 New Zealand = 0.079* Chile = 0.601* France = 0.186* China = -0.095 Rest of the word = 0.048*</p> <p><b>UK:</b> Australia =-0.008 New Zealand =-0.025* Chile =0.045* South Africa =0.034* France =0.079* Rest of the world =0.015</p> <p>0.622</p> <p>0.14</p>

# Price Coefficients & Elasticities

Equations	Price Coefficients						
	Market Share	$\gamma_{i1}$	$\gamma_{i2}$	$\gamma_{i3}$	$\gamma_{i4}$	$\gamma_{i5}$	$\gamma_{i6}$
U.S.Rice	0.0487	0.039*** (3.16)					
Non-U.S.Rice	0.0978	-0.018 (-1.52)	0.065* (1.96)				
U.S. Wheat	0.3251	0.053** (2.38)	-0.072* (-1.74)	0.199* (1.82)			
Non-U.S.Wheat	0.4614	-0.052** (-2.39)	0.016 (0.37)	-0.170* (-1.72)	0.201* (1.74)		
U.S. Sorghum	0.0533	-0.013 (-1.09)	0.003 (-0.19)	-0.023 (-0.889)	0.018 (0.690)	0.031* (1.756)	
Non-U.S.Sorghum	0.0136	0.013 (0.945)	-0.018 (-1.44)	-0.038* (-1.68)	0.001 (0.07)	0.014 (0.791)	0.014 (1.44)

Equations	Price Elasticities						
	Market Share	$E_{i1}$	$E_{i2}$	$E_{i3}$	$E_{i4}$	$E_{i5}$	$E_{i6}$
U.S.Rice	0.0487	-0.14 ***					
Non-U.S.Rice	0.0978	-0.29	-0.24 *				
U.S. Wheat	0.3251	1.43 **	-0.41 *	-0.062 *			
Non-U.S.Wheat	0.4614	-0.61 **	0.63	-0.063 *	-0.102 *		
U.S. Sorghum	0.0533	-0.22	0.081	-0.017	0.094	-0.36 *	
Non-U.S.Sorghum	0.0136	0.28	-0.174	-0.103 *	0.016	0.275	0.035

# Promotion Coefficients

## Promotion Coefficients

Equations	U.S. Rice Promotion	U.S. Wheat Promotion	U.S. Sorghum Promotion
<b>U.S.Rice</b>	0.009*** (-2.66)	0.0067 (-0.74)	-0.0085*** (-2.67)
<b>Non-U.S.Rice</b>	-0.017* (-1.76)	-0.019 * (-1.76)	0.015 (-1.42)
<b>U.S. Wheat</b>	0.017 (-1.11)	0.093* (-1.69)	-0.011 (-0.66)
<b>Non-U.S.Wheat</b>	0.024* (-1.78)	-0.027 (-0.51)	-0.026* (-1.69)
<b>U.S. Sorghum</b>	-0.006** (-2.06)	0.004 (-0.37)	0.008 ** (-2.11)
<b>Non-U.S.Sorghum</b>	-0.004* (-1.687)	-0.015* (-2.14)	0.0005 (-0.18)

# LR price and promotion elasticities

Equations	LR Price Elasticity					
	$E_{i1}$	$E_{i2}$	$E_{i3}$	$E_{i4}$	$E_{i5}$	$E_{i6}$
U.S.Rice	-0.15 ***					
Non-U.S.Rice	-0.63	-0.51*				
U.S. Wheat	3.06 **	-0.87*	-0.13 **			
Non-U.S.Wheat	-1.00**	-0.103	-0.103 *	-0.16 *		
U.S. Sorghum	-0.41	0.15	-0.03	0.17	-0.65 *	
Non-U.S.Sorghum	0.39	-0.24	-0.14 *	-0.02	0.38	0.048

Equations	LR Promotion Elasticity			LR Expenditure Elasticity
	U.S. Rice $R_i$	U.S.Wheat $W_i$	U.S.Grains $S_i$	$\eta_i$
U.S.Rice	0.205 ***	0.153	-0.192 ***	0.218 ***
Non-U.S.Rice	-0.389 *	-0.442	0.337	-0.567 **
U.S. Wheat	0.111	0.616 *	-0.071	2.286
Non-U.S.Wheat	0.085 *	-0.097	-0.092 *	1.986 *
U.S. Sorghum	-0.209 **	0.149	0.269 **	2.000
Non-U.S.Sorghum	-0.414 *	-1.558 **	0.055	3.050*

# An Average DBCR and TBCR

<b>Grains</b>	<b>Direct Benefit-Cost Ratio</b>	<b>Total Benefit-Cost Ratio</b>
Rice	5.34	5.46
Wheat	26.10	30.10
Sorghum	5.18	-0.72