

Market Model 1

Horizontal Market

Dream for windows 95/98/NT/2000

File Edit Browse Tools Help

English study 1 scenario 1 region 1

Dream Windows - Opened study 1 Date: 04/24/01

Study Scenario Market Technology Adoption Costs Dynamics Spillover Results

Initial Price 0.00 US\$ / T Transmission 1.00

PRODUCTION		CONSUMPTION	
Quantity	0.00 10000	Quantity	0.00 10000
Elasticity	0.000 ☐ Increment ☐ End Value ☐ Manual	Elasticity	0.000 ☐ Increment ☐ End Value ☐ Manual
Growth Rate (%/year)	0.00 ☐ Increment ☐ End Value ☐ Manual	Growth Rate (%/year)	0.00 ☐ Increment ☐ End Value ☐ Manual
Tax/Subsidy (%/year)	0.00 ☐ Increment ☐ End Value ☐ Manual	Tax/Subsidy (%/year)	0.00 ☐ Increment ☐ End Value ☐ Manual

Scenario scenario 1 Region region 1 Commodity Not Selected

Market Model 2

Small Open Economy

Dream Windows - Unnamed study 1 Date: 04/24/01

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English study 1 scenario 1 Region 1

World Price US\$/T Change 0.00 %/yr

PRODUCTION

Quantity 1000 T

Elasticity

Growth Rate (%/year)

Tax/Subsidy (%/year)

CONSUMPTION

Quantity 1000 T

Elasticity

Growth Rate (%/year)

Tax/Subsidy (%/year)

Scenario scenario 1 Region Region 1 Commodity Not Selected

Market Model 3

Vertical Market

Dream for Windows 95/98/NT/2000

File Edit Browse Tools Help

English study 1 scenario 1 Farm

Dream Windows - Unopened (study 1) Date: 04/24/01

	Farm	Services	Consumer
Quantity		0.00	0.00
Price		0.00	0.00
Elasticity (Supply)		0.000	0.000
Elasticity (Demand)			0.000
Growth Rate (%/year)			0.00

Scenario: scenario 1

Commodity: Not Selected

Market Model 4

Closed Economy

Dream for Windows 95/98/NT/2000

File Edit Browse Tools Help

English study 1 scenario 1 Region 1

Dream Windows - Opened study 1 Date: 05/11/01

Study Scenario Market Technology Adoption Costs Dynamics Spillover Results

Initial Price US\$ / T

PRODUCTION

Quantity 1000 T

Elasticity

Increment ☐ End Value ☐ Manual ☐

Growth Rate (%/year)

Increment ☐ End Value ☐ Manual ☐

TaxSubsidy (%/year)

Increment ☐ End Value ☐ Manual ☐

CONSUMPTION

Quantity 1000 T

Elasticity

Increment ☐ End Value ☐ Manual ☐

Growth Rate (%/year)

Increment ☐ End Value ☐ Manual ☐

TaxSubsidy (%/year)

Increment ☐ End Value ☐ Manual ☐

Scenario scenario 1 Region Region 1 Commodity Not Selected

Technology

Dream for Windows 95/98/NT/2000

File Edit Browse Tools Help

English study 1 scenario 1 region 1

Dream Windows - Opened study 1 Date: 04/24/01

Study Scenario Market Technology Adoption Costs Dynamics Spillover Results

R&D Impacts ☒ Supply ☐ Demand

R&D Time Lag 0 Years

Define potential R&D impacts on ☒ Time page ☐ Dynamics page

Potential impacts if R&D successful and fully adopted

Fixed Change (%)			Cumulative Change (%/yr)		
Δ Cost%	Δ Yield%	Sk%	Δ Cost%	Δ Yield%	Sk%
0.00	0.00	0.00			0.00
0.00		0.00			
		0.00			0.00

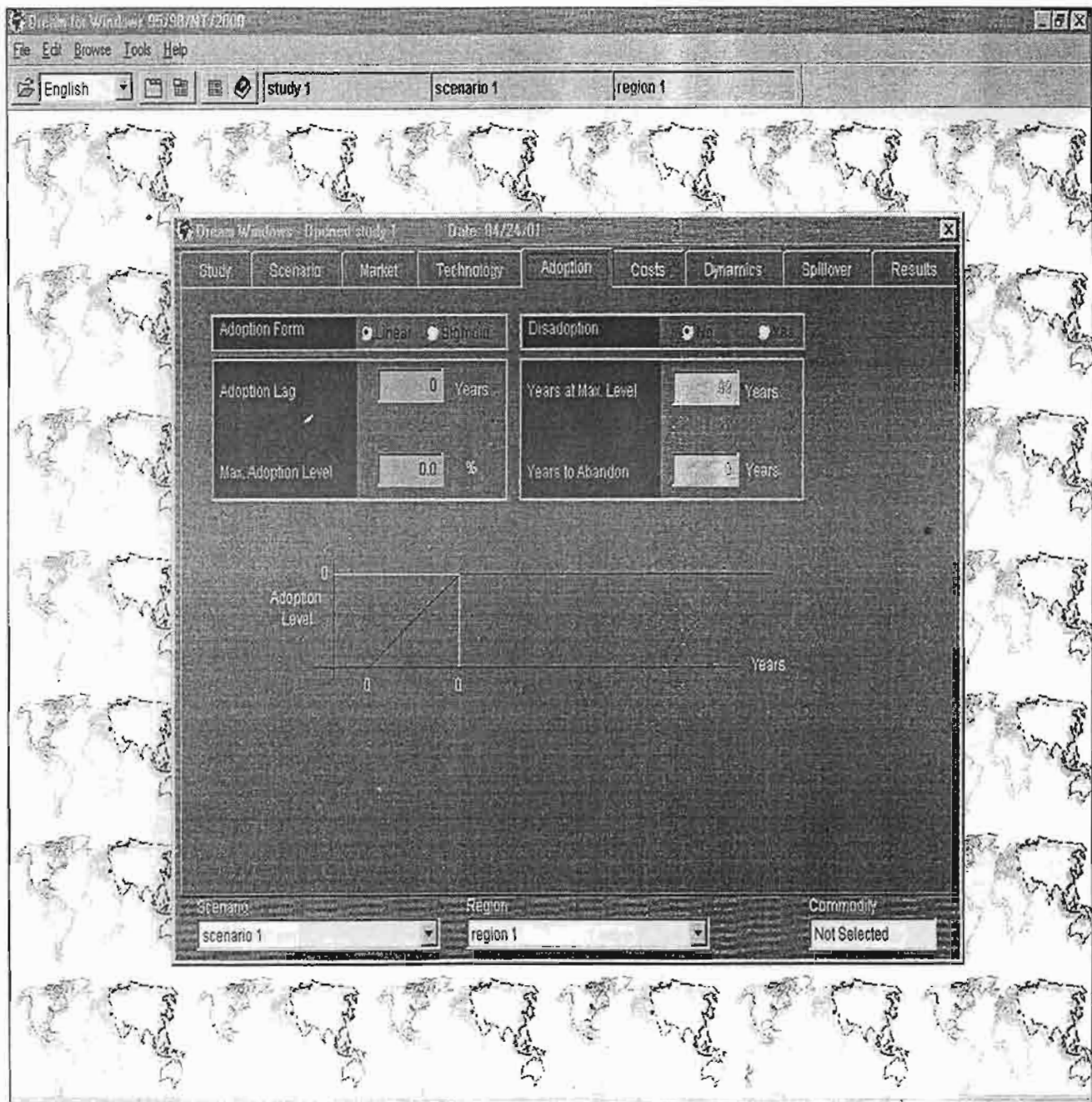
With Technology

Without

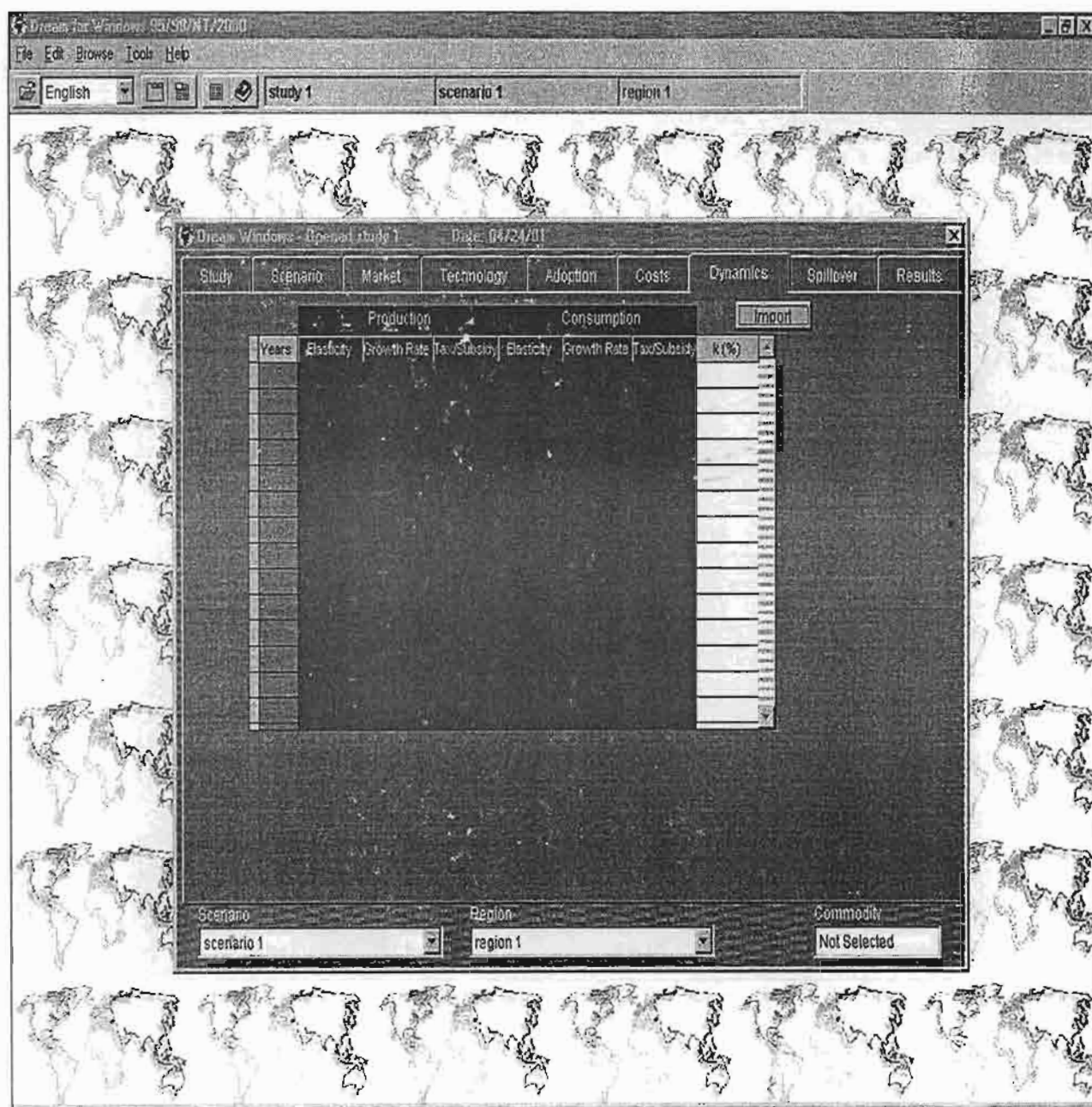
Probability of R&D Success % 100

Scenario scenario 1 Region region 1 Commodity Not Selected

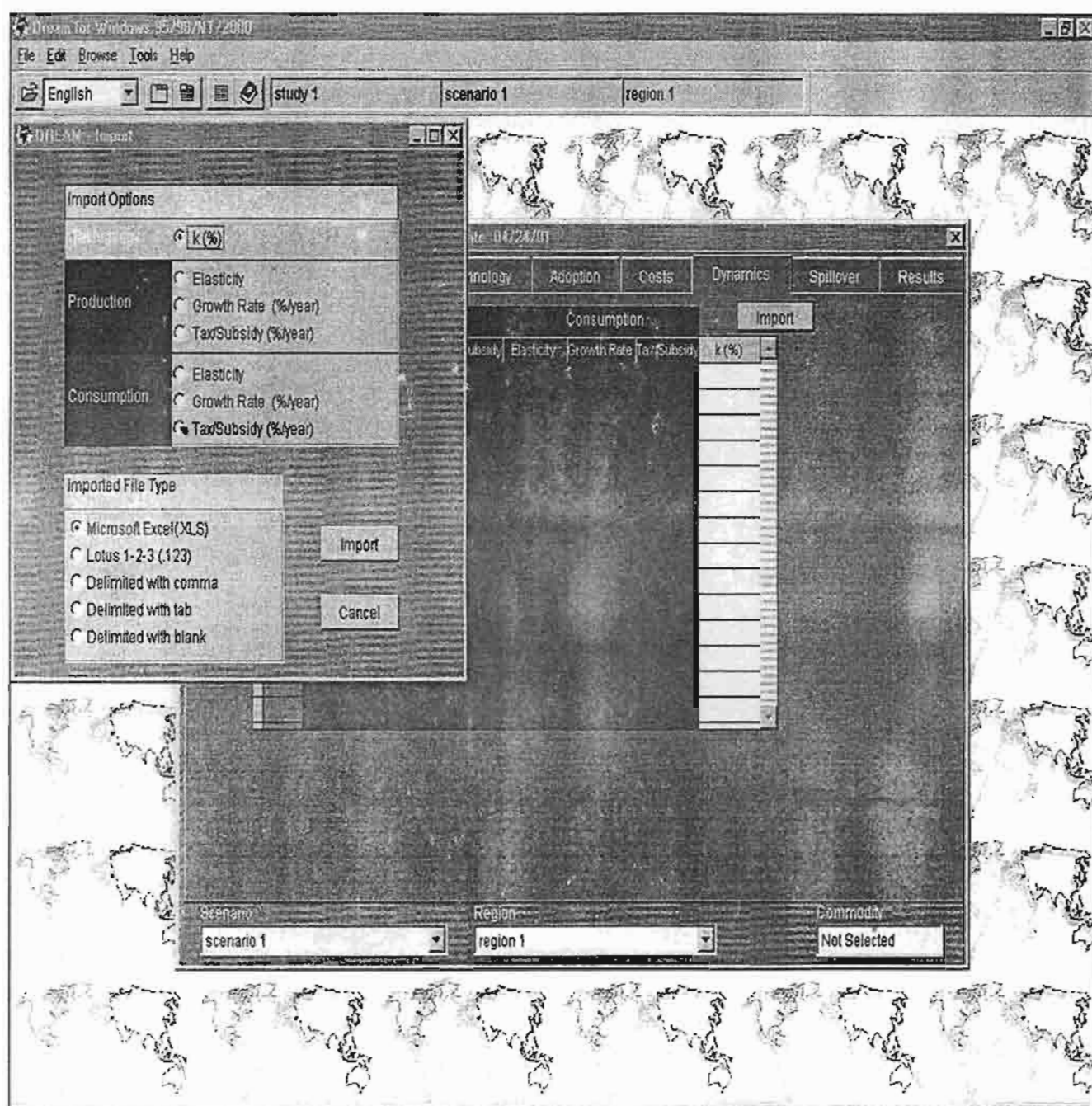
Adoption



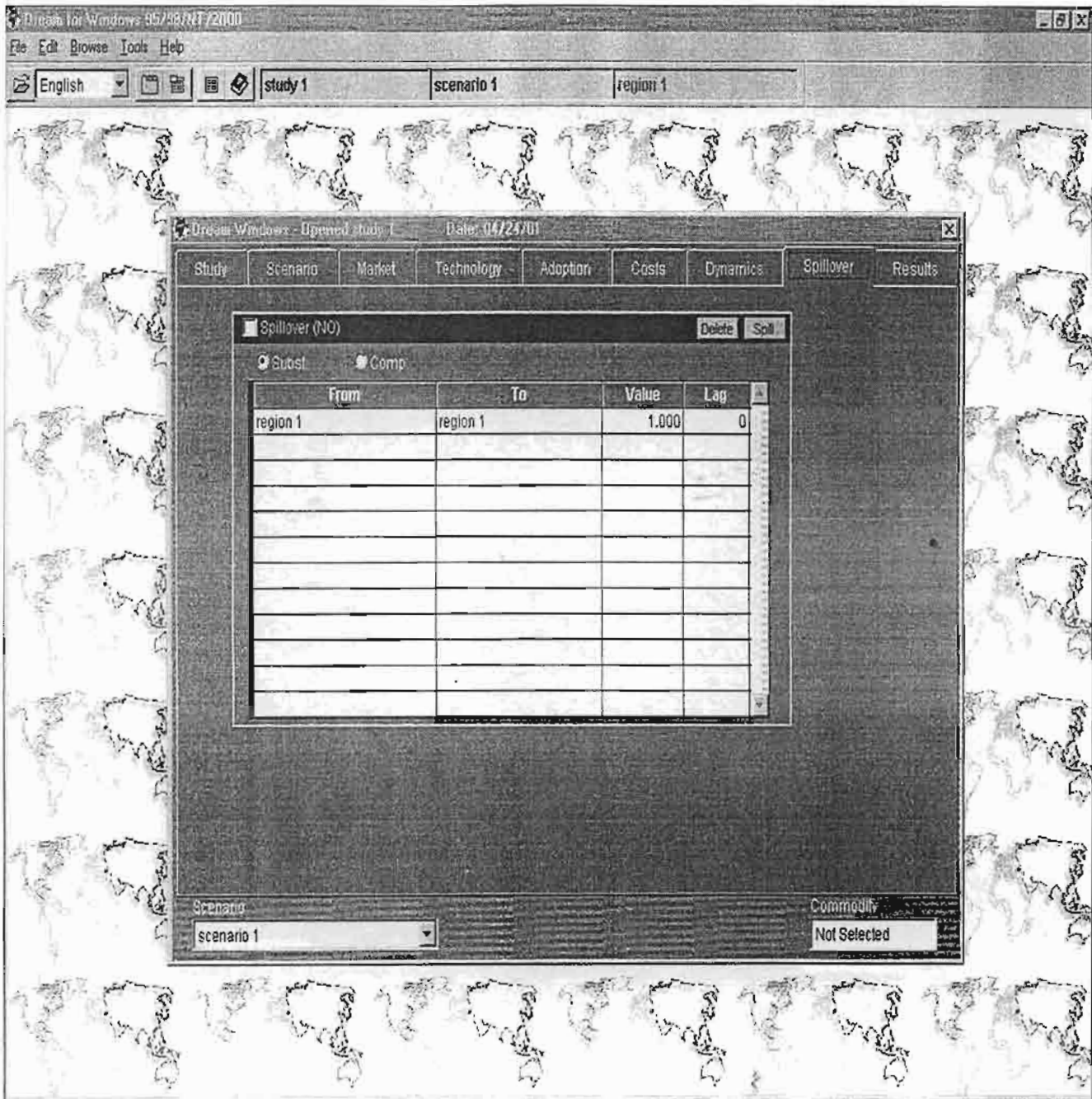
Dynamics



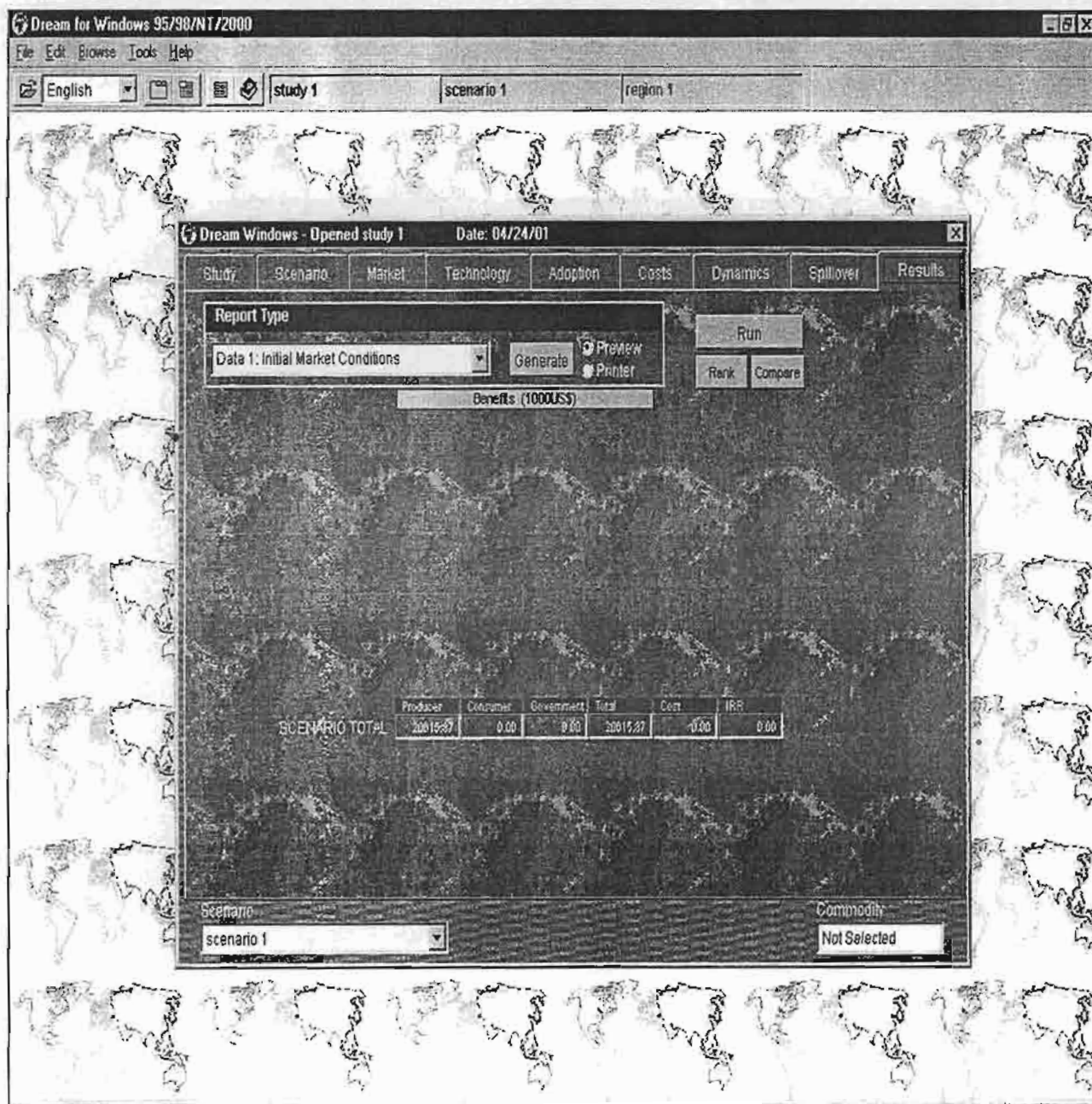
Dynamics with Import



Spillover

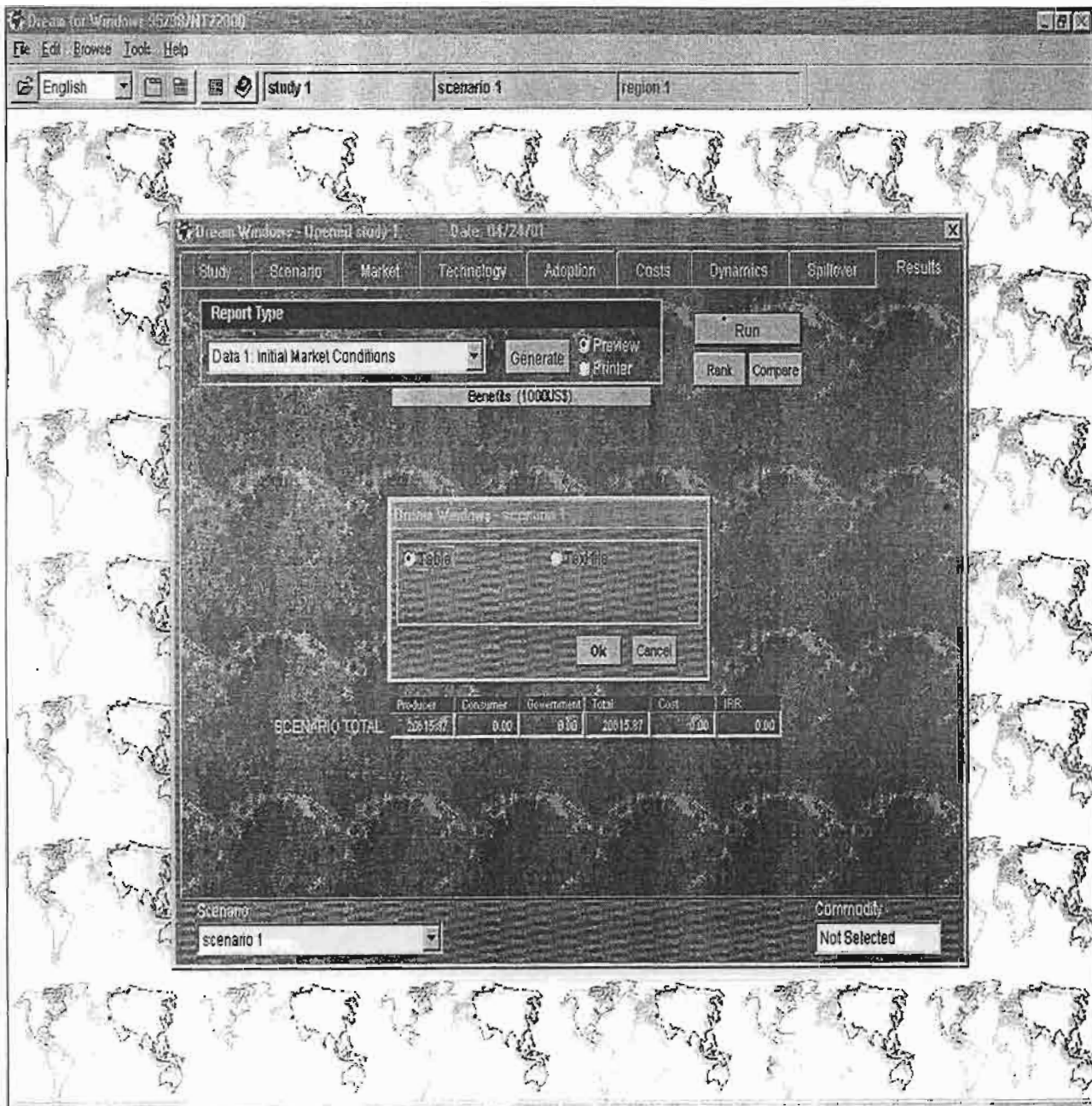


Results



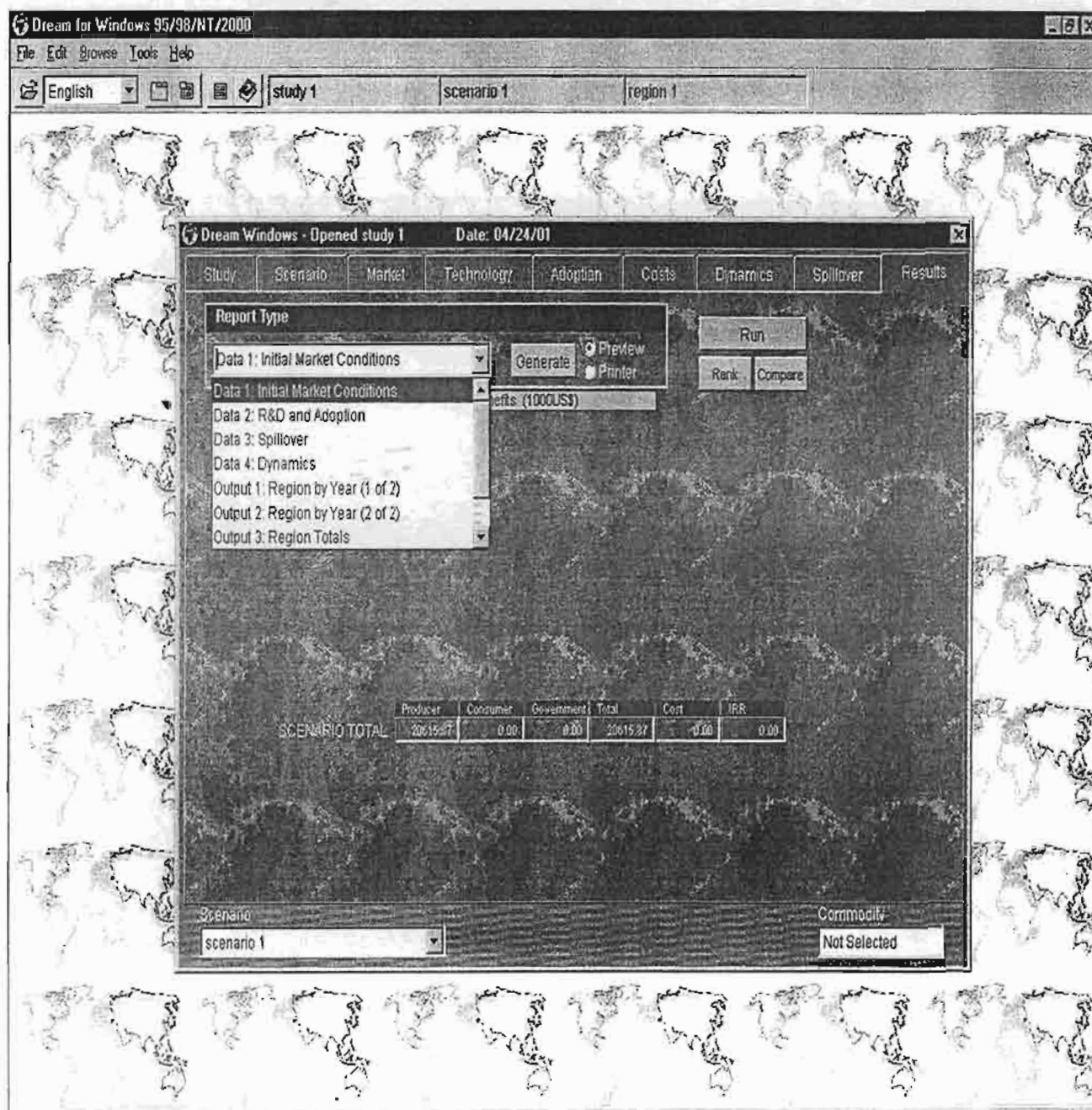
Results

Type of Output



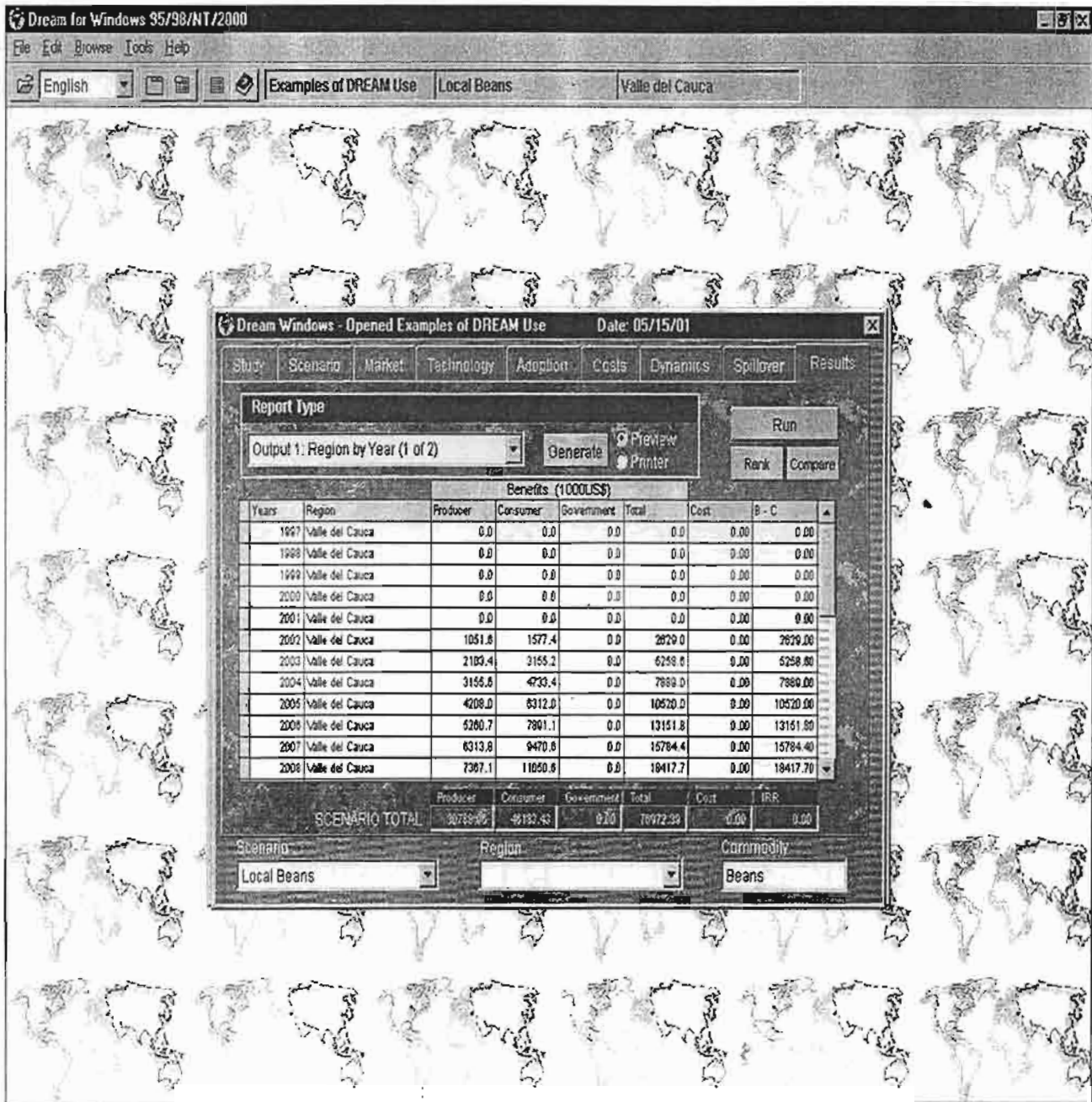
Results

Report Type

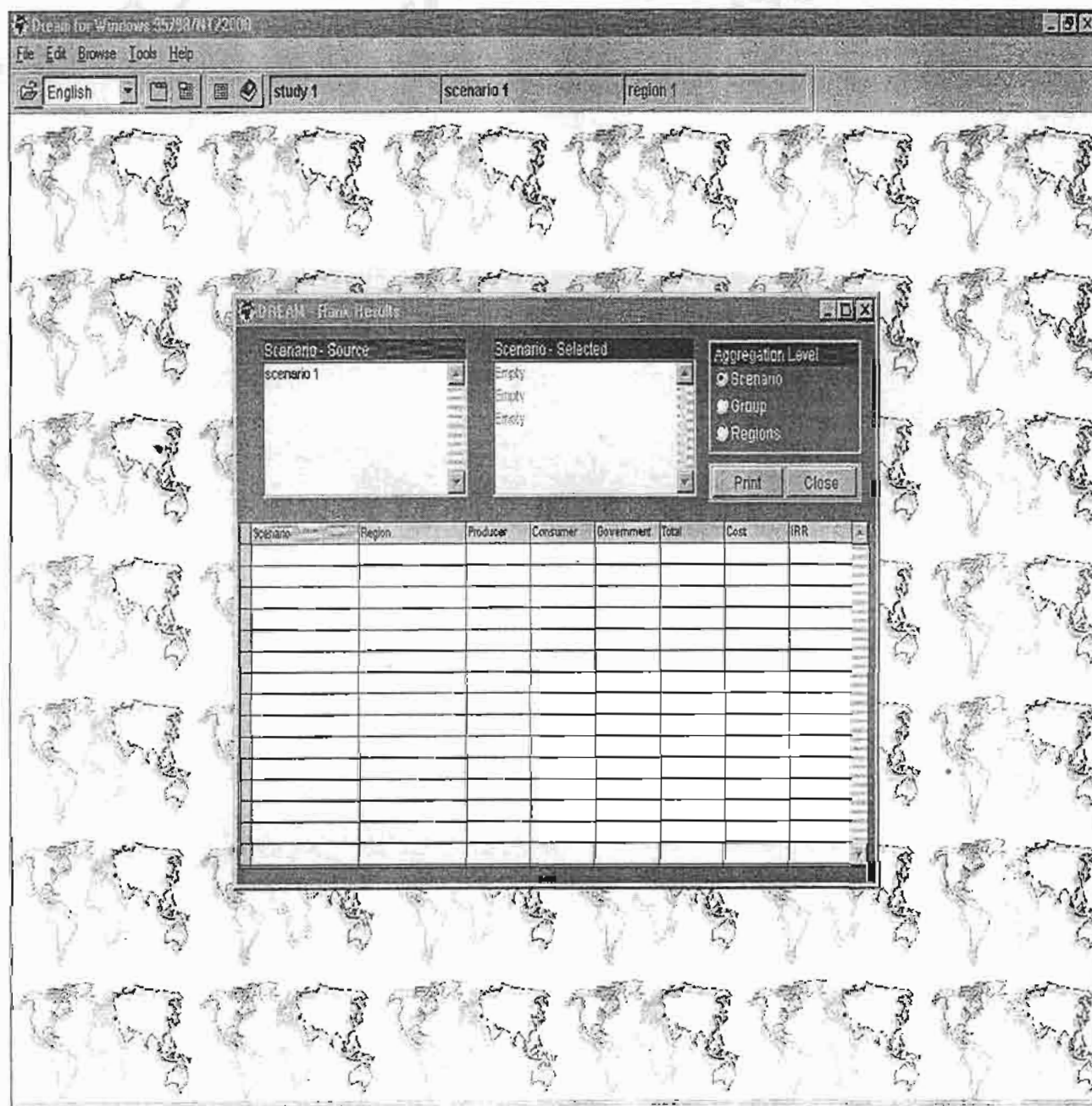


Results

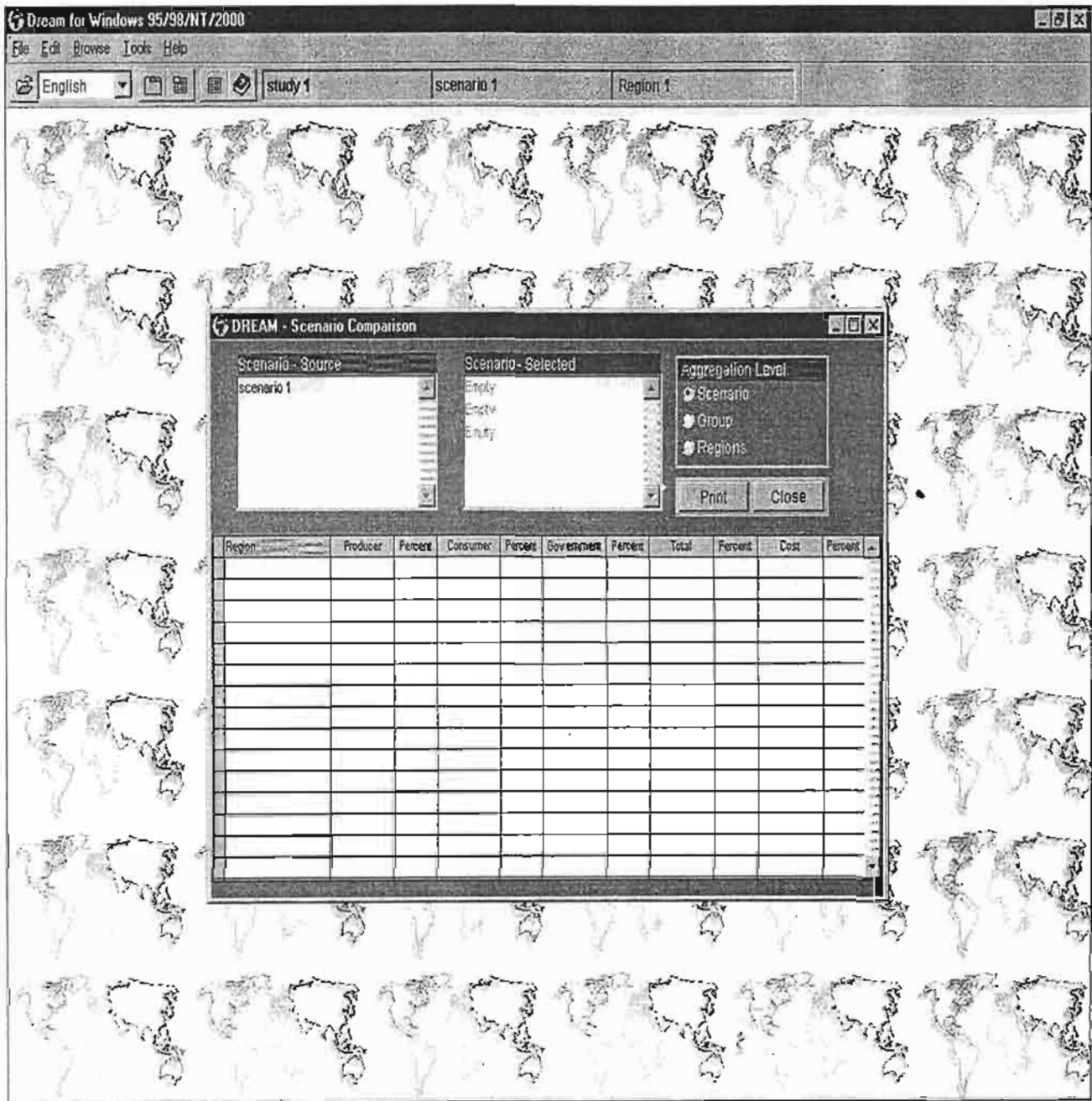
Example of Report Type



Rank Results



Compare Results



Results

Text File

Dream for Windows 95/98/NT/2000

File Edit Browse Tools Help Format

English Examples of DREAM Use Local Beans Valle del Cauca

bean2.txt

Study: Examples of DREAM Use
 Scenario: Local Beans
 Commodity: Beans Regions: 1 Single Closed Economy - Spillover: No
 Period: 15 years Base year: 1997
 Discount: 5.0% Benefit: 1000US\$ Quantity: 1000T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumption	Price	Sup.	Elasticity	Transmission	Exc	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
	--quantity units--		<pr units>		<pr un>			%
Valle del Cauca	20000.0	20000.0	115.00	0.600	-0.400	0.00	1.00	
	20000	20000						

SUMMARY OF R&D & ADOPTION DATA

Region	K	Prob. of	Max.	K	Shift	K	-Time Lags -
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pot.	Success	Adopt	Price	Max	Type	Var
Valle del Cauca	5.00	80.0	20.0	115.00	0.92	S	0.00

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5
 Kvar is the variable unit cost reduction (%/year), if specified.
 Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic
 * WARNING: - This combination of Kpot and Kvar produces negative Ktotal in some years

Region: 1 Valle del Cauca Price transmission (v,w): 0.00, 1.00

Costs Dynamics Spillover Results

Preview Printer Run Rank Compare

Commodity: Beans

Examples of Impact Assessment on ACIAR Research

by

Deborah Hill

Senior Economist, Australian Centre for
International Agricultural Research

Study: Biological control of weeds -Thailand
Scenario: Rice
Commodity: Rice
Period: 30 years
Discount: 8.0% (end of year)
Regions: 2 Horizontal Multimarket - Spillover: No
Base year: 1984
Benefit: 1000A\$
Quantity: 1000 T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumption	Price	Elasticity	Transmission	Exog. Growth	Tax/Subsidy				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	<-quantity units-->		<pr units>			<pr un>		%/yr	%/yr	%/yr	%/yr
ROW	562247.4	562302.0	196.00	0.230	-0.430	0.00	1.00	0.00	0.00	0.00	0.00
Thailand	222.6	168.0	196.00	0.230	-0.430	0.00	1.00	0.00	0.00	0.00	0.00
	562470	562470									

SUMMARY OF R&D & ADOPTION DATA

Region	K Pot.	Success	Max.	Price	K Shift	K Var	-Time Lags	-Time Lags	-Time Lags	-Time Lags	-Time Lags	-Time Lags
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	-%	-%	-%	<price units>			%/yr	-yrs	-yrs	-yrs	-yrs	-yrs
ROW	0.00	100.0	0.0	196.00	0.00	S	0.00	0.0	0.0	99.0	0.0	X
Thailand	9.26	100.0	15.0	196.00	2.72	S	0.00	11.0	3.0	30.0	0.0	X

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5
Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING: - This combination of Kpot and Kvar produces negative Ktotal in some years

Year	Price			Production			R&D			Consumption			Benefits			Benefits		
	Total	K	Spill	K	Var	K	NoR&D	R&D	Price	Quantity	Value of Productn	Value of Consumptn	Price	Quantity	Value of Consumptn	Price	Quantity	Value of Consumptn
1984	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1985	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1986	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1987	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1988	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1989	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1990	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1991	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1992	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1993	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1994	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200490	0.0	0.00	0.0	110211192	0.0	0.0
1995	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	0.00	0.00	0.00	110200472	0.0	0.00	0.0	110211183	0.0	0.0
1996	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200299	-0.0	0.00	0.3	110211071	0.0	0.0
1997	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
1998	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
1999	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2000	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2001	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2002	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2003	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2004	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2005	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2006	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2007	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2008	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2009	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2010	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2011	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2012	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0
2013	0.00	0.00	0.00	0.00	0.00	0.00	196.0	195.9	0.00	0.00	0.00	110200230	-0.0	0.00	0.4	110211071	0.0	0.0

Region: 2 Thailand		Price transmission (v,w):				0.00, 1.000								
		Producers				Consumers				Government				
		<---no R&D--->		with R&D		<---no R&D--->		with R&D		<---no R&D--->		with R&D		
Year	Price	Quantity	Price	Quantity	Benefits	Price	Quantity	Price	Quantity	Benefits	"Prod"	"Cons"	Benefits	Research Costs
1984	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	297.0
1985	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	297.0
1986	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	0.0
1987	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	0.0
1988	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	196.0
1989	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	196.0
1990	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	196.0
1991	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	1.5
1992	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	1.5
1993	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	1.5
1994	196.0	222.6	196.0	222.6	0.0	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	1.5
1995	196.0	222.6	196.0	222.6	40.8	196.0	168.0	196.0	168.0	0.0	0.0	0.0	0.0	1.5
1996	196.0	222.6	195.9	223.1	445.3	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
1997	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
1998	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
1999	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2000	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2001	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2002	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2003	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2004	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2005	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2006	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2007	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2008	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2009	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2010	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2011	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2012	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5
2013	196.0	222.6	195.9	223.3	606.8	196.0	168.0	195.9	168.0	0.0	0.0	0.0	0.0	1.5

2215.4

0.2

2215.4

Present value of benefits

Year	Total	K	Base	K	Spill	K	Var	K	Price	NoR&D	R&D	--R&D change in Price	Production --R&D change in Quantity	Value of Production	Benefits /Vop (%)	--R&D change in Price	Consumption --R&D change in Quantity	Value of Consumption	Benefits /VoC (%)
1984	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1992	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1993	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1994	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	0.00	0.0	43629	0.0	0.00	0.0	32928	0.0
1995	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	196.0	-0.00	0.0	43638	0.0	-0.00	0.0	32927	0.0
1996	1.99	1.99	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.5	43731	1.0	-0.00	0.0	32927	0.0
1997	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
1998	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
1999	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2000	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2001	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2002	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2003	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2004	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2005	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2006	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2007	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2008	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2009	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2010	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2011	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2012	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0
2013	2.72	2.72	0.00	0.00	0.00	0.00	0.00	0.00	196.0	196.0	195.9	-0.00	0.7	43768	1.3	-0.00	0.0	32927	0.0

PRESENT VALUE SUMMARIES
GROUP1

Region	Present Value of R&D Benefits			Costs		Returns	
	Producer	Consumer	Government	Total	(B-C)	B/C	IRR
2 Thailand	2215.4	0.2	0.0	2215.7	909.9	1305.7	2.43
Total NPV Benefits	2215.4	0.2	0.0	2215.7	909.9	1305.7	2.43

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs		B-C	
	Producer	Consumer	Government	Total	Total	Total	Total
1984	0.0	0.0	0.0	0.0	297.0	-297.0	
1985	0.0	0.0	0.0	0.0	297.0	-297.0	
1986	0.0	0.0	0.0	0.0	0.0	0.0	
1987	0.0	0.0	0.0	0.0	0.0	0.0	
1988	0.0	0.0	0.0	0.0	196.0	-196.0	
1989	0.0	0.0	0.0	0.0	196.0	-196.0	
1990	0.0	0.0	0.0	0.0	196.0	-196.0	
1991	0.0	0.0	0.0	0.0	1.5	-1.5	
1992	0.0	0.0	0.0	0.0	1.5	-1.5	
1993	0.0	0.0	0.0	0.0	1.5	-1.5	
1994	0.0	0.0	0.0	0.0	1.5	-1.5	
1995	40.8	0.0	0.0	40.8	1.5	39.3	
1996	445.3	0.0	0.0	445.3	1.5	443.8	
1997	606.8	0.0	0.0	606.8	1.5	605.4	
1998	606.8	0.0	0.0	606.8	1.5	605.4	
1999	606.8	0.0	0.0	606.8	1.5	605.4	
2000	606.8	0.0	0.0	606.8	1.5	605.4	
2001	606.8	0.0	0.0	606.8	1.5	605.4	
2002	606.8	0.0	0.0	606.8	1.5	605.4	
2003	606.8	0.0	0.0	606.8	1.5	605.4	
2004	606.8	0.0	0.0	606.8	1.5	605.4	
2005	606.8	0.0	0.0	606.8	1.5	605.4	
2006	606.8	0.0	0.0	606.8	1.5	605.4	
2007	606.8	0.0	0.0	606.8	1.5	605.4	
2008	606.8	0.0	0.0	606.8	1.5	605.4	
2009	606.8	0.0	0.0	606.8	1.5	605.4	
2010	606.8	0.0	0.0	606.8	1.5	605.4	
2011	606.8	0.0	0.0	606.8	1.5	605.4	
2012	606.8	0.0	0.0	606.8	1.5	605.4	
2013	606.8	0.0	0.0	606.8	1.5	605.4	

Group 02

Region	Producer	Consumer	Government	Total	Costs	Returns (B-C)	B/C	IRR
1 ROW	-770.6	770.7	0.0	0.0	0.0	0.0	---	---
Total NPV Benefits	-770.6	770.7	0.0	0.0	0.0	0.0	---	---

Cost and Benefit Summary Across All Regions in Group

Year	Producer	Consumer	Government	Total	Costs	B-C
1984	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0
1995	-14.2	14.2	0.0	0.0	0.0	0.0
1996	-154.9	154.9	0.0	0.0	0.0	0.0
1997	-211.1	211.1	0.0	0.0	0.0	0.0
1998	-211.1	211.1	0.0	0.0	0.0	0.0
1999	-211.1	211.1	0.0	0.0	0.0	0.0
2000	-211.1	211.1	0.0	0.0	0.0	0.0
2001	-211.1	211.1	0.0	0.0	0.0	0.0
2002	-211.1	211.1	0.0	0.0	0.0	0.0
2003	-211.1	211.1	0.0	0.0	0.0	0.0
2004	-211.1	211.1	0.0	0.0	0.0	0.0
2005	-211.1	211.1	0.0	0.0	0.0	0.0
2006	-211.1	211.1	0.0	0.0	0.0	0.0
2007	-211.1	211.1	0.0	0.0	0.0	0.0
2008	-211.1	211.1	0.0	0.0	0.0	0.0
2009	-211.1	211.1	0.0	0.0	0.0	0.0
2010	-211.1	211.1	0.0	0.0	0.0	0.0
2011	-211.1	211.1	0.0	0.0	0.0	0.0
2012	-211.1	211.1	0.0	0.0	0.0	0.0
2013	-211.1	211.1	0.0	0.0	0.0	0.0

Total Scenario									
----- Present Value of R&D Benefits -----><-----Costs-----><----- Returns ----->									
Region	Producer	Consumer	Government	Total	Costs	(B-C)	B/C	IRR	
1 ROW	-770.6	770.7	0.0	0.0	0.0	0.0	0.0	0.0	---
2 Thailand	2215.4	0.2	0.0	2215.7	909.9	1305.7	2.43	2.43	---
Total NPV Benefits	1444.8	770.9	0.0	2215.7	909.9	1305.8	2.43	2.43	---
Cost and Benefit Summary Across All Regions in Group									
<----- Benefits -----><----- Costs -----><----- Returns ----->									
Year	Producer	Consumer	Government	Total	Costs	B-C			
1984	0.0	0.0	0.0	0.0	297.0	-297.0			
1985	0.0	0.0	0.0	0.0	297.0	-297.0			
1986	0.0	0.0	0.0	0.0	0.0	0.0			
1987	0.0	0.0	0.0	0.0	0.0	0.0			
1988	0.0	0.0	0.0	0.0	196.0	-196.0			
1989	0.0	0.0	0.0	0.0	196.0	-196.0			
1990	0.0	0.0	0.0	0.0	196.0	-196.0			
1991	0.0	0.0	0.0	0.0	1.5	-1.5			
1992	0.0	0.0	0.0	0.0	1.5	-1.5			
1993	0.0	0.0	0.0	0.0	1.5	-1.5			
1994	0.0	0.0	0.0	0.0	1.5	-1.5			
1995	26.5	14.2	0.0	40.8	1.5	39.3			
1996	290.3	155.0	0.0	445.3	1.5	443.8			
1997	395.7	211.1	0.0	606.9	1.5	605.4			
1998	395.7	211.1	0.0	606.9	1.5	605.4			
1999	395.7	211.1	0.0	606.9	1.5	605.4			
2000	395.7	211.1	0.0	606.9	1.5	605.4			
2001	395.7	211.1	0.0	606.9	1.5	605.4			
2002	395.7	211.1	0.0	606.9	1.5	605.4			
2003	395.7	211.1	0.0	606.9	1.5	605.4			
2004	395.7	211.1	0.0	606.9	1.5	605.4			
2005	395.7	211.1	0.0	606.9	1.5	605.4			
2006	395.7	211.1	0.0	606.9	1.5	605.4			
2007	395.7	211.1	0.0	606.9	1.5	605.4			
2008	395.7	211.1	0.0	606.9	1.5	605.4			
2009	395.7	211.1	0.0	606.9	1.5	605.4			
2010	395.7	211.1	0.0	606.9	1.5	605.4			
2011	395.7	211.1	0.0	606.9	1.5	605.4			
2012	395.7	211.1	0.0	606.9	1.5	605.4			
2013	395.7	211.1	0.0	606.9	1.5	605.4			

Study: Biological control of weeds -Thailand
 Scenario: Highways
 Regions: 1 Small Open Economy - Spillover: No
 Commodity: Roads
 Base year: 1984
 Period: 30 years
 Discount: 8.0% (end of year) Benefit:1000A\$ Quantity: 1000 T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumption	Price	Sup.	Elasticity	Transmission	Exog. Growth	Tax/Subsidy			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	<-quantity units-->		<pr units>			<pr un>		%/yr	%/yr	%/yr	%/yr
Thailand	0.5	0.5	1310.00	0.000	0.000	0.00	1.00	0.00	0.00	0.00	0.00
	0	0									

SUMMARY OF R&D & ADOPTION DATA

Region	K	Prob.of	Max.	Pot. Success	Adopt	Price	Max	Shift	K	Var	-Time Lags	Adopt
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	-%	-%	-%	<price units>	%/yr	-yrs	-yrs	-yrs	-yrs	-yrs	-yrs	-yrs
Thailand	96.95	100.0	15.0	1310.00	190.50	S	0.00	11.0	3.0	99.0	0.0	L

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5

Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years

Region: 1 Thailand										Price transmission (v,w):		0.00, 1.000							
										Producers		Consumers		Government					
<---no R&D---										<---with R&D---		<---no R&D---		<---with R&D---					
Price Quantity										Benefits		Price Quantity		Benefits		< Tax Rev.>			
Year										Price Quantity		Benefits		Price Quantity		Benefits		Research Costs	
1984	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1985	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1986	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1987	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1988	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1989	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1990	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1991	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1992	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1993	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1994	1310.0	0.5	1310.0	0.5	0.0	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1995	1310.0	0.5	1310.0	0.5	34.9	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1996	1310.0	0.5	1310.0	0.5	69.8	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1997	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1998	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
1999	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2000	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2001	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2002	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2003	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2004	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2005	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2006	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2007	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2008	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2009	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2010	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2011	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2012	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
2013	1310.0	0.5	1310.0	0.5	104.7	1310.0	0.5	1310.0	0.0	0.0	1310.0	0.5	1310.0	0.0	0.0	0.0	0.0		
Present value of benefits										390.9		0.0		0.0		0.0			

Year	K			Price			Production			Consumption							
	Total	Base	K	Spill	K	X	R&D	NoR&D	R&D	--R&D change in -- Price	Quantity	Value of Productn	--R&D change in -- Price	Quantity	Value of Consump	Benefits /Voc (%)	
1984	0.00	0.00	0.00	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1985	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1986	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1987	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1988	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1989	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1990	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1991	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1992	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1993	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1994	0.00	0.00	0.0	0.0	0.00	1310.0	1310.0	1310.0	0.00	0.0	0.0	720	0.0	0.00	0.0	720	0.0
1995	63.50	63.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	4.8	720	4.8	0.00	0.0	720	0.0
1996	127.00	127.00	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	9.6	720	9.6	0.00	0.0	720	0.0
1997	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
1998	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
1999	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2000	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2001	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2002	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2003	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2004	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2005	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2006	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2007	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2008	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2009	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2010	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2011	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2012	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0
2013	190.50	190.50	0.0	0.00	0.00	1310.0	1310.0	1310.0	0.00	0.0	14.5	720	14.5	0.00	0.0	720	0.0

PRESENT VALUE SUMMARIES

Group 01

Region	Present Value of R&D Benefits			Costs		Returns	
	Producer	Consumer	Government	Total	(B-C)	B/C	IRR
1 Thailand	390.9	0.0	0.0	390.9	0.0	390.9	---
Total NPV Benefits	390.9	0.0	0.0	390.9	0.0	390.9	---

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs		B-C
	Producer	Consumer	Government	Total	Total	
1984	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0
1995	34.9	0.0	0.0	34.9	0.0	34.9
1996	69.8	0.0	0.0	69.8	0.0	69.8
1997	104.7	0.0	0.0	104.7	0.0	104.7
1998	104.7	0.0	0.0	104.7	0.0	104.7
1999	104.7	0.0	0.0	104.7	0.0	104.7
2000	104.7	0.0	0.0	104.7	0.0	104.7
2001	104.7	0.0	0.0	104.7	0.0	104.7
2002	104.7	0.0	0.0	104.7	0.0	104.7
2003	104.7	0.0	0.0	104.7	0.0	104.7
2004	104.7	0.0	0.0	104.7	0.0	104.7
2005	104.7	0.0	0.0	104.7	0.0	104.7
2006	104.7	0.0	0.0	104.7	0.0	104.7
2007	104.7	0.0	0.0	104.7	0.0	104.7
2008	104.7	0.0	0.0	104.7	0.0	104.7
2009	104.7	0.0	0.0	104.7	0.0	104.7
2010	104.7	0.0	0.0	104.7	0.0	104.7
2011	104.7	0.0	0.0	104.7	0.0	104.7
2012	104.7	0.0	0.0	104.7	0.0	104.7
2013	104.7	0.0	0.0	104.7	0.0	104.7

Study: Biological control of weeds -Thailand
Scenario: Reservoirs
Commodity: Water
Period: 30 years
Discount: 8.0% (end of year) Benefit:1000A\$ Quantity: 1000 T
Regions: 1 Small Open Economy - Spillover: No
Base year: 1984

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumptn	Price	Elasticity	Transmission	Exog. Growth	Tax/Subsidy
(1)	(2)	(3)	(4)	Sup.	Dem. Wedge	Sup. Dem.	Sup. Dem.
	<--quantity units-->	<pr units>	<pr units>	(5)	(6)	(7) (8)	(9) (10) (11) (12)
						%/yr %/yr %/yr %/yr	%/yr %/yr
Thailand	1.1	1.1	745.45	0.000	0.000	0.00 1.00 0.00 0.00	0.00 0.00 0.00 0.00
	1	1					

SUMMARY OF R&D & ADOPTION DATA

Region	K Pot.	Success	Max. Adopt	Price	K Max	Shift Type	K Var	-Time Lags	Adopt
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	R&D Adopt AtMax	Form
	-%	-%	-%	<price units>	<price units>	%/yr	%/yr	-yrs- -yrs- -yrs-	(12) (13)
Thailand	100.00	100.0	15.0	745.45	111.81	S	0.00	11.0 3.0 99.0	0.0 L

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5

Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years

Region: 1 Thailand		Price transmission (v,w): 0.00, 1.000																			
<---no R&D--->				Producers				<--- no R&D --->				Consumers		<--- with R&D --->		<--- Tax Rev.>		<--- Research Costs			
Year	Price	Quantity		Price	Quantity	Benefits		Price	Quantity	Benefits		Price	Quantity	Benefits		"Prod"	"Cons"	Benefits	Costs		
1984	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1985	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1986	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1987	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1988	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1989	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1990	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1991	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1992	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1993	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1994	745.4	1.1	745.4	1.1	745.4	0.0	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1995	745.4	1.1	745.4	1.1	745.4	40.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1996	745.4	1.1	745.4	1.1	745.4	81.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1997	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1998	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
1999	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2000	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2001	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2002	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2003	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2004	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2005	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2006	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2007	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2008	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2009	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2010	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2011	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2012	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
2013	745.4	1.1	745.4	1.1	745.4	122.9	745.4	1.1	745.4	1.1	0.0	745.4	1.1	0.0	0.0	0.0	0.0	0.0	0.0		
Present value of benefits																458.9		0.0		0.0	

Year	K Total	K Base	K Spill	K Var	-- Price --		--R&D change in --		Production		--R&D change in --		Consumption	
					NoR&D	R&D	Price	Quantity	Value of Productn	Benefits /Vop (%)	Price	Quantity	Value of Consumptn	Benefits /VoC (%)
1984	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1985	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1986	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1987	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1988	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1989	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1990	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1991	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1992	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1993	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1994	0.00	0.00	0.0	0.00	745.4	745.4	0.00	0.0	819	0.0	0.00	0.0	819	0.0
1995	37.27	37.27	0.0	0.00	745.4	745.4	0.00	0.0	819	5.0	0.00	0.0	819	0.0
1996	74.54	74.54	0.0	0.00	745.4	745.4	0.00	0.0	819	10.0	0.00	0.0	819	0.0
1997	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
1998	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
1999	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2000	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	619	15.0	0.00	0.0	819	0.0
2001	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2002	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2003	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2004	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2005	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2006	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2007	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2008	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	319	15.0	0.00	0.0	819	0.0
2009	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2010	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2011	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2012	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0
2013	111.81	111.81	0.0	0.00	745.4	745.4	0.00	0.0	819	15.0	0.00	0.0	819	0.0

PRESENT VALUE SUMMARIES

Group 01

Region	Present Value of R&D Benefits			Costs		Returns	
	Producer	Consumer	Government	Total	(B-C)	B/C	IRR
1 Thailand	458.9	0.0	0.0	458.9	0.0	458.9	---
Total NPV Benefits	458.9	0.0	0.0	458.9	0.0	458.9	---

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs		B-C
	Producer	Consumer	Government	Total	Total	
1984	0.0	0.0	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0
1986	0.0	0.0	0.0	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0
1988	0.0	0.0	0.0	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.0
1995	40.9	0.0	0.0	40.9	40.9	40.9
1996	81.9	0.0	0.0	81.9	81.9	81.9
1997	122.9	0.0	0.0	122.9	122.9	122.9
1998	122.9	0.0	0.0	122.9	122.9	122.9
1999	122.9	0.0	0.0	122.9	122.9	122.9
2000	122.9	0.0	0.0	122.9	122.9	122.9
2001	122.9	0.0	0.0	122.9	122.9	122.9
2002	122.9	0.0	0.0	122.9	122.9	122.9
2003	122.9	0.0	0.0	122.9	122.9	122.9
2004	122.9	0.0	0.0	122.9	122.9	122.9
2005	122.9	0.0	0.0	122.9	122.9	122.9
2006	122.9	0.0	0.0	122.9	122.9	122.9
2007	122.9	0.0	0.0	122.9	122.9	122.9
2008	122.9	0.0	0.0	122.9	122.9	122.9
2009	122.9	0.0	0.0	122.9	122.9	122.9
2010	122.9	0.0	0.0	122.9	122.9	122.9
2011	122.9	0.0	0.0	122.9	122.9	122.9
2012	122.9	0.0	0.0	122.9	122.9	122.9
2013	122.9	0.0	0.0	122.9	122.9	122.9

Hand on Computer Exercise of the Case Studies

by

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The Gains from Research into Tradable Commodities

Geoff W. Edwards and John W. Freebairn

This paper develops a model for assessing the aggregate level and distribution of the benefits of research into tradable commodities. It estimates gains to Australia and to the rest of the world from research into the wool and wheat industries.

Key words: research and development, trade, wheat, wool.

Market models have been widely used to examine the gains from research into agricultural commodities. Norton and Davis have recently reviewed the methodology and published applications. Research makes possible a downward shift of the supply curve, and gains are measured as changes in economic surplus. Many studies consider the case of a nontraded good and assume that research affects all production units. Only a few studies have allowed for international trade. Some, such as Akino and Hayami and Ramalho de Castro and Schuh, assume that the country in which research reduces costs is able to export, or import, any quantity of the commodity without influencing world price. Studies by Martin and Havlicek and Sarris and Schmitz, for example, allow for effects on world prices via an excess demand curve. However, in all studies known to us research is assumed to shift supply only in one country.¹ Further, the social benefits from research are assessed only from the perspective of that country.

Many situations in which assessments of the benefits of research are required can be best represented as tradable commodity situations. Further, a particular research advance may reduce costs for a commodity in more than one country. Given that national governments are likely to be more concerned about the ef-

fects of technology changes on their own citizens than they are about the effects on citizens of the rest of the world, information is needed on the national effects of research when trade and different cost changes at home and abroad are important characteristics of the model. However, some international organizations and perhaps some national governments are interested in economic effects of research for aggregations of countries or for the whole world. This should be reflected in attempts to model the effects of research for tradable commodities.

In this paper a model is developed for assessing the aggregate level of benefits and the distribution of benefits of research into tradable commodities. A disaggregated commodity supply and demand model with separate sectors for the home country, *A*, and the rest of the world, *ROW*, is specified. Benefits (and costs) to producers, to consumers and in aggregate in *A*, *ROW*, and the world are assessed as changes in economic surpluses. Algebraic methods are employed. A discussion of the results yields several policy implications. The effect of relaxing key assumptions is considered. The model is illustrated by estimating the gains to Australia, the rest of the world, and the world from research into the wool and wheat industries.

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Hertford and Schmitz and Seabie and Posada considered supply shifts confined to a part of an industry within a nontraded commodity framework.

The Model

The model is a competitive market-clearing one. Supply and demand for a commodity are specified separately for country *A* and for *ROW*. World supply and demand are obtained by horizontal summation. These determine the

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world price, which applies to consumers and producers throughout the world. Exports (imports) by country A equal imports (exports) by ROW.

Research causes the supply curve to shift downward in country A and/or in ROW. Initially, the shift is assumed to be parallel. This implies equal cost reductions for all firms in a sector. Following Rose and Lindner and Jarrett (1980), a parallel shift of supply is used as a first approximation. It does not matter whether the research that shifts supply is undertaken in A or in ROW. The benefits may be measured net or gross of the costs of research depending on whether these costs are reflected in the price of new technology to producers and, hence, in the "with research" supply curve. It is convenient, but not essential, to assume initially no payments from country A to ROW or from ROW to A in exchange for property rights in the results of research. The assumption of free commodity trade implies a common price to producers and consumers throughout the world.

Suppose the set of linear supply and demand equations for country A and ROW are as follows:

- (1) A Demand : $Q_{da} = a_t - bP_t$,
 (2) A Supply : $Q_{sa} = \alpha_t + \beta P_t$,
 (3) ROW Demand : $Q_{dr} = c_t - dP_t$,
 (4) ROW Supply : $Q_{sr} = \gamma_t + \eta P_t$,
 (5) Market Equilibrium: $Q_t = Q_{da} + Q_{dr} = Q_{sa} + Q_{sr}$,

where P is price, Q is total quantity supplied and demanded, Q_{da} and Q_{dr} are quantities demanded in A and ROW, Q_{sa} and Q_{sr} are quantities supplied in A and ROW, b , β , d , and η are demand and supply price slopes (and recall, for example, that b is demand elasticity multiplied by Q_{da}/P) assumed to be constant, and a_t , α_t , c_t , and γ_t are the intercept terms, which may vary over time. These equations can be solved to determine the "without research" quantities and price.

Now introduce supply shifts caused by research-induced technological change. These are measured as a vertical shift of the supply curve to represent a fall in per unit production costs. The cost reductions are denoted as k_t for A and as h_t for ROW. Then, the "with research" supply equations become

- (6) $Q'_{sa} = \alpha_t + \beta k_t + \beta P'_t$,
 (7) $Q'_{sr} = \gamma_t + \eta h_t + \eta P'_t$,

where all terms are as defined above except that the prime superscript denotes with research. Equations (1), (6), (3), (7), and (5) are solved to determine the with research quantities and price.

The effect of the research-induced cost reductions on changes in economic surplus in a particular year t can be expressed in terms of initial quantities and the demand and supply price slope parameters. General expressions are:

consumer gains in country A

$$(8) \quad G_{ca}^A = \frac{1}{2}(P - P') (Q_{da} + Q'_{da}) \\ = \frac{\phi_t}{\Pi} Q_{da} + \frac{b\phi_t^2}{2\Pi^2};$$

producer gains in country A

$$(9) \quad G_{pa}^A = \frac{1}{2}[k_t - (P - P')] (Q_{sa} + Q'_{sa}) \\ = \left(k_t - \frac{\phi_t}{\Pi}\right) Q_{sa} + \frac{\beta}{2} \left(k_t - \frac{\phi_t}{\Pi}\right)^2;$$

aggregate gains in country A

$$(10) \quad G_t^A = G_{ca}^A + G_{pa}^A \\ = k_t Q_{sa} - \frac{\phi_t}{\Pi} (Q_{sa} - Q_{da}) + \frac{b\phi_t^2}{2\Pi^2} \\ + \frac{\beta}{2} \left(k_t - \frac{\phi_t}{\Pi}\right)^2;$$

consumer gains in ROW

$$(11) \quad G_{cr}^r = \frac{1}{2}(P - P') (Q_{dr} + Q'_{dr}) \\ = \frac{\phi_t}{\Pi} Q_{dr} + \frac{d\phi_t^2}{2\Pi^2};$$

producer gains in ROW

$$(12) \quad G_{pr}^r = \frac{1}{2}[h_t - (P - P')] (Q_{sr} + Q'_{sr}) \\ = \left(h_t - \frac{\phi_t}{\Pi}\right) Q_{sr} + \frac{\eta}{2} \left(h_t - \frac{\phi_t}{\Pi}\right)^2;$$

aggregate gains in ROW

$$(13) \quad G_t^r = G_{cr}^r + G_{pr}^r \\ = h_t Q_{sr} + \frac{\phi_t}{\Pi} (Q_{dr} - Q_{sr}) + \frac{d\phi_t^2}{2\Pi^2} \\ + \frac{\eta}{2} \left(h_t - \frac{\phi_t}{\Pi}\right)^2;$$

world consumer gains

$$(14) \quad G_{ca} = G_{ca}^A + G_{cr}^r;$$

world producer gains

$$(15) \quad G_{pa} = G_{pa}^A + G_{pr}^r;$$

aggregate world gain

$$(16) \quad G_t = G_{pt} + G_{ct} \\ = k_t Q_{sat} + h_t Q_{drt} + \frac{\beta}{2} \left(k_t - \frac{\phi_t}{\Pi} \right)^2 \\ + \frac{\eta}{2} \left(h_t - \frac{\phi_t}{\Pi} \right)^2;$$

where

$$(17) \quad \phi_t = \beta k_t + \eta h_t,$$

$$(18) \quad \Pi = b + \beta + d + \eta,$$

and all other terms are defined above.

Because research is like an investment that provides benefits over a number of years, the gross benefits of a research program will be represented by the present value formula:

$$(19) \quad PV(i) = \sum d_t G_t(i),$$

where $PV(i)$ denotes the present value of research benefits to group i (where i refers to producers, consumers, and aggregate in A , ROW , and world), $d_t = (1+r)^{-t}$ is the discount factor, and $G_t(i)$ is the level of annual benefits to group i specified in previous equations. Different rates and levels of adoption of the cost reductions in A and ROW can readily be accommodated via different time paths for the k_t and h_t variables which enter $G_t(i)$.

Implications

The analysis has implications for two groups of decision makers. The first is policy makers and research administrators concerned with allocating research resources to maximize national welfare. The second is people in international agencies or elsewhere who wish to see research being directed to increasing world welfare. Our analysis is conditional upon validity of the surplus measures and initially on the simplifying assumptions of free trade, parallel shifts of supply curves, and free transfer of technology.

National Level

Seven implications of the model for decisions on research at the national level may be noted. Some of these implications follow from a comparison of the disaggregated trading model of this paper and a comparable closed economy model (e.g., Hertford and Schmitz, Edwards and Freebairn 1981).

Consider first the relationship between the ratio of domestic to foreign cost reductions and aggregate domestic gains from research. By manipulating equation (10), it can be shown that country A gains from cost-reducing research² if

$$(20) \quad \frac{k_t}{h_t} > \frac{\eta(Q_{sa} - Q_{da})}{(b + d + \eta) Q_{sa} + \beta Q_{da}}, \text{ or}$$

$$(21) \quad \frac{k_t}{h_t} > \frac{e_s^r Q_{sr} (Q_{sa} - Q_{da})}{(e_d^a Q_{da} + e_d^r Q_{dr} + e_s^r Q_{sr}) Q_{sa} + e_s^a Q_{sa} Q_{da}},$$

where e_s^r , e_d^r , e_s^a , and e_d^a are elasticities of supply in ROW , demand in ROW , supply in country A , and demand in country A , all measured at the initial equilibrium; and Q is initial equilibrium quantity, with subscripts "s" and "d" denoting quantities supplied and demanded.

Expression (21) can be used to calculate break-even values of k_t/h_t above which country A gains from cost-reducing research. As an illustration, table 1 reports such calculations for the special case where the four elasticities are of any identical size. When country A 's share in world production is 20% or less, the break-even ratio is approximately one-half with no domestic consumption, approximately one-quarter with half of production consumed domestically, and zero with all production consumed domestically. Inspection of expression (21), or of equation (10), confirms that being a net importer of a commodity whose costs are reduced in country A and/or in ROW

² This analysis disregards the final two terms in equation (10). By ignoring what is normally a minor part of gains to country A , the break-even values discussed below will be (normally small) overestimates.

Table 1. Minimum Ratios of Domestic to Rest-of-World Cost Reductions (k/h) for a Country to Gain from Research

Ratio of Domestic Production to World Production	Ratio of Domestic Consumption to Domestic Production				
	0.00	0.25	0.50	0.75	1.00
0.01	0.497	0.373	0.248	0.124	0.000
0.10	0.474	0.351	0.231	0.114	0.000
0.20	0.444	0.324	0.211	0.103	0.000
0.30	0.412	0.296	0.189	0.091	0.000
0.40	0.375	0.265	0.167	0.079	0.000

Note: Computed from (21).

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by research is sufficient for country A to gain from the research.

The value of k_i/h_i necessary for country A to gain from research for an export commodity falls as country A's share in world production increases. The price effect of a given cost reduction in ROW is reduced as its share in world production decreases. Because the gain to country A consumers increases with the cost reduction in ROW, the break-even k_i/h_i becomes less responsive to country A's share in world production as its consumption to production ratio rises.

Although the break-even values of k_i/h_i are independent of the elasticities when these are identical in size, *ceteris paribus*, changes in individual elasticities or slopes alter those values. For export commodities, the break-even k_i/h_i increases with increases in the elasticity of supply in ROW (with η) and falls with increases in the elasticity of supply in country A (with β) and with the elasticity of demand in country A and ROW (with b and d).

Second, a country's producers will always gain from a research-induced parallel supply shift when costs in ROW are unaffected. A reduction in costs confined to a country comprising part of the total market will reduce price less than the reduction in costs unless demand in the market as a whole is completely inelastic and supply in the whole market is perfectly elastic. Failure to recognize this common sense result led Hertford and Schmitz to imply that a country's producers of a tradable commodity could lose from a parallel shift in supply confined to that country.³

Third, while producers in country A gain less when research reduces costs in ROW as well as their own costs, they will lose from such research only if the cost reductions in ROW are sufficiently larger than their own. From equation (9), when research reduces costs in country A and in ROW, the fall in unit costs in country A net of the fall in world price is

$$k_i - \frac{\phi_i}{\Pi} = \frac{k_i(b + \beta + d + \eta) - \beta k_i - \eta h_i}{\Pi} \\ = \frac{(b + d) k_i + \eta(k_i - h_i)}{\Pi} > 0 \text{ for } h_i \leq k_i.$$

³ Duane and Tisdell show that a country's producers may lose from research when the supply shift is divergent. However, the likelihood of producers losing in that case is less for an export commodity than for a nontraded commodity, and is very low unless the country's share in world production is substantial.

Further,

$$k_i - \frac{\phi_i}{\Pi} > 0 \text{ for } \frac{k_i}{h_i} > \frac{\eta}{b + d + \eta}.$$

The relationship between slopes and elasticities may be utilized again. For the case where country A produces one percent of world production and the elasticities are of any identical size, a value of 0.497 results; the cost reduction in ROW must be slightly more than twice as high as in country A if producers in A are to lose from research. The break-even cost ratio falls as A's share in world production increases; this can be seen from the figures in the first column of table 1. Changes in the proportion of production exported do not affect producers' gains or, therefore, the break-even cost ratio. The ratio increases with increases in the domestic and foreign elasticities of demand (in b and d) and falls with increasing foreign elasticity of supply (in η).

Fourth, the fact that producers of an export commodity and the country as a whole gain less as research enables larger or more quickly adoptable cost reductions in ROW suggests two guidelines that may help a country obtain a better payoff from research in its export-oriented industries. The first is that research which improves technologies or overcomes problems unique to the country will give a higher national economic payoff, other things (including the magnitude of the cost reduction) being equal, than research into technologies and problems that are also important in ROW. Adaptive research to make discoveries in other countries productive in the local setting often may be an attractive type of research according to the first guideline. The second guideline is that producers in an export industry and the nation will benefit more, *ceteris paribus*, the harder it is and the longer it takes for other countries to adopt its research results.

A country will obtain a higher payoff from research causing a given reduction in its costs of producing an imported commodity if the research causes cost reductions overseas, and if these occur quickly. (Producers in an importing country accounting for one percent of world production will gain unless the cost reduction in ROW is a little more than twice the reduction in their own industry). Other things equal, research that is not expected to reduce costs in ROW therefore needs to give a higher cost reduction domestically to offer the same

national return as research that is expected to lower costs in other countries.

Sixth, with identical values for initial domestic and foreign production and common values for elasticities of supply and demand, a country gains more from research that causes given cost reductions domestically and in ROW for an imported commodity than it does for an exported commodity. Producer gains are identical in the two cases, but consumers gain more for the imported commodity because consumption is larger. In the limiting case where downward shifts in supply leave world price unchanged, a country's gain from a given cost reduction is the same for import and export commodities.

Seventh, the increase in a country's economic welfare from a given cost reduction per unit for an export industry, even with no effect on costs in ROW, is less than the gain from the same cost reduction for a nontraded industry with the same initial production. When exports are large, the diminution in national welfare gain due to the fall in price may be substantial if demand is inelastic. For a nontraded commodity, the transfer from producers to consumers does not affect the national gain, which depends almost entirely on the size of the industry and the size of the cost reduction (Hertford and Schmitz). The relative advantage of research into nontraded goods over research into export commodities is increased if the latter research reduces costs in ROW. A given cost reduction for an import commodity gives a larger national return than the same cost reduction for a nontraded industry of identical size, even if the costs of producing the tradable commodity in ROW are not reduced. The margin in favor of the imported commodity is increased if research reduces costs in ROW.⁴

International Level

The analysis also has implications for people in international agencies or elsewhere who wish to assess research policies at least partly from the view of their effect on world welfare. Assume that changes in consumer and producer surplus in different countries are weight-

ed equally. A critical technical point is that, in general, the measurement of world aggregate gains from technological change affecting a part of the world supply or which has different effects on supply in different regions needs to be conducted using a disaggregated model. Inspection of formula (16) indicates that only for the special case where the cost reductions are equal in the two sectors, i.e., when $k_i = h_i = k$, does the formula collapse to

$$G = kQ + \frac{(b+d)(B+\eta)}{2\pi} k^2,$$

which can be readily measured as the area between the "without research" and "with research" aggregate supply curves and the demand curve. In all other cases, application of formula (16) requires detailed information for quantities and slope or elasticity parameters for the supply and demand curves of the two sectors.

From a policy point of view, the key implication is that attempts to maximize national economic returns from research programs and projects may prevent significant increases in real income in ROW. Scitovsky pointed out that, because of effects on foreigners through changes in world prices "investment in export industries is always less, and that in import-competing industries is always more, desirable from the national, than from the international point of view" (p. 151). In the present context, a national tendency to allocate more resources to import industries and less to export industries than is optimal from a world view is not the sole effect that internationalists may wish to criticize. Further reductions in world welfare are to be expected from the incentive in individual countries to concentrate research for export commodities on work expected to have little applicability in other countries and research for imported commodities on work expected to have applications in ROW. The story is more complicated if the weights attached to change in welfare from research differ between countries or between groups within countries.

Alternative Assumptions

The above implications depend on the assumptions of the model and in some applications some of them will not be reasonable. Relaxing the assumption that research causes a parallel shift of the supply curve leaves unaffected the change in price for a given reduction

⁴ The analysis also points to gains to country A if it can achieve a reallocation of research effort in ROW from technologies and problems unique to industries in ROW to technologies and problems ROW shares with A and, in the case of research applicable only in ROW, a redirection from ROW's import industries to its export industries.

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in unit costs defined as the "with shift" equilibrium. The gains to consumers and the losses to those nonadopting producers common to variously specified supply shifts do not change with type of shift.⁵ But the gains to producers adopting the research are influenced. A divergent shift gives smaller, and possibly negative, gains; while a convergent shift gives larger gains than a parallel shift. Aggregate world gains are largest with a convergent shift, intermediate with a parallel shift gives larger gains than a parallel shift.

Much world trade in agricultural products is influenced by tariff and nontariff trade barriers assumed away in the free trade model. Two general effects of price-insulating policies in ROW countries may be noted. By reducing world prices, they reduce country A's production and its cost savings from research. By reducing the elasticity of excess demand/supply in ROW, they increase the price-depressing effect of research adoption in country A. Compared with the free trade model, protection in ROW therefore results in smaller gains to research adoption in A's export industries. The effect on import industries is unclear because of the offsetting effects on cost savings and prices. Overall, the qualitative pattern of the results stands.

Allowing for royalty payments on the transfer of A's research to ROW would mean receipt of royalty payments by A, a lesser fall in the supply curve in the ROW because production costs are augmented by the royalty payment, and a smaller fall in world price than occurs with free technology transfer. These effects increase A's return from its research into export commodities, but the opposing royalty and price effects mean that its gains from research into import commodities may increase or decrease.

Finally, the assumption of linear supply and demand curves is justified as an approximation. The key effect of the algebraic form on our analysis is the nature of the research-induced shift of the supply curve discussed above; the effects on changes in prices of al-

ternative algebraic forms are unlikely to be important.

An Application

In this section the model is used to calculate the economic gains from research that affects the costs of wheat and wool production in various ways in Australia and in ROW.

The initial equilibrium values for quantities produced and consumed and for prices that apply in absence of the research being valued were taken or derived from Bureau of Agricultural Economics publications. The values are simple averages for the two years 1979-80 and 1980-81. The initial values for wheat were:

$$\begin{aligned} Q_{aa} &= 13,300 \text{ kilo tonnes,} \\ Q_{ar} &= 423,700 \text{ kilo tonnes,} \\ Q_{aa} &= 2,500 \text{ kilo tonnes,} \\ Q_{ar} &= 434,500 \text{ kilo tonnes, and} \\ P &= \$159.0 \text{ per tonne.} \end{aligned}$$

Production and consumption in Japan and the EEC were excluded from the initial values on the grounds that protection policies in those countries violate the free trade assumption of the model. For wool the initial values were:

$$\begin{aligned} Q_{aa} &= 707,000 \text{ kilo tonnes,} \\ Q_{ar} &= 2,116,000 \text{ kilo tonnes,} \\ Q_{aa} &= 35,350 \text{ kilo tonnes,} \\ Q_{ar} &= 2,787,650 \text{ kilo tonnes,} \\ P &= 2,501.9 \text{ per tonne.} \end{aligned}$$

The calculations were performed for a range of values for the elasticities of supply and demand. The elasticities are common to Australia and to ROW, and they apply at the initial equilibrium. The discount rate used to express future benefits from research in present value terms was 10%. The cost reductions from research are assumed to occur in equal annual amounts over five years.

The value of benefits resulting from cost-reducing research, as estimated by the model, is shown for wheat in table 2 and for wool in table 3. A number of observations are apparent.

When research reduces costs of wheat production by 40% in Australia and leaves costs unchanged in ROW, Australia's benefits are affected little by elasticities of supply and demand. This is because the implied world demand for Australian production is extremely elastic. In effect, the small country assumption is close to the mark in this case; this also

⁵ While all producers realize identical cost reductions in a sector experiencing a parallel supply shift (so that nonadopters are all outside the sector), a sector experiencing a nonparallel shift may have nonadopters. Where the cost reduction is not the same for all firms in a sector, estimation of sector gains requires model disaggregation into groups for which the cost reductions are identical unless price is unaffected (Edwards and Freebairn 1982). The assumption of a common cost reduction in each firm is also necessary with the alternative excess demand specification noted in the introduction.

Table 2. Gains to Australia, Rest of World, and World from Research that Reduces Costs of Producing Wheat (Present Values in Millions of Dollars Summed over 30 Years)

	Cost Reduction 10% in Australia, 0% in ROW				Cost Reduction 10% in Australia, 10% in ROW				Cost Reduction 0% in Australia, 10% in ROW			
	Elasticities of Supply and Demand											
	0.3 -0.1	1.0 -0.1	0.3 -0.2	1.0 -0.2	0.3 -0.1	1.0 -0.1	0.3 -0.2	1.0 -0.2	0.3 -0.1	1.0 -0.1	0.3 -0.2	1.0 -0.2
Gain to Australia												
Consumers	8	9	6	9	256	310	205	285	248	300	199	276
Producers	1,789	1,835	1,798	1,840	453	163	727	303	-1,301	-1,578	-1,043	-1,406
Total	1,797	1,844	1,804	1,849	709	475	932	589	-1,053	-1,228	-844	-1,130
Gain to ROW												
Consumers	1,347	1,633	1,078	1,498	44,419	53,880	35,608	49,561	43,063	52,234	34,519	48,042
Producers	-1,313	-1,590	-1,051	-1,458	14,438	5,254	23,149	9,666	15,761	6,862	24,212	11,150
Total	34	43	27	40	58,857	59,134	58,757	59,227	58,824	59,096	58,730	59,192
Gain to world												
Consumers	1,355	1,642	1,084	1,508	44,675	54,190	35,813	49,846	43,311	52,534	34,718	48,318
Producers	476	245	747	382	14,891	5,419	23,876	9,969	14,460	5,334	23,169	9,744
Total	1,831	1,887	1,831	1,890	59,566	59,609	59,689	59,815	57,771	57,868	57,887	58,062

explains the negligible benefits derived from research by Australian consumers of wheat. Because of Australia's importance in world wool production, world demand for Australian wool is much less price elastic than for wheat. Australia's gains from a research-induced cost reduction are therefore more sensitive to the elasticities than they are for wheat. The highest estimate of research benefits is 22% greater than the lowest estimate. The difference in Australia's importance in the world markets also explains why Australia's gains for wool are greatest with inelastic supply and elastic demand and smallest with elastic supply and

inelastic demand, while for wheat Australia gains most when supply and demand are elastic and least when they are both inelastic.

When research reduces costs in ROW as well as in Australia, the payoff to Australia for each commodity is much more sensitive to the elasticity of supply and demand. Further, with supply shifting uniformly throughout the market, Australia's gains from research for wheat as well as for wool are highest with inelastic supply and elastic demand and lowest with elastic supply and inelastic demand. When research reduces costs of wheat production by 10% domestically and in ROW, the gains to

Table 3. Gains to Australia, Rest of World, and World from Research that Reduces Costs of Producing Wool (Present Values in Millions of Dollars Summed over 30 Years)

	Cost Reduction 10% in Australia, 0% in ROW				Cost Reduction 10% in Australia, 10% in ROW				Cost Reduction 0% in Australia, 10% in ROW			
	Elasticities of Supply and Demand											
	0.05 -0.05	1.00 -0.05	0.05 -0.40	1.00 -0.40	0.05 -0.05	1.00 -0.05	0.05 -0.40	1.00 -0.40	0.05 -0.05	1.00 -0.05	0.05 -0.40	1.00 -0.40
Gain to Australia												
Consumers	9	18	2	14	38	72	84	55	28	54	6	41
Producers	1,325	1,191	1,472	1,288	756	72	1,346	437	-566	-1,043	-126	-789
Total	1,334	1,209	1,474	1,302	794	144	1,354	492	-538	-989	-120	-748
Gain to ROW												
Consumers	746	1,421	165	1,069	2,983	5,687	663	4,311	2,235	4,261	497	3,222
Producers	-566	-1,067	-126	-802	2,264	216	4,029	1,309	2,832	1,311	4,155	2,146
Total	180	354	39	267	5,247	5,903	4,692	5,621	5,067	5,572	4,652	5,368
Gain to world												
Consumers	755	1,439	167	1,083	3,021	5,759	747	4,366	2,263	4,315	503	3,263
Producers	759	124	1,346	486	3,020	288	5,375	1,746	2,266	268	4,029	1,357
Total	1,514	1,563	1,513	1,569	6,041	6,047	6,122	6,112	4,529	4,583	4,532	4,620

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Australia range between 26% and 52% of the gains when costs are reduced only in Australia. Australian consumers, who purchased 19% of Australian production in the initial situation, benefit from the fall in price with a worldwide research effect and obtain 22% to 65% of Australia's benefits from research. The gains to Australia from wool research that reduces costs throughout the world are 12% to 92% of gains when costs are reduced only in Australia. Because Australian wool consumption is initially only 5% of Australian production, gains to domestic consumers are always less than \$3 million per year in present value terms. For both commodities Australia sustains losses, though consumers gain, when research reduces costs overseas only.

A very different picture emerges if one takes an ROW perspective or a world view. World gains from research that reduces costs for wool by 10% in Australia and in ROW are approximately three times world gains for a 10% cost reduction confined to Australia; world gains for wheat are some thirty-three times larger. This highlights the possibility that a country which maximized its own payoff from research by concentrating on research with no value in ROW could prevent significant increases in world income.

Conclusion

A disaggregated market model has been used to examine the social benefits from cost-reducing research for tradable commodities. The model is in the partial equilibrium mold of earlier analyses. The general results of the analysis remain valid when the key assumptions of parallel supply shifts, free commodity trade, free technology transfer, and linear demand and supply are relaxed.

The analysis suggests that a country seeking to maximize the social benefits from research for an export commodity needs to allow for reductions in those benefits if the investment results in lower costs of production in other countries. However, a country's gains from research for commodities it imports increase with increases in the resulting cost reductions in ROW as well as within the country's own industry. When a country's research reduces costs in ROW, maximization of national social welfare requires that, *ceteris paribus*, a higher proportion of research resources be devoted to import industries and a smaller proportion

to export industries than when research causes no cost reductions in ROW. Reallocation of research to nontraded commodities from export commodities and from nontraded commodities to import commodities is also suggested. From the view of world social welfare, these reallocations are the opposite of what is desirable.

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References

- Akino, M., and T. Hayami. "Efficiency and Equity in Public Research: Rice Breeding in Japan's Economic Development." *Amer. J. Agr. Econ.* 57(1975):1-10.
- Bureau of Agricultural Economics. *Situation and Outlook 1982: Wheat*. Canberra: Australian Government Publishing Service, 1982.
- . *Situation and Outlook 1982: Wool*. Canberra: Australian Government Publishing Service, 1982.
- Duncan, R., and C. Tisdell. "Research and Technical Progress: The Returns to Producers." *Econ. Rec.* 47(1971):124-29.
- Edwards, G. W., and I. W. Freebairn. *Measuring a Country's Gains from Research: Theory and Application to Rural Research in Australia*. A Report to the Commonwealth Council for Rural Research and Extension. Canberra: Australian Government Publishing Service, 1981.
- . "The Social Benefits from an Increase in Productivity in a Part of an Industry." *Rev. Mktg. and Agr. Econ.* 50(1982):193-210.
- Hertford, R., and A. Schmitz. "Measuring Economic Returns to Agricultural Research." *Resource Allocation and Productivity in National and International Agricultural Research*, ed. T. M. Arndt, D. G. Dalrymple, and V. W. Ruttan. Minneapolis: University of Minnesota Press, 1977.
- Lindner, R. K., and F. G. Jarrett. "Supply Shifts and the Size of Research Benefits." *Amer. J. Agr. Econ.* 60(1978):48-58.
- . "Supply Shifts and the Size of Research Benefits: A Reply." *Amer. J. Agr. Econ.* 62(1980):841-44.
- Martin, M. A., and J. Havlicek. "Some Welfare Implications of the Adoption of Mechanical Cotton Harvesters in the United States." *Amer. J. Agr. Econ.* 59(1977):739-44.
- Norton, G. W., and J. S. Davis. "Evaluating Returns to Agricultural Research: a Review." *Amer. J. Agr. Econ.* 63(1981):685-99.
- Ramallo de Castro, J. P., and G. E. Schuh. "An Empirical Test of an Economic Model for Establishing Research Priorities: A Brazil Case Study." *Resource Allocation and Productivity in National and International Agricultural Research*, ed. T. M. Arndt, D. G.

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- Dalrymple, and V. W. Rutan. Minneapolis: University of Minnesota Press, 1977.
- Rose, R. N. "Supply Shifts and Research Benefits: Comment." *Amer. J. Agr. Econ.* 62(1980):834-37.
- Sarris, A. H., and A. Schmitz. "Toward a U.S. Agricultural Export Policy for the 1980s." *Amer. J. Agr. Econ.* 63(1981):832-39.
- Scitovsky, T. "Two Concepts of External Economies." *J. Polit. Econ.* 62(1954):143-51.
- Scobie, G. M., and R. Posada T. *The Impact of High-Yielding Rice Varieties in Latin America with Special Emphasis on Colombia, Cali, Colombia*: Centro Internacional de Agricultura Tropical. Series IE-01, 1977.

Study: Edwards and Freebairn 1984
 Scenario: Wheat Research
 Commodity: Wheat
 Period: 30 years
 Discount: 10.0%
 Regions: 2 Horizontal Multimarket - Spillover: No
 Base year: 1980
 Benefit: 1000 A\$ Quantity: 1000 T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumptn	Price	Sup.	Elasticity	Transmission	Exog.	Growth	Tax/Subsidy			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	<--quantity units-->		<pr units>		<pr un>		% /yr		% /yr		% /yr	
Australia	13300.0	2500.0	159.00	0.300	-0.100	0.00	1.00	0.00	0.00	0.00	0.00	
Rest of the World	423700.0	434500.0	159.00	0.300	-0.100	0.00	1.00	0.00	0.00	0.00	0.00	
	437000	437000										

SUMMARY OF R&D & ADOPTION DATA

Region	K	Pot.	Success	Adopt	Max.	Price	Max	Shift	K	-Time	Lags	Adopt	Adopt	Form
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	-%		-%		<price units>		% /yr		-yrs		-yrs		-yrs	
Australia	10.00	100.0	100.0	100.0	159.00	15.90	S	0.00	0.0	5.0	99.0	0.0	L	
Rest of the World	0.00	100.0	0.0	159.00	0.00	S	0.00	0.0	0.0	0.0	99.0	0.0	L	

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5

Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years

Region: 1 Australia		Price transmission (v,w):				0.00, 1.000			
		Producers		Consumers		Government		Research Costs	
<---no R&D--->		<---with R&D--->		<---no R&D--->		<---with R&D--->		<Tax Rev.>	
Year	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	"Prod" "Cons" Benefits
1980	159.0	13300.0	158.9	13377.9	41449.7	159.0	2500.0	2500.1	181.4
1981	159.0	13300.0	158.8	13455.9	83141.8	159.0	2500.0	2500.2	362.9
1982	159.0	13300.0	158.7	13533.9	125076.1	159.0	2500.0	2500.3	544.4
1983	159.0	13300.0	158.7	13611.9	167252.8	159.0	2500.0	2500.4	725.9
1984	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1985	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1986	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1987	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1988	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1989	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1990	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1991	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1992	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1993	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1994	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1995	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1996	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1997	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1998	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
1999	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2000	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2001	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2002	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2003	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2004	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2005	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2006	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2007	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2008	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
2009	159.0	13300.0	158.6	13689.8	209671.8	159.0	2500.0	2500.5	907.4
Present value of benefits									7752.4
									0.0

Year	K	K	K	K	Var	NoR&D	R&D	Price	--R&D	change in	Production	Benefits	--R&D	change in	Consumption	Benefits
	Total	Base	Spill	K					Price	Quantity	Productn	/VoP (%)	Price	Quantity	Consumptn	/VoC (%)
1980	3.18	3.18	0.0	0.00	0.00	159.0	158.9	-0.07	-0.07	77.9	2126127	1.9	-0.07	0.1	397336	0.0
1981	6.36	6.36	0.0	0.00	0.00	159.0	158.8	-0.14	-0.14	155.9	2137543	3.8	-0.14	0.2	397173	0.0
1982	9.54	9.54	0.0	0.00	0.00	159.0	158.7	-0.21	-0.21	233.9	2148948	5.8	-0.21	0.3	397009	0.1
1983	12.72	12.72	0.0	0.00	0.00	159.0	158.7	-0.29	-0.29	311.9	2160342	7.7	-0.29	0.4	396846	0.1
1984	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1985	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1986	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1987	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1988	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1989	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1990	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1991	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1992	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1993	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1994	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1995	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1996	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1997	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1998	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
1999	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2000	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2001	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2002	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2003	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2004	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2005	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2006	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2007	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2008	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2
2009	15.90	15.90	0.0	0.00	0.00	159.0	158.6	-0.36	-0.36	389.8	2171724	9.6	-0.36	0.5	396683	0.2

Region: 2 Rest of the World Price transmission (v,w): 0.00, 1.000

Year	Producers				Consumers				Government				Research	
	Price	Quantity	with R&D	Benefits	Price	Quantity	with R&D	Benefits	< Tax Rev.>	"Prod" "Cons"	Benefits	Costs		
1980	159.0	423700.0	158.9	423641.9	-30752.9	159.0	434500.0	158.9	434519.8	0.0	0.0	0.0	0.0	0.0
1981	159.0	423700.0	158.8	423583.9	-61501.7	159.0	434500.0	158.8	434539.6	0.0	0.0	0.0	0.0	0.0
1982	159.0	423700.0	158.7	423525.9	-92246.3	159.0	434500.0	158.7	434559.5	0.0	0.0	0.0	0.0	0.0
1983	159.0	423700.0	158.7	423467.8	-122986.6	159.0	434500.0	158.7	434579.3	0.0	0.0	0.0	0.0	0.0
1984	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1985	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1986	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1987	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1988	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1989	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1990	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1991	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1992	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1993	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1994	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1995	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1996	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1997	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1998	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
1999	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2000	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2001	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2002	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2003	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2004	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2005	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2006	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2007	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2008	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
2009	159.0	423700.0	158.6	423409.8	-153722.8	159.0	434500.0	158.6	434599.1	0.0	0.0	0.0	0.0	0.0
Present value of benefits										1347379.8				0.0
										-1313338.3				0.0

Year	K Total	K Base	K Spill	K Var	-- Price --			--R&D change in--			Production			--R&D change in--			Consumption		
					NoR&D	R&D	Price	Price	Quantity	Value of productn	Benefits /VoP (%)	Price	Quantity	Value of Consumptn	Benefits /VoC (%)				
1980	0.00	0.00	0.0	0.00	159.0	158.9	-0.07	-0.07	-58.0	67328322	-0.0	-0.07	19.8	69057113	0.0				
1981	0.00	0.00	0.0	0.00	159.0	158.8	-0.14	-0.14	-116.0	67288353	-0.0	-0.14	39.6	69028723	0.0				
1982	0.00	0.00	0.0	0.00	159.0	158.7	-0.21	-0.21	-174.0	67248393	-0.1	-0.21	59.5	69000331	0.1				
1983	0.00	0.00	0.0	0.00	159.0	158.7	-0.29	-0.29	-232.1	67208440	-0.1	-0.29	79.3	68971936	0.1				
1984	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1985	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1986	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1987	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1988	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1989	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1990	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1991	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1992	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1993	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1994	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1995	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1996	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1997	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1998	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
1999	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2000	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2001	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2002	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2003	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2004	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2005	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2006	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2007	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2008	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				
2009	0.00	0.00	0.0	0.00	159.0	158.6	-0.36	-0.36	-290.1	67168497	-0.2	-0.36	99.1	68943538	0.2				

PRESENT VALUE SUMMARIES

Group 01

Region	Present Value of R&D Benefits			Returns		
	Producer	Consumer	Government	Total	(B-C)	B/C
1 Australia	1789181.3	7752.4	0.0	1796933.7	0.0	1796933.7
Total NPV Benefits	1789181.3	7752.4	0.0	1796933.7	0.0	1796933.7

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs		
	Producer	Consumer	Government	Total	B-C	
1980	41449.7	181.4	0.0	41631.2	0.0	41631.2
1981	83141.8	362.9	0.0	83504.7	0.0	83504.7
1982	125076.1	544.4	0.0	125620.6	0.0	125620.6
1983	167252.8	725.9	0.0	167978.8	0.0	167978.8
1984	209671.8	907.4	0.0	210579.2	0.0	210579.2
1985	209671.8	907.4	0.0	210579.2	0.0	210579.2
1986	209671.8	907.4	0.0	210579.2	0.0	210579.2
1987	209671.8	907.4	0.0	210579.2	0.0	210579.2
1988	209671.8	907.4	0.0	210579.2	0.0	210579.2
1989	209671.8	907.4	0.0	210579.2	0.0	210579.2
1990	209671.8	907.4	0.0	210579.2	0.0	210579.2
1991	209671.8	907.4	0.0	210579.2	0.0	210579.2
1992	209671.8	907.4	0.0	210579.2	0.0	210579.2
1993	209671.8	907.4	0.0	210579.2	0.0	210579.2
1994	209671.8	907.4	0.0	210579.2	0.0	210579.2
1995	209671.8	907.4	0.0	210579.2	0.0	210579.2
1996	209671.8	907.4	0.0	210579.2	0.0	210579.2
1997	209671.8	907.4	0.0	210579.2	0.0	210579.2
1998	209671.8	907.4	0.0	210579.2	0.0	210579.2
1999	209671.8	907.4	0.0	210579.2	0.0	210579.2
2000	209671.8	907.4	0.0	210579.2	0.0	210579.2
2001	209671.8	907.4	0.0	210579.2	0.0	210579.2
2002	209671.8	907.4	0.0	210579.2	0.0	210579.2
2003	209671.8	907.4	0.0	210579.2	0.0	210579.2
2004	209671.8	907.4	0.0	210579.2	0.0	210579.2
2005	209671.8	907.4	0.0	210579.2	0.0	210579.2
2006	209671.8	907.4	0.0	210579.2	0.0	210579.2
2007	209671.8	907.4	0.0	210579.2	0.0	210579.2
2008	209671.8	907.4	0.0	210579.2	0.0	210579.2
2009	209671.8	907.4	0.0	210579.2	0.0	210579.2

Group 02

Region	Producer	Consumer	Government	Total	Costs	Returns (B-C)	B/C	IRR
2 Rest of the World	-131338.3	1347379.8	0.0	34041.5	0.0	34041.5	---	---
Total NPV Benefits	-131338.3	1347379.8	0.0	34041.5	0.0	34041.5	---	---

Cost and Benefit Summary Across All Regions in Group

Year	Producer	Consumer	Government	Total	Costs	B-C
1980	-30752.9	31539.7	0.0	786.7	0.0	786.7
1981	-61501.7	63080.9	0.0	1579.1	0.0	1579.1
1982	-92246.3	94623.5	0.0	2377.2	0.0	2377.2
1983	-122986.6	126167.6	0.0	3180.9	0.0	3180.9
1984	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1985	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1986	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1987	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1988	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1989	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1990	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1991	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1992	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1993	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1994	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1995	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1996	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1997	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1998	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
1999	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2000	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2001	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2002	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2003	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2004	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2005	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2006	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2007	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2008	-153722.8	157713.1	0.0	3990.3	0.0	3990.3
2009	-153722.8	157713.1	0.0	3990.3	0.0	3990.3

Total Scenario

Region	Producer	Consumer	Government	Total	Costs	(B-C)	Returns	B/C	IRR
1 Australia	1789181.3	7752.4	0.0	1796933.7	0.0	1796933.7	0.0	1796933.7	---
2 Rest of the World	-1313338.3	1347379.8	0.0	34041.5	0.0	34041.5	0.0	34041.5	---
Total NPV Benefits	475842.9	1355132.3	0.0	1830975.3	0.0	1830975.3	0.0	1830975.3	---

Cost and Benefit Summary Across All Regions in Group

Year	Producer	Consumer	Government	Total	Costs	B-C
1980	10696.7	31721.2	0.0	42417.9	0.0	42417.9
1981	21640.0	63443.8	0.0	85083.9	0.0	85083.9
1982	32829.8	95168.0	0.0	127997.8	0.0	127997.8
1983	44266.1	126893.5	0.0	171159.7	0.0	171159.7
1984	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1985	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1986	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1987	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1988	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1989	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1990	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1991	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1992	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1993	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1994	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1995	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1996	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1997	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1998	55949.0	158620.6	0.0	214569.6	0.0	214569.6
1999	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2000	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2001	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2002	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2003	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2004	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2005	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2006	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2007	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2008	55949.0	158620.6	0.0	214569.6	0.0	214569.6
2009	55949.0	158620.6	0.0	214569.6	0.0	214569.6

Study: Edwards and Freebairn 1984
 Scenario: Wool Research
 Commodity: Wool
 Period: 30 years
 Discount: 10.0%

Regions: 2 Horizontal Multimarket - Spillover: No
 Base year: 1984
 Benefit: 1000 A\$ Quantity: 1000 T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumptn	Price	Sup.	Elasticity	Transmission	Exog. Growth	Tax/Subsidy			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	<--quantity units-->		<pr units>			<pr un>		%/yr	%/yr	%/yr	%/yr
Australia	707.0	35.3	2501.90	0.050	-0.050	0.00	1.00	0.00	0.00	0.00	0.00
Rest of the World	2116.0	2787.7	2501.90	0.050	-0.050	0.00	1.00	0.00	0.00	0.00	0.00
2823	2823										

SUMMARY OF R&D & ADOPTION DATA

Region	K Pot.	Prob.of Success	Max. Adopt	Price	K Max	Shift Type	K Var	-Time Lags R&D	-Time Lags Adopt	-Time Lags AtMax	-Time Lags Aband	Form
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	-%	-%	-%	<price units>			%/yr	-yrs-	-yrs-	-yrs-	-yrs-	
Australia	10.00	100.0	100.0	2501.90	250.19	S	0.00	0.0	5.0	99.0	0.0	L
Rest of the World	10.00	100.0	100.0	2501.90	250.19	S	0.00	0.0	5.0	99.0	0.0	L
Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5												
Kkvar is the variable unit cost reduction (%/year), if specified.												
Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic												
* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years												

Region: 1 Australia Price transmission (v,w): 0.00, 1.000

Year	<---no R&D--->			Producers			<---no R&D--->			Consumers			<---with R&D--->			Government			Research Costs		
	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price
1984	2501.9	707.0	2476.8	707.3	17692.8	2501.9	35.3	2476.8	35.3	2476.8	35.3	2476.8	35.3	883.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1985	2501.9	707.0	2451.8	707.7	35394.5	2501.9	35.3	2451.8	35.3	2451.8	35.3	2451.8	35.3	1767.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1986	2501.9	707.0	2426.8	708.0	53105.0	2501.9	35.3	2426.8	35.3	2426.8	35.3	2426.8	35.3	2651.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1987	2501.9	707.0	2401.8	708.4	70824.4	2501.9	35.3	2401.8	35.3	2401.8	35.3	2401.8	35.3	3536.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1988	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1989	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1992	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1993	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1994	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1995	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1997	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2009	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	2501.9	707.0	2376.8	708.7	88552.7	2501.9	35.3	2376.8	35.3	2376.8	35.3	2376.8	35.3	4421.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Present value of benefits															37769.3						0.0
															756456.2						0.0

Price			Production				Consumption				Benefits				Value of Benefits			
Year	Total	K	Base	K	Spill	K	Var	NoR&D	R&D	--R&D Price	change in Quantity	- Value of Productn	Benefits /VoP (%)	--R&D Price	change in Quantity	- Value of Consumptn	Benefits /VoC (%)	
1984	50.03	50.03	0.0	0.00	2501.9	2476.8	-25.01	0.3	1752030	1.0	-25.01	0.0	87477	1.0	87477	1.0	87477	
1985	100.07	100.07	0.0	0.00	2501.9	2451.8	-50.03	0.7	1735199	2.0	-50.03	0.0	86637	2.0	86637	2.0	86637	
1986	150.11	150.11	0.0	0.00	2501.9	2426.8	-75.05	1.0	1718351	3.0	-75.05	0.0	85796	3.0	85796	3.0	85796	
1987	200.15	200.15	0.0	0.00	2501.9	2401.8	-100.07	1.4	1701485	4.1	-100.07	0.0	84953	4.1	84953	4.1	84953	
1988	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1989	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1990	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1991	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1992	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1993	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1994	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1995	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1996	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1997	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1998	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
1999	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2000	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2001	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2002	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2003	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2004	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2005	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2006	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2007	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2008	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2009	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2010	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2011	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2012	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	
2013	250.19	250.19	0.0	0.00	2501.9	2376.8	-125.09	1.7	1684602	5.2	-125.09	0.0	84110	5.2	84110	5.2	84110	

PRESENT VALUE SUMMARIES
Group 01

Region	Producer	Consumer	Government	Total	Costs	(B-C)	Returns	B/C	IRR
1 Australia	756456.2	37769.3	0.0	794225.5	0.0	794225.5	0.0	794225.5	0.0
Total NPV Benefits	756456.2	37769.3	0.0	794225.5	0.0	794225.5	0.0	794225.5	0.0

Cost and Benefit Summary Across All Regions in Group

Year	Producer	Consumer	Government	Total	Costs	B-C
1984	17692.8	883.3	0.0	18576.2	0.0	18576.2
1985	35394.5	1767.2	0.0	37161.7	0.0	37161.7
1986	53105.0	2651.4	0.0	55756.5	0.0	55756.5
1987	70824.4	3536.2	0.0	74360.7	0.0	74360.7
1988	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1989	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1990	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1991	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1992	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1993	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1994	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1995	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1996	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1997	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1998	88552.7	4421.3	0.0	92974.0	0.0	92974.0
1999	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2000	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2001	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2002	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2003	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2004	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2005	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2006	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2007	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2008	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2009	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2010	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2011	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2012	88552.7	4421.3	0.0	92974.0	0.0	92974.0
2013	88552.7	4421.3	0.0	92974.0	0.0	92974.0

Group 02

Region	Present Value of R&D Benefits			Costs			Returns	
	Producer	Consumer	Government	Total	(B-C)	B/C	IRR	
2 Rest of the World	2264019.0	2982706.0	0.0	5246725.1	0.0	5246725.1	---	---
Total NPV Benefits	2264019.0	2982706.0	0.0	5246725.1	0.0	5246725.1	---	---

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs			B-C
	Producer	Consumer	Government	Total	Costs	B-C	
1984	52953.4	69762.9	0.0	122716.3	0.0	122716.3	
1985	105933.3	139560.6	0.0	245494.0	0.0	245494.0	
1986	158939.7	209393.3	0.0	368333.0	0.0	368333.0	
1987	211972.5	279260.8	0.0	491233.4	0.0	491233.4	
1988	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1989	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1990	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1991	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1992	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1993	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1994	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1995	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1996	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1997	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1998	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
1999	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2000	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2001	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2002	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2003	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2004	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2005	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2006	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2007	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2008	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2009	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2010	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2011	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2012	265031.8	349163.2	0.0	614195.1	0.0	614195.1	
2013	265031.8	349163.2	0.0	614195.1	0.0	614195.1	

Total Scenario

Region	Producer	Consumer	Government	Total	Costs	Returns (B-C)	B/C	IRR
1 Australia	756456.2	37769.3	0.0	794225.5	0.0	794225.5	---	---
2 Rest of the World	2264019.0	2982706.0	0.0	5246725.1	0.0	5246725.1	---	---
Total NPV Benefits	3020475.3	3020475.3	0.0	6040950.7	0.0	6040950.7	---	---

Cost and Benefit Summary Across All Regions in Group

Year	Producer	Consumer	Government	Total	Costs	B-C
1984	70646.2	70646.2	0.0	141292.5	0.0	141292.5
1985	141327.9	141327.9	0.0	282655.8	0.0	282655.8
1986	212044.8	212044.8	0.0	424089.6	0.0	424089.6
1987	282797.0	282797.0	0.0	565594.1	0.0	565594.1
1988	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1989	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1990	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1991	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1992	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1993	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1994	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1995	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1996	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1997	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1998	353584.6	353584.6	0.0	707169.2	0.0	707169.2
1999	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2000	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2001	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2002	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2003	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2004	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2005	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2006	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2007	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2008	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2009	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2010	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2011	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2012	353584.6	353584.6	0.0	707169.2	0.0	707169.2
2013	353584.6	353584.6	0.0	707169.2	0.0	707169.2

study: examples of DREAM use

Scenario: Cotton-Small Open Ec
 Commodity: Cotton
 Period: 15 years
 Discount: 5.0%
 Regions: 1 Small Open Economy - Spillover: No
 Base year: 1994
 Benefit: 1000US\$ Quantity: 1000 T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumptn	Price	Sup.	Elasticity	Transmission	Exog.	Growth	Tax/Subsidy		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	<--quantity units-->	<pr units>				<pr un>		%/yr	%/yr	%/yr	%/yr
Colombia	32000.0	26000.0	800.00	0.200	-0.400	0.00	1.00	0.00	0.00	0.00	0.00
	32000	26000									

SUMMARY OF R&D & ADOPTION DATA

Region	K	Prob.of	Max.	Pot.	Success	Adopt	Price	Max	Shift	K	-Time	Lags	Adopt
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	
	-%	-%	-%	<price units>	%/yr	-yrs-	-yrs-	-yrs-	-yrs-	-yrs-	-yrs-	-yrs-	
Colombia	5.00	80.0	20.0	800.00	6.40	S	0.00	5.0	8.0	99.0	0.0	X	

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5
 Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years

(a) In this case, this is not a transmission elasticity but rather the annual % change in the world price (see market: change.
 cotton.doc/Example_Database
 Computer Exercises: Thai Economic Impact Assessment Workshop 21 - 24 May 2001

Region: 1 Colombia Price transmission (v,w): 0.00, 1.000

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Hand on Computer Exercise of the Case Studies

Producers										Consumers										Government			
<---no R&D--->					with R&D					<---no R&D--->					with R&D					< Tax Rev. >			
Year	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Year	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	"Prod"	"Cons"	Benefits	Research Costs
1994	800.0	32000.0	800.0	32000.0	0.0	800.0	26000.0	800.0	26000.0	0.0	800.0	26000.0	800.0	26000.0	0.0	800.0	26000.0	800.0	26000.0	0.0	0.0	0.0	0.0
1995	808.0	32064.0	808.0	32064.0	0.0	808.0	25896.0	808.0	25896.0	0.0	808.0	25896.0	808.0	25896.0	0.0	808.0	25896.0	808.0	25896.0	0.0	0.0	0.0	0.0
1996	816.0	32128.1	816.0	32128.1	0.0	816.0	25792.4	816.0	25792.4	0.0	816.0	25792.4	816.0	25792.4	0.0	816.0	25792.4	816.0	25792.4	0.0	0.0	0.0	0.0
1997	824.2	32192.3	824.2	32192.3	0.0	824.2	25689.2	824.2	25689.2	0.0	824.2	25689.2	824.2	25689.2	0.0	824.2	25689.2	824.2	25689.2	0.0	0.0	0.0	0.0
1998	832.4	32256.7	832.4	32256.7	0.0	832.4	25586.4	832.4	25586.4	0.0	832.4	25586.4	832.4	25586.4	0.0	832.4	25586.4	832.4	25586.4	0.0	0.0	0.0	0.0
1999	840.8	32321.2	840.8	32321.2	5223.7	840.8	25484.1	840.8	25484.1	0.0	840.8	25484.1	840.8	25484.1	0.0	840.8	25484.1	840.8	25484.1	0.0	0.0	0.0	0.0
2000	849.2	32385.9	849.2	32385.9	16123.0	849.2	25382.2	849.2	25382.2	0.0	849.2	25382.2	849.2	25382.2	0.0	849.2	25382.2	849.2	25382.2	0.0	0.0	0.0	0.0
2001	857.7	32450.6	857.7	32450.6	44796.4	857.7	25280.6	857.7	25280.6	0.0	857.7	25280.6	857.7	25280.6	0.0	857.7	25280.6	857.7	25280.6	0.0	0.0	0.0	0.0
2002	866.2	32515.5	866.2	32515.5	98621.1	866.2	25179.5	866.2	25179.5	0.0	866.2	25179.5	866.2	25179.5	0.0	866.2	25179.5	866.2	25179.5	0.0	0.0	0.0	0.0
2003	874.9	32580.6	874.9	32580.6	156339.6	874.9	25078.8	874.9	25078.8	0.0	874.9	25078.8	874.9	25078.8	0.0	874.9	25078.8	874.9	25078.8	0.0	0.0	0.0	0.0
2004	883.6	32645.7	883.6	32645.7	190782.0	883.6	24978.5	883.6	24978.5	0.0	883.6	24978.5	883.6	24978.5	0.0	883.6	24978.5	883.6	24978.5	0.0	0.0	0.0	0.0
2005	892.5	32711.0	892.5	32711.0	204881.3	892.5	24878.6	892.5	24878.6	0.0	892.5	24878.6	892.5	24878.6	0.0	892.5	24878.6	892.5	24878.6	0.0	0.0	0.0	0.0
2006	901.4	32776.5	901.4	32776.5	209919.7	901.4	24779.0	901.4	24779.0	0.0	901.4	24779.0	901.4	24779.0	0.0	901.4	24779.0	901.4	24779.0	0.0	0.0	0.0	0.0
2007	910.4	32842.0	910.4	32842.0	210338.0	910.4	24679.9	910.4	24679.9	0.0	910.4	24679.9	910.4	24679.9	0.0	910.4	24679.9	910.4	24679.9	0.0	0.0	0.0	0.0
2008	919.5	32907.7	919.5	32907.7	210757.2	919.5	24581.2	919.5	24581.2	0.0	919.5	24581.2	919.5	24581.2	0.0	919.5	24581.2	919.5	24581.2	0.0	0.0	0.0	0.0
Present value of benefits										787286.9										0.0			

Production										Consumption									
-- Price --					--R&D change in - Value of					--R&D change in - Value of					Consumption				
Year	Total	K	Base	Spill	K	Var	K	NoR&D	R&D	Price	Quantity	Productn	VoP (%)	Benefits	Price	Quantity	Consumptn	VoC (%)	Benefits
1994	0.00	0.00	0.00	0.0	0.00	0.00	800.0	800.0	800.0	0.00	0.0	25600000	0.0	0.0	0.00	0.0	20800000	0.0	0.0
1995	0.00	0.00	0.00	0.0	0.00	0.00	808.0	808.0	808.0	0.00	0.0	25907712	0.0	0.0	0.00	0.0	20923968	0.0	0.0
1996	0.00	0.00	0.00	0.0	0.00	0.00	816.0	816.0	816.0	0.00	0.0	26219122	0.0	0.0	0.00	0.0	21048674	0.0	0.0
1997	0.00	0.00	0.00	0.0	0.00	0.00	824.2	824.2	824.2	0.00	0.0	26534276	0.0	0.0	0.00	0.0	21174124	0.0	0.0
1998	0.00	0.00	0.00	0.0	0.00	0.00	832.4	832.4	832.4	0.00	0.0	26853218	0.0	0.0	0.00	0.0	21300322	0.0	0.0
1999	0.16	0.16	0.16	0.0	0.00	0.00	840.8	840.8	840.8	0.00	1.2	27177047	0.0	0.0	0.00	0.0	21427272	0.0	0.0
2000	0.49	0.49	0.49	0.0	0.00	0.00	849.2	849.2	849.2	0.00	3.8	27505899	0.0	0.0	0.00	0.0	21554979	0.0	0.0
2001	1.38	1.38	1.38	0.0	0.00	0.00	857.7	857.7	857.7	0.00	10.5	27842260	0.1	0.0	0.00	0.0	21683446	0.0	0.0
2002	3.03	3.03	3.03	0.0	0.00	0.00	866.2	866.2	866.2	0.00	22.9	28187661	0.3	0.0	0.00	0.0	21812680	0.0	0.0
2003	4.79	4.79	4.79	0.0	0.00	0.00	874.9	874.9	874.9	0.00	36.0	28537863	0.5	0.0	0.00	0.0	21942683	0.0	0.0
2004	5.84	5.84	5.84	0.0	0.00	0.00	883.6	883.6	883.6	0.00	43.4	28887445	0.6	0.0	0.00	0.0	22073462	0.0	0.0
2005	6.25	6.25	6.25	0.0	0.00	0.00	892.5	892.5	892.5	0.00	46.2	29237049	0.7	0.0	0.00	0.0	22205020	0.0	0.0
2006	6.40	6.40	6.40	0.0	0.00	0.00	901.4	901.4	901.4	0.00	46.9	29588997	0.7	0.0	0.00	0.0	22337361	0.0	0.0
2007	6.40	6.40	6.40	0.0	0.00	0.00	910.4	910.4	910.4	0.00	46.5	29944233	0.7	0.0	0.00	0.0	22470492	0.0	0.0
2008	6.40	6.40	6.40	0.0	0.00	0.00	919.5	919.5	919.5	0.00	46.1	30303738	0.6	0.0	0.00	0.0	22604416	0.0	0.0

PRESENT VALUE SUMMARIES

All regions

Region	Present Value of R&D Benefits			Costs		Returns	
	Producer	Consumer	Government	Total	(B-C)	B/C	IRR
1 Colombia	787286.9	0.0	0.0	787286.9	0.0	787286.9	---
Total NPV Benefits	787286.9	0.0	0.0	787286.9	0.0	787286.9	---

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs		Total	
	Producer	Consumer	Government	Total	Costs	B-C	
1994	0.0	0.0	0.0	0.0	0.0	0.0	
1995	0.0	0.0	0.0	0.0	0.0	0.0	
1996	0.0	0.0	0.0	0.0	0.0	0.0	
1997	0.0	0.0	0.0	0.0	0.0	0.0	
1998	0.0	0.0	0.0	0.0	0.0	0.0	
1999	5223.7	0.0	0.0	5223.7	0.0	5223.7	
2000	16123.0	0.0	0.0	16123.0	0.0	16123.0	
2001	44796.4	0.0	0.0	44796.4	0.0	44796.4	
2002	98621.1	0.0	0.0	98621.1	0.0	98621.1	
2003	156339.6	0.0	0.0	156339.6	0.0	156339.6	
2004	190782.0	0.0	0.0	190782.0	0.0	190782.0	
2005	204881.3	0.0	0.0	204881.3	0.0	204881.3	
2006	209919.7	0.0	0.0	209919.7	0.0	209919.7	
2007	210338.0	0.0	0.0	210338.0	0.0	210338.0	
2008	210757.2	0.0	0.0	210757.2	0.0	210757.2	

(a) In this case, this is not a transmission elasticity but rather the annual % change in the world price (see market: change.
cotton.doc/Example_Database
Computer Exercises: Thai Economic Impact Assessment Workshop 21 - 24 May 2001

Study: Examples of DREAM Use
Scenario: Soil Conservation
Commodity: Potato Regions: 1 Single Closed Economy - Spillover: No
Period: 15 years Base year: 1997
Discount: 5.0% Benefit: 1000US\$ Quantity: 1000T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumptn	Price	Sup.	Elasticity	Transmission	Exog.	Growth	Tax/Subsidy		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	<--quantity units-->	<pr units>				<pr un>		%/yr	%/yr	%/yr	%/yr
Hillside	3000.0	3000.0	160.00	0.800	-1.000	0.00	1.00	0.00	0.00	0.00	0.00
	3000	3000									

SUMMARY OF R&D & ADOPTION DATA

Region	K	Pot.	Success	Max.	Price	K	Shift	K	-Time	Lags	Adopt
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	-%	-%	-%	<price units>	%/yr	-yrs-	-yrs-	-yrs-	-yrs-	-yrs-	-yrs-
Hillside	8.00	100.0	40.0	160.00	5.12	S	0.20	6.0	4.0	99.0	0.0
											X

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5

Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years

Region: 1 Hillside

Price transmission (v,w): 0.00, 1.000

Year	Producers				Consumers				Government			
	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity
1997	160.0	3000.0	160.0	3000.0	160.0	3000.0	160.0	3000.0	0.0	0.0	0.0	0.0
1998	160.0	3000.0	160.0	3000.0	160.0	3000.0	160.0	3000.0	0.0	0.0	0.0	0.0
1999	160.0	3000.0	160.0	3000.0	160.0	3000.0	160.0	3000.0	0.0	0.0	0.0	0.0
2000	160.0	3000.0	160.0	3000.0	160.0	3000.0	160.0	3000.0	0.0	0.0	0.0	0.0
2001	160.0	3000.0	160.0	3000.0	160.0	3000.0	160.0	3000.0	0.0	0.0	0.0	0.0
2002	160.0	3000.0	160.0	3000.0	160.0	3000.0	160.0	3000.0	0.0	0.0	0.0	0.0
2003	160.0	3000.0	159.8	3002.5	506.6	160.0	3000.0	159.8	3002.5	405.2	0.0	0.0
2004	160.0	3000.0	158.9	3019.9	4012.7	160.0	3000.0	158.9	3019.9	3210.2	0.0	0.0
2005	160.0	3000.0	157.5	3045.5	9169.7	160.0	3000.0	157.5	3045.5	7335.8	0.0	0.0
2006	160.0	3000.0	157.2	3051.5	10402.5	160.0	3000.0	157.2	3051.5	8322.0	0.0	0.0
2007	160.0	3000.0	157.1	3052.6	10619.5	160.0	3000.0	157.1	3052.6	8495.6	0.0	0.0
2008	160.0	3000.0	157.1	3053.7	10836.7	160.0	3000.0	157.1	3053.7	8669.3	0.0	0.0
2009	160.0	3000.0	157.0	3054.7	11053.8	160.0	3000.0	157.0	3054.7	8843.1	0.0	0.0
2010	160.0	3000.0	157.0	3055.8	11271.1	160.0	3000.0	157.0	3055.8	9016.9	0.0	0.0
2011	160.0	3000.0	156.9	3056.9	11488.5	160.0	3000.0	156.9	3056.9	9190.8	0.0	0.0
Present value of benefits										37545.9	0.0	0.0

Year	Price				Production				Consumption			
	Total	Base	K	Spill	R&D	Price	Quantity	Value of	R&D change in	Price	Quantity	Value of
1997	0.00	0.00	0.00	0.00	160.0	160.0	0.00	0.0	480000	0.0	0.0	480000
1998	0.00	0.00	0.00	0.00	160.0	160.0	0.00	0.0	480000	0.0	0.0	480000
1999	0.00	0.00	0.00	0.00	160.0	160.0	0.00	0.0	480000	0.0	0.0	480000
2000	0.00	0.00	0.00	0.00	160.0	160.0	0.00	0.0	480000	0.0	0.0	480000
2001	0.00	0.00	0.00	0.00	160.0	160.0	0.00	0.0	480000	0.0	0.0	480000
2002	0.00	0.00	0.00	0.00	160.0	160.0	0.00	0.0	480000	0.0	0.0	480000
2003	0.30	0.25	0.00	0.04	160.0	159.8	-0.13	2.5	479999	0.1	-0.13	2.5
2004	2.39	2.03	0.00	0.36	160.0	158.9	-1.06	19.9	479978	0.8	-1.06	19.9
2005	5.46	4.59	0.00	0.86	160.0	157.5	-2.42	45.5	479889	1.9	-2.42	45.5
2006	6.18	5.12	0.00	1.06	160.0	157.2	-2.75	51.5	479858	2.1	-2.75	51.5
2007	6.31	5.12	0.00	1.19	160.0	157.1	-2.80	52.6	479852	2.2	-2.80	52.6
2008	6.44	5.12	0.00	1.32	160.0	157.1	-2.86	53.7	479846	2.2	-2.86	53.7
2009	6.57	5.12	0.00	1.45	160.0	157.0	-2.92	54.7	479840	2.3	-2.92	54.7
2010	6.70	5.12	0.00	1.58	160.0	157.0	-2.97	55.8	479833	2.3	-2.97	55.8
2011	6.82	5.12	0.00	1.70	160.0	156.9	-3.03	56.9	479827	2.3	-3.03	56.9

Discounting Rules: Cost - Start
Benefit - Start

PRESENT VALUE SUMMARIES

Grupo Uno

Region	Present Value of R&D Benefits			Costs		Returns	
	Producer	Consumer	Government	Total	(B-C)	B/C	IRR
1 Hillside	46932.4	37545.9	0.0	84478.3	0.0	84478.3	---
Total NPV Benefits	46932.4	37545.9	0.0	84478.3	0.0	84478.3	---

Cost and Benefit Summary Across All Regions in Group

Year	Benefits			Costs		Total	
	Producer	Consumer	Government	Total	B-C		
1997	0.0	0.0	0.0	0.0	0.0	0.0	
1998	0.0	0.0	0.0	0.0	0.0	0.0	
1999	0.0	0.0	0.0	0.0	0.0	0.0	
2000	0.0	0.0	0.0	0.0	0.0	0.0	
2001	0.0	0.0	0.0	0.0	0.0	0.0	
2002	0.0	0.0	0.0	0.0	0.0	0.0	
2003	506.6	405.2	0.0	911.8	0.0	911.8	
2004	4012.7	3210.2	0.0	7222.9	0.0	7222.9	
2005	9169.7	7335.8	0.0	16505.5	0.0	16505.5	
2006	10402.5	8322.0	0.0	18724.5	0.0	18724.5	
2007	10619.5	8495.6	0.0	19115.2	0.0	19115.2	
2008	10836.7	8669.3	0.0	19506.0	0.0	19506.0	
2009	11053.8	8843.1	0.0	19897.0	0.0	19897.0	
2010	11271.1	9016.9	0.0	20288.0	0.0	20288.0	
2011	11488.5	9190.8	0.0	20679.3	0.0	20679.3	

Study: Examples of DREAM Use
 Scenario: Tortilla made of Maiz
 Commodity: Corn Regions: 3 Vertical Market (3 level, fixed proportions) - Spillover: No
 Period: 15 years Base year: 1997
 Discount: 5.0% Benefit: 1000US\$ Quantity: 1000T

SUMMARY OF INITIAL MARKET CONDITIONS

Region	Production	Consumptn	Price	Sup.	Elasticity	Transmission	Exog.	Growth	Tax/Subsidy		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	<--quantity	units-->	<pr units>			<pr un>		%/yr	%/yr	%/yr	%/yr
Farm- maize grain	2000.0	0.0	120.00	0.560	0.000	0.00	1.00	0.00	0.00	0.00	0.00
Maize processing	1600.0	0.0	30.00	1.000	0.000	0.00	1.00	0.00	0.00	0.00	0.00
Consumer- tortilla	1600.0	1600.0	180.00	0.600	-0.800	0.00	1.00	0.00	0.00	0.00	0.00

SUMMARY OF R&D & ADOPTION DATA

Region	Pot.	Success	Adopt	Price	Max	Shift	K	Time	Lags	Adopt	Adopt	Form
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	-%	-%	-%	<price	units>		%/yr	-yrs-	-yrs-	-yrs-	-yrs-	
Farm- maize grain	4.00	85.0	80.0	120.00	3.26	- S	0.00	2.0	3.0	99.0	0.0	X
Maize processing	0.00	0.0	0.0	30.00	0.00	S	0.00	0.0	0.0	99.0	0.0	L
Consumer- tortilla	0.00	0.0	0.0	180.00	0.00	S	0.00	0.0	0.0	99.0	0.0	L

Kmax is maximum absolute unit cost reduction (in price units). Product of Cols 2-5

Kvar is the variable unit cost reduction (%/year), if specified.

Shift type: S - Supply, D - Demand Adoption Form: L - Linear, X - Logistic

* WARNING! - This combination of Kpot and Kvar produces negative Ktotal in some years

Region: 1 Farm- maize grain Price transmission (v,w): 0.00, 1.000

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Hand on Computer Exercise of the Case Studies

Producers				Consumers				Government			
<---no R&D--->				<--- no R&D --->				<--- Tax Rev. --->			
Year	Price	Quantity	Benefits	Price	Quantity	Price	Quantity	Price	Quantity	Benefits	Research Costs
1997	120.0	2000.0	120.0	2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	120.0	2000.0	120.0	2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	120.0	2000.0	119.8	2000.9	211.1	0.0	0.0	0.0	0.0	0.0	0.0
2000	120.0	2000.0	118.7	2010.7	2307.2	0.0	0.0	0.0	0.0	0.0	0.0
2001	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2002	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2003	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2004	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2005	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2006	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2007	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2008	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2009	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2010	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
2011	120.0	2000.0	118.3	2014.6	3146.1	0.0	0.0	0.0	0.0	0.0	0.0
Present value of benefits				24759.4				0.0			

Production				Consumption			
--R&D change in -				--R&D change in -			
Year	Total	K	Var	Price	Quantity	Price	Quantity
1997	0.00	0.00	0.00	180.0	180.0	0.00	0.0
1998	0.00	0.00	0.00	180.0	180.0	0.00	0.0
1999	0.21	0.21	0.00	180.0	179.8	-0.11	0.0
2000	2.39	2.39	0.00	180.0	178.7	-1.24	0.9
2001	3.26	3.26	0.00	180.0	178.3	-1.69	10.7
2002	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2003	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2004	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2005	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2006	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2007	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2008	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2009	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2010	3.26	3.26	0.00	180.0	178.3	-1.69	14.6
2011	3.26	3.26	0.00	180.0	178.3	-1.69	14.6

Region: 2 Maize processing

Price transmission (v,w):

0.00, 1.000

Producers										Consumers										Government									
<---no R&D--->										<--- no R&D --->										< Tax Rev. >									
Price Quantity										Price Quantity										"Prod" "Cons" Benefits									
Research Costs										Quantity Benefits										Research Costs									
1997	30.0	1600.0	30.0	1600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1998	30.0	1600.0	30.0	1600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	30.0	1600.0	29.7	1600.7	23.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2000	30.0	1600.0	27.3	1608.5	258.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2001	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2002	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2003	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2004	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2005	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2006	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2007	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2009	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	30.0	1600.0	26.3	1611.7	352.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Present value of benefits										2773.0										0.0									

Production										Consumption										R&D change in - Value of Benefits									
Year										R&D change in - Value of Benefits										R&D change in - Value of Benefits									
Total										Price Quantity										Price Quantity									
K										K										K									
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1998	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.25	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2000	2.81	2.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2005	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2006	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2007	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2008	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2009	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2010	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2011	3.84	3.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Price transmission (v,w): 0.00, 1.000

Year	Producers				Consumers				Government		Research Costs
	Price	Quantity	Benefits	Costs	Price	Quantity	Benefits	Costs	Benefits	Costs	
1997	180.0	1600.0	180.0	1600.0	180.0	1600.0	180.0	1600.0	0.0	0.0	0.0
1998	180.0	1600.0	180.0	1600.0	180.0	1600.0	180.0	1600.0	0.0	0.0	0.0
1999	180.0	1600.0	179.8	1600.7	180.0	1600.0	179.8	1600.7	177.3	0.0	0.0
2000	180.0	1600.0	178.7	1608.5	180.0	1600.0	178.7	1608.5	1938.0	0.0	0.0
2001	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2002	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2003	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2004	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2005	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2006	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2007	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2008	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2009	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2010	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
2011	180.0	1600.0	178.3	1611.7	180.0	1600.0	178.3	1611.7	2642.7	0.0	0.0
Present value of benefits											20797.9

[illegible]