최 종
연구보고서

농산물시장의 국제 가격전이 효과 분석모형의 개발 및 응용

Development and Application of a New Model for the Analysis of International Price Transmission Impacts(PTM) on Agricultural Market

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한 국 농 촌 경 제 연 구 원

농 림 부

제 출 문

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본 보고서를 "농산물시장의 국제 가격전이 효과 분석모형의 개발 및 응용" 과제의 최종보고서로 제출합니다.

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머 리 말

우리나라의 농산물 수입액은 96억 달러이며, 곡물 수입량은 1,500만 톤에 달한다. 시장개방의 가속화로 이러한 수입 규모는 더욱 증가할 것으로 전망되며, 국제 농산물 가격이나 거시경제 변수의 변화가 우리 농업에 미치는 영향도 점차 확대될 것이다. 국제 농산물 가격의 변화는 수입 비용은 물론 국내 농산물 가격 변화를 통해 농가경제에 직접적인 영향을 미치게 된다. 국제시장의 변화는 여러 가지 경로를 통해 국내시장으로 전달되며, 비관세 장벽이 없는 완전한 개방경제체제에서 이론적으로 국제가격이 1% 변화하면 국내가격도 1% 변화한다. 그러나 비관세 장벽이나 종량세 등이 존재할 경우 가격전이계수는 낮고 가격변화의 전달 속도도 느리게 나타난다. 국제 농산물 시장의 개방화 추세는 각종 비관세 장벽의 감축 또는 철폐를 가져와 국가간 또는 국제시장과 국내시장간의 가격전이 크기와 속도는 점차 증가하고 있다.

따라서 국제 농산물 가격의 변화가 어떠한 경로를 통해 어느 정도의 시차를 가지고 국내 농산물 가격에 영향을 미치게 되는가를 분석하는 것은 식량의 안정적 수급 및 농정 수립을 위한 필수적인 단계이다. 여기서는 국제 농산물 가격 및 거시경제 변수와 국내 농산물 가격 사이의 가격전이계수와 시차를 분석고자 하였다. 주요 연구내용은 가격전이계수 추정을 위한 데이터베이스 구축, 모형 설정, 추정 결과 및 데이터에 대한 테스트, 주요국의 농정 등이다.

이 보고서는 캐나다 매니토바 대학의 연구진과 농촌경제연구원 연구진의 협동연구 결과이다. 학계, 정부, 생산자 단체 등 농산물 무역 및 가격전이 효과에 관심이 있는 분들께 좋은 참고자료로 활용되기를 기대한다.

2003. 9.

한국농촌경제연구원장 **이 정 환**

요 약 문

I. 연구 목적 및 내용

<연구목적>

○ 이 연구의 목적은 국제 농산물 가격 변동과 거시경제 변화의 국내 시장 전이 모형 개발 및 응용 방안 제시에 있음. 국제가격 변동이 한국 시장에 미치는 영향을 분석하여 국내 농정 및 WTO 협상 등 대외무역 정책 수립에 참고자료를 제공하고자 함.

- 이 연구는 국제 농산물 가격 외에 국제 거시경제변수가 국내 농산물 시장에 미치는 전이효과를 분석대상으로 하며, 국제시장과 국내시장 간의 연계성과 관련된 보다 체계화된 모델을 구축하는 데에 연구의 목적이 있음.

- 가격비 분석을 통한 시장의 효율성 분석

- 또한 이 연구는 국제 농산물 가격과 거시경제지표 변화가 국내 시장에 전이되는 속도를 측정함으로써 시장의 불확실성과 위험도를 관리할 수 있는 조기경보체제(EWS) 구축에 기초자료를 제공하고자 함.

<연구내용>

1. PTM 이론 및 선행연구 검토
   - PTM 관련 이론
   - 선행연구 검토

II. 주요 연구결과

1. Data

<분석 대상 품목>

○ 연구대상 품목의 선정을 위해 국내 수입 자료와 국제 교역 자료를 종합하여 분석하였음. 이를 토대로 연구대상 품목은 국내에 수입이 꾸준히 이루어지고 있는 품목들과 수입실적은 미미하나 국제시장의 거래규모가 작아 시장 불안정 요인이 있는 품목을 선정하였음.

○ 선정된 품목은 곡물류 가운데 쌀(thin market의 경우), 밀, 보리, 콩, 옥수수 등 5개 품목이며 축산물은 쇠고기, 돼지고기, 닭고기 등 3개 품목임.

○ 분석을 위한 기초자료는 1970년부터 2001년까지 33년간의 월별 자료를 원칙으로 하였음. 따라서 최대한 자료가 존재하는 품목의 경우 384개의 시계열이 형성됨. 가격자료는 농가판매가격, 도매가격, 수입가격 등 세 가지를 원칙으로 하였음.

- 자료가 완벽하게 존재하는 품목은 1,152개의 데이터가 수집, 정리되었음. 그러나 가격전이 분석에 필요한 데이터는 상업적 수입이 이루어진 1990년대 이후의 자료임(품목별로 차이가 있음).

<한국>

○ 자료원은 농협중앙회 농협조사월보, 농림부 작물통계, 한국은행 통계월보, 통계청 한국통계월보. 농수산물유통공사 농수산물도소매가격동향 및 www.kati.net, 한국무역협회, www.kotis.net, 축협중앙회 축협조사월보, 한국육류유통수출입협회(kmta.or.kr) 등임.

<일본>

○ 일본의 자료원은 농림수산성통계정보국 농산물가통계, 식량청 식량관리통계연보, 한국 무역협회(www.kotis.net), 일본 농림수산성 통계정보국 축산물 유통통계 등임.

<미국>

○ USDA 데이터베이스를 이용하였음.

2. 분석모형

○ 모형 1: 국제 가격전이 분석을 위한 모형은 기본적으로 Boyd and Brorsen (1986), Goodwin and Schroeder (1991), Gardner and Brooks (1994), Goodwin and Holt (1999), Goodwin and Grennes (2002), Baulch (1997), and Asche, Bremnes, and Wessells (1999), 성명환 (1996) 등과 유사함.

- 두 변수 모형은 가격전이 분석을 위해 널리 이용되는 것으로 보다 많은 변수를 포함시킬 경우에 발생할 수 있는 multicollinearity 문제와 추정치의 낮은 신뢰도를 보완하는 의미가 있음(Goodwin and Schroeder, 1991).

$$log(P^K) = a_1 + b_1 log(P^W) + e \qquad (1)$$

여기서, P^K = *Korea Import Price*
P^w = *World Farm Price (e.g. U.S. farm price)*
b_1 = *price transmission coefficient*
e = *error term*

○ 인과성과 시차 분석은 Granger (1969), Akaike (1976), Boyd and Brorsen (1986), Colman (1996), Copeland and Copeland (1998), Frino, Walters, and West (2000) 등을 참조하였음. Multicollinearity, 정상성, 시차변수 등을 고려하여 절대 가격이 아닌 가격비와 차분 자료를 이용하였음.

$$P_t = \sum_{i=1}^{p} AP_{t-i} + e_t,$$

$$P_t = \begin{bmatrix} P_{1t} \\ P_{2t} \end{bmatrix}, \quad A = \begin{bmatrix} a_{11}(i) & a_{12}(i) \\ a_{21}(i) & a_{22}(i) \end{bmatrix}, \quad and\ e_t = \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \qquad (2)$$

여기서, P_{1t}, P_{2t} 는 한국의 수입가격과 미국의 농가판매가격. et는 잔차항이며 white noise 상태를 가정함.

○ AIC에 의해 시차는 2개월로 결정되었음.

$$\text{한국 수입가격} = f(K\ Import\ Price_{t-1},\ K\ Import\ Price_{t-2},\ US\ Farm\ Price_{t-1},\ US\ Farm\ Price_{t-2}) \qquad (3)$$

$$\text{미국 농판가격} = f(K\ Import\ Price_{t-1},\ K\ Import\ Price_{t-2},\ US\ Farm\ Price_{t-1},\ US\ Farm\ Price_{t-2}) \qquad (4)$$

○ 모형 2: 거시경제 변수로 환율과 수입가격, 소비자물가지수와 농판가격 및 소매가격 사이의 가격전이 효과를 분석

$$log(P^K) = a_2 + b_2 log(P^{mv}) + e$$

여기서, P^K = *Korea import price level for a given commodity*
P^{mv} = *macro variable for Korea*
b_2 = *price transmission coefficient*
e = *error term*

○ 모형 3: 가격비 분석을 통한 효율성, 국제경쟁력 분석(Kwiecinski and Quaisser, 1993).

$$R^{kw} = P^K/P^W$$

여기서, R^{kw}= *domestic price to world price ratio*
P^k = *Korea farm price level for a given commodity*
P^w = *Other country farm price level (e.g. U.S, Japan, for a given commodity)*

- 육류는 산출물/투입물 지수를 산출하여 국제간 효율성을 분석하였음.

$$R^{LF} = P^L/P^F$$

여기서, R^{LF}= *livestock output/input ratio e.g. beef price to corn price ratio*
P^L = *livestock price e.g. beef price*
P^F = *feed price e.g. corn price*

3. 자료의 성격 테스트

○ Stationarity Test: 절대값으로 나타난 자료는 정상성이 없는 것으로 나타남.

표 1 한국 자료의 Stationarity 테스트(미국$ 변환)

Market Level	Commodity	Currency	ADF Test Statistic
Farm Level			
	Corn	$US	-2.07
	Soybean	$US	-1.66
	Barley	$US	-2.12
	Rice	$US	-2.10
	Beef	$US	-1.44
	Pork	$US	-2.24
	Chicken	$US	-3.78*
Wholesale Level			
	Soybean	$US	-3.99*
	Barley	$US	-2.43
	Rice	$US	-2.09
	Beef	$US	-2.21
	Pork	$US	-2.21
	Chicken	$US	-1.59
Import Level			
	Corn	$US	-1.49
	Soybean	$US	-1.12
	Wheat	$US	-1.92
	Beef	$US	-2.56
	Chicken	$US	-2.13
Retail Level			
	Rice	$US	-2.10
	Beef	$US	-0.70
	Pork	$US	-1.79

a/ ADF is augmented Dickey Fuller Statistic, null hypothesis is non-stationarity. Asterisk indicates reject null hypothesis at 10% level of confidence. All variables are in logarithms.

표 2 한국 자료의 Stationarity 테스트(원화 기준)

Market Level	Commodity	Currency	ADF Test Statistic
Farm Level			
	Corn	Won	-0.96
	Soybean	Won	-1.15
	Barley	Won	-0.69
	Rice	Won	-1.60
	Beef	Won	-0.03
	Pork	Won	-2.22
	Chicken	Won	-4.00*
Wholesale Level			
	Soybean	Won	-1.89
	Barley	Won	-1.82
	Rice	Won	-1.47
	Beef	Won	-1.10
	Pork	Won	-2.28
	Chicken	Won	-2.58*
Import Level			
	Corn	Won	-2.11
	Soybean	Won	-1.95
	Wheat	Won	-2.17
	Beef	Won	-2.71
	Pork	Won	-0.90
	Chicken	Won	-2.02
Retail Level			
	Rice	Won	-1.60
	Beef	Won	-0.36
	Pork	Won	-0.77

a/ ADF is augmented Dickey Fuller Statistic, null hypothesis is non-stationarity. Asterisk indicates reject null hypothesis at 10% level of confidence. All variables are in logarithm.

표 3 미국 자료의 Stationarity 테스트(미국$ 기준)

Market Level	Commodity	Currency	ADF Test Statistic
Farm Level			
	Corn	$US	-4.00*
	Soybean	$US	-1.56
	Wheat	$US	-2.14
	Barley	$US	-2.00
	Rice	$US	0.30
	Beef	$US	-2.49
	Pork	$US	-1.70
	Chicken	$US	-1.01
Retail Level			
	Rice	$US	-1.01
	Beef	$US	-0.10
	Pork	$US	-3.04*
	Chicken	$US	-2.77*
Korea Consumer Price Index (CPI)			-1.29
Exchange rate			-2.08

a/ ADF is augmented Dickey Fuller Statistic, null hypothesis is non-stationarity. Asterisk indicates reject null hypothesis at 10% level of confidence. All variables are in logarithms.

○ Cointegration 테스트: 대부분의 가격 사이에 Cointegration이 존재하지 않는 것으로 나타남.

표 4 Cointegration 테스트

	Commodity	ADF
Import US$ & Korea Farm US$	Corn	-2.13
	Soybean	-1.72
	Beef	-1.47
	Pork	-2.51
	Chicken	-4.11*
Import US$ & Korea Wholesale US$	Soybean	-3.96*
	Beef	-2.02
	Pork	-2.37
	Chicken	-1.94
Import US$ & U.S. Farm US$	Corn	-1.91
	Soybean	-3.03
	Wheat	-1.69
	Beef	-2.55
	Pork	-1.58
	Chicken	-1.34
Import, Won & Exchange rate	Corn	-1.98
	Soybean	-1.48
	Wheat	-1.74
	Beef	-3.67*
	Pork	-0.92
	Chicken	-1.68
Korea Farm, Won & Korea CPI	Corn	-2.34
	Soybean	-3.00
	Barley	-2.41
	Rice	-1.37
	Beef	-1.55
	Pork	-2.24
	Chicken	-4.03*
U.S. Retail US$ & U.S. Farm US$	Rice	-2.38
	Beef	-1.15
	Pork	-3.01

표 4 Cointegration 테스트(계속)

	Commodity	ADF
Korea Retail, Won & Korea Farm, Won	Rice	-2.80
	Beef	-1.74
	Pork	-0.54
Korea Retail US$ & U.S. Retail US$	Rice	-2.09
	Beef	-1.48
Korea Retail, Won & Korea CPI	Rice	-2.60
	Beef	-0.99
	Pork	-2.19

4. 가격전이 모형 추정

4.1. 미국 농판가격과 한국의 수입가격

<가격전이>

○ 미국의 농판가격과 우리나라 수입가격 사이의 가격전이 탄성치는 쇠고기를 제외하고는 모두 0.6-0.8 정도로 높게 나타났음. 곡물류의 경우 t 값과 R^2 모두 높게 나타났으나 육류의 경우 R^2가 낮음.

표 5 가격전이 탄성치(미국 농판가격과 한국 수입가격, $US 기준) a/

	Constant	β^a	R^2
Corn	1.54 (7.61)	0.74 (16.13)	0.76
Soybean	1.15 (6.14)	0.82 (23.41)	0.87
Wheat	2.20 (13.67)	0.62 (18.50)	0.81
Beef	1.04 (16.93)	0.04 (0.24)	0.0007
Pork	0.85 (27.36)	0.69 (5.92)	0.30
Chicken	0.36 (5.81)	0.82 (3.25)	0.11

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses.

○ White Noise 테스트

표 6 White Noise 테스트(인과성 분석 모형)

Commodity	[a]Barrlettss K-S Statistic	[a]Fishers Kappa
US Corn Farm → Korea Corn Import	.0754	2.96
Korea Corn Import → US Corn Farm	.0859	3.74
US Soybean Farm → Korea Soybean Import	.0952	3.03
Korea Soybean Import → US Soybean Farm	.1766	4.08
US Wheat Farm → Korea Wheat Import	.0910	4.85
Korea Wheat Import→ US Wheat Farm	.1901	4.03

a: Tests failed to reject the null hypothesis of white noise residuals at the ten percent level of significance in all 6 equations.

○ 인과성 및 전이 시차 분석: F값이 매우 높아 2기 시차모형이 설명력을 갖는 것으로 나타났으나 월별 자료의 성격상 R^2는 낮게 나타남.

○ 미국의 농산물 가격이 2개월의 시차를 가지고 우리나라 농산물 가격에 영향을 미치는 것으로 분석되었음. 그러나 우리나라 농산물 가격이 미국 농산물 가격에 영향을 미친다고 보기 어려움.

- 미국은 우리나라보다 국제가격에 영향을 미칠 수 있는 대국으로 볼 수 있음. 축산물은 가격전이 효과가 낮아 분석에서 제외하였음.

- 영향을 미치는 시차가 짧을수록 가격결정에 있어서 효율성이 높다고 볼 수 있음. 우리나라와 미국의 가격전이 시차가 2개월인 것은 대체로 시장의 효율성이 높다고 평가할 수 있음(미국과 유럽 사이에는 대체로 3주 내지 9주의 시차가 있는 것으로 분석됨, Boyd and Brosen, 1986).

표 7 인과성 및 시차 분석 결과

Commodity	Causality Wald F-Statistic	Equation F-statistic	R^2
US Corn Farm → 2[a] Korea Corn Import	8.81*	7.86*	.29
Korea Corn Import → 2[a] US Corn Farm	.08	9.35*	.32
US Soybean Farm → 2[a] Korea Soybean Import	5.93*	3.44*	.15
Korea Soybean Import → 2[a] US Soybean Farm	.46	2.73*	.13
US Wheat Farm → 2[a] Korea Wheat Import	8.67*	9.87*	.34
Korea Wheat Import → 2[a] US Wheat Farm	1.16	3.25*	.15

* Indicates significance at 5 percent level.
a For example, US corn farm price leads or causes Korean corn import price by 2 months, as evidenced by the significant causality Wald F-statistic

4.2. 수입가격이 농판가격 및 도매가격에 미치는 영향

○ 수입가격이 우리나라 농산물 가격에 많은 영향을 미치는 것으로 간주되어 왔음. 우리나라 농산물 가격이 하락하는 요인 가운데 많은 부분이 수입 농산물 때문으로 여겨져 왔음.

○ 농산물 수입가격이 우리나라 농판가격에 미치는 영향은 매우 유의적인 수준으로 분석되었음. 특히 쇠고기의 경우 가격전이 탄성치가 0.97로 나타나 수입가격 변화가 우리나라 농판가격 변화에 큰 영향을 미치는 것으로 나타남.

○ 그러나 옥수수와 콩은 수입가격이 농판가격에 미치는 영향이 축산물에 비해 낮음. 이러한 현상은 우리나라 곡물 시장은 국산과 수입산의 용도가 구분되는 등 시장분할 현상이 강하기 때문임.

○ 우리나라의 외환위기 시기를 변수로 포함시킨 결과 외환위기 상황이 농가판매 가격에 상당한 영향을 미친 것으로 나타남.

○ 수입가격이 우리나라 도매가격에 미친 영향도 농판가격에 미친 영향의 경우와 유사한 것으로 분석되었음. 그러나 영향의 정도는 품목에 따라 다르게 나타나고 있음.

표 8 수입가격과 농판가격 사이의 가격전이 탄성치(미국$ 기준), a/

	Constant	β^a	D1	R^2
Corn	4.30	0.39	-0.27	0.71
	(19.57)	(8.51)	(-11.68)	
Soybean	7.14	0.09	-0.39	0.57
	(16.50)	(1.11)	(-10.26)	
Beef	0.64	0.97	-0.51	0.60
	(2.78)	(4.51)	(-9.52)	
Pork	0.15	0.45	-0.34	0.53
	(3.30)	(8.04)	(-7.31)	
Chicken	0.03	0.39	-0.18	0.18
	(0.83)	(3.90)	(-2.62)	

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

표 9 수입가격과 도매가격 사이의 가격전이 탄성치(미국$ 기준), a/

	Constant	β^a	D1	R^2
Soybean	6.30	0.29	-0.52	0.46
	(8.83)	(2.24)	(-8.35)	
Beef	1.33	0.55	-0.46	0.52
	(5.81)	(2.57)	(-8.66)	
Pork	0.57	0.41	-0.36	0.51
	(12.10)	(7.13)	(-7.75)	
Chicken	0.66	0.53	-0.24	0.34
	(23.08)	(5.88)	(-4.03)	

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

4.3. 거시경제변수의 영향

○ 농산물 가격은 농업내부의 미시변수뿐만 아니라 경제를 전반을 나타내

는 거시변수에 의해서도 영향을 받음. 이 연구에서는 환율과 물가 변수의 변화가 농산물 가격에 미치는 영향을 분석하였음.

○ 환율과 수입가격은 양의 상관관계를 나타내는 것으로 알려져 있음. 환율의 가격전이 계수는 쇠고기가 0.75로 분석 대상 품목 가운데 가장 높게 나타났으며, 다음으로 콩, 밀, 닭고기, 옥수수 등의 순으로 나타났음.

○ 환율의 가격전이 탄성치는 쇠고기를 제외하고는 크지 않은 것으로 분석되었음. 그러나 외환위기 시기(1997. 10. - 1998. 12.)에는 환율의 가격전이 탄성치가 모든 품목에서 1보다 크게 나타나 수입업자들이 환율 변화에 대한 위험을 전가시키고 과잉으로 대응하여 시장의 불안정 초래한 측면이 있음.

표 10 환율과 수입가격 사이의 가격전이 탄성치, a/

	Constant	β^a	R^2
Corn	3.48 (6.16)	0.21 (2.59)	0.08
Soybean	3.00 (4.87)	0.38 (4.30)	0.18
Wheat	2.67 (6.07)	.37 (5.93)	0.30
Beef	2.79 (7.89)	0.75 (14.96)	0.73
Pork	7.85 (7.25)	-0.26 (-0.02)	0.000
Chicken	5.37 (5.86)	0.26 (2.00)	0.05

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses.

표 8 수입가격과 농판가격 사이의 가격전이 탄성치(미국$ 기준), a/

	Constant	β^a	D1	R^2
Corn	4.30	0.39	-0.27	0.71
	(19.57)	(8.51)	(-11.68)	
Soybean	7.14	0.09	-0.39	0.57
	(16.50)	(1.11)	(-10.26)	
Beef	0.64	0.97	-0.51	0.60
	(2.78)	(4.51)	(-9.52)	
Pork	0.15	0.45	-0.34	0.53
	(3.30)	(8.04)	(-7.31)	
Chicken	0.03	0.39	-0.18	0.18
	(0.83)	(3.90)	(-2.62)	

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

표 9 수입가격과 도매가격 사이의 가격전이 탄성치(미국$ 기준), a/

	Constant	β^a	D1	R^2
Soybean	6.30	0.29	-0.52	0.46
	(8.83)	(2.24)	(-8.35)	
Beef	1.33	0.55	-0.46	0.52
	(5.81)	(2.57)	(-8.66)	
Pork	0.57	0.41	-0.36	0.51
	(12.10)	(7.13)	(-7.75)	
Chicken	0.66	0.53	-0.24	0.34
	(23.08)	(5.88)	(-4.03)	

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

4.3. 거시경제변수의 영향

○ 농산물 가격은 농업내부의 미시변수뿐만 아니라 경제를 전반을 나타내

는 거시변수에 의해서도 영향을 받음. 이 연구에서는 환율과 물가 변수의 변화가 농산물 가격에 미치는 영향을 분석하였음.

○ 환율과 수입가격은 양의 상관관계를 나타내는 것으로 알려져 있음. 환율의 가격전이 계수는 쇠고기가 0.75로 분석 대상 품목 가운데 가장 높게 나타났으며, 다음으로 콩, 밀, 닭고기, 옥수수 등의 순으로 나타났음.

○ 환율의 가격전이 탄성치는 쇠고기를 제외하고는 크지 않은 것으로 분석되었음. 그러나 외환위기 시기(1997. 10. - 1998. 12.)에는 환율의 가격전이 탄성치가 모든 품목에서 1보다 크게 나타나 수입업자들이 환율 변화에 대한 위험을 전가시키고 과잉으로 대응하여 시장의 불안정 초래한 측면이 있음.

표 10 환율과 수입가격 사이의 가격전이 탄성치, a/

	Constant	β^a	R^2
Corn	3.48 (6.16)	0.21 (2.59)	0.08
Soybean	3.00 (4.87)	0.38 (4.30)	0.18
Wheat	2.67 (6.07)	.37 (5.93)	0.30
Beef	2.79 (7.89)	0.75 (14.96)	0.73
Pork	7.85 (7.25)	-0.26 (-0.02)	0.000
Chicken	5.37 (5.86)	0.26 (2.00)	0.05

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses.

표 11 외환위기 시기의 환율과 수입가격 사이 가격전이 탄성치, a

	Constant	β^a	R^2
Corn	-3.30 (6.09)	1.17 (6.09)	0.73
Soybean	-2.35 (-1.53)	1.15 (5.35)	0.67
Wheat	-3.06 (-2.62)	1.18 (7.25)	0.79
Beef	-1.18 (-0.68)	1.31 (5.42)	0.68
Pork	-0.81 (-0.31)	1.25 (3.47)	0.46
Chicken	-0.58 (-0.35)	1.12 (4.93)	0.63

a/β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. Data covers the financial crisis from October 1997 through January 1999

○ 소비자물가지수 변화가 농산물 가격에 미치는 영향을 분석한 결과 대부분 곡물의 농판가격이 물가지수보다 높은 상승률을 나타내는 것으로 나타났음. 그러나 축산물 가격은 쇠고기를 제외하고 매우 낮은 가격전이 탄성치를 나타냈음.

○ 반면 소비자물가와 소매가격 사이의 가격전이 탄성치는 쇠고기와 돼지고기가 각각 2.15와 3.25로 쌀의 0.82보다 높았음. 이러한 결과는 육류의 농판가격과 소비자 가격이 단절되어 있다는 육류 유통 및 가격 형성 문제를 확인시켜주는 것임.

표 12 소비자가격지수와 농판가격 및 소매가격 사이의 가격전이 탄성치, a/

	Constant	β^a	R^2
a) Price Transmission Elasticity from Korean Consumer Price Index (1983=100) to Korean Farm Price			
Corn	0.44 (1.93)	1.08 (25.37)	0.89
Soybean	-0.74 (-0.73)	1.56 (8.35)	0.46
Barley	-0.16 (-0.53)	1.25 (21.67)	0.85
Rice	3.17 (9.81)	0.81 (13.43)	0.69
Beef	1.09 (0.63)	1.39 (4.31)	0.18
Pork	7.28 (6.66)	0.04 (0.18)	0.0004
Chicken	5.94 (3.30)	0.21 (0.64)	0.0049
b) Price Transmission Elasticity from Korean Consumer Price Index (1983=100) to Retail Korean Price			
Rice	3.27 (14.09)	0.82 (18.91)	0.81
Beef	-1.82 (-1.09)	2.15 (6.93)	0.37
Pork	-8.68 (-10.12)	3.25 (20.40)	0.84

a/ β is the price transmission elasticity, since the model is in log-log form.
T-values are in parentheses

4.4. 가격비 분석

○ 우리나라와 미국의 농산물 농가판매가격을 비교하면, 우리나라 농판가격이 미국에 비해 높고 그 비율 또한 증가해 왔음. 이러한 결과는 우리나라의 농업정책이 식량안보, 농가소득 보전 등 가격지지 정책에 주로 의존해온 결과로 볼 수 있음

- 일본에 비해서는 우리나라 농산물 가격이 낮게 나타나고 있으나 쌀의 경우 가격차가 축소되고 있어 일본이 상대적으로 국제 경쟁력을 높여가고 있다고 볼 수 있음.

○ 그러나 돼지고기와 닭고기의 가격차는 크지 않으며, 닭고기의 가격차는 축소되는 경향을 나타냄.

그림 1 한국과 미국의 쌀 가격 비교

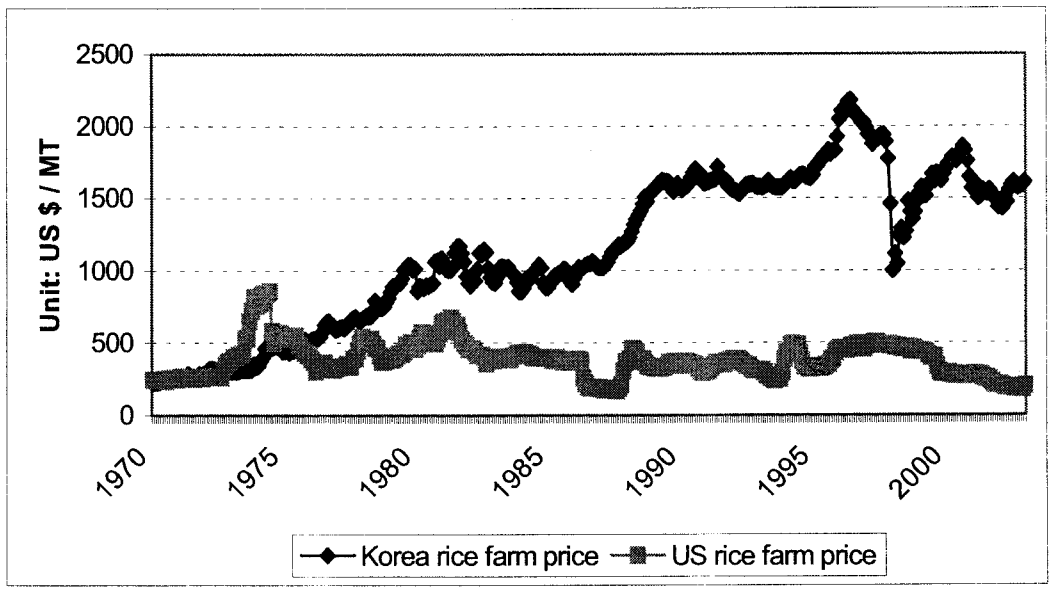


그림 2 한국과 미국의 대두 가격 비교

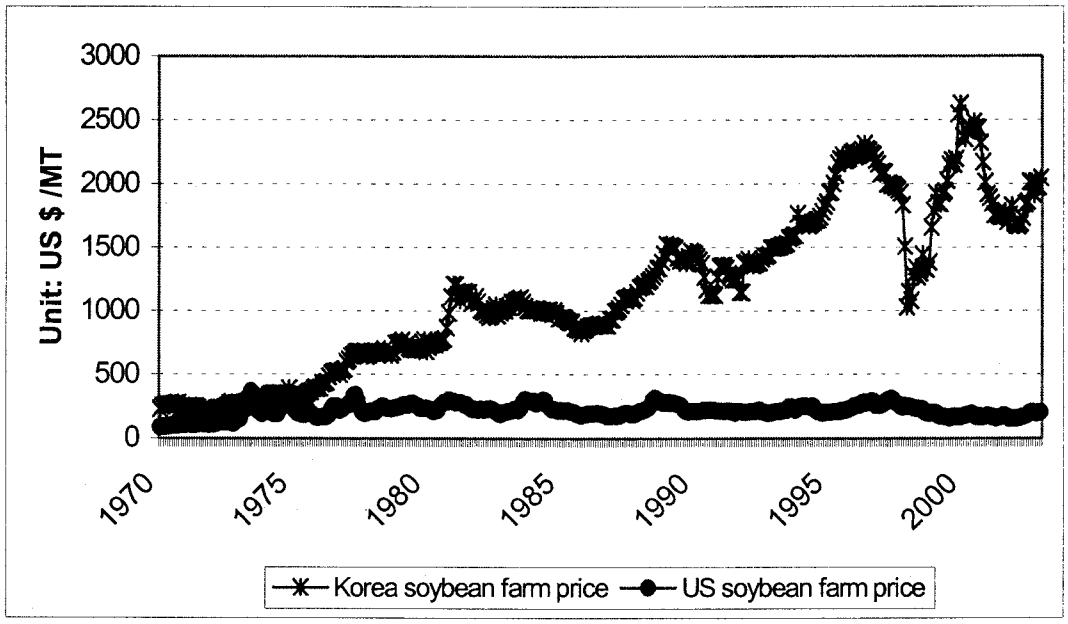


그림 3 한국과 미국의 쇠고기 가격 비교

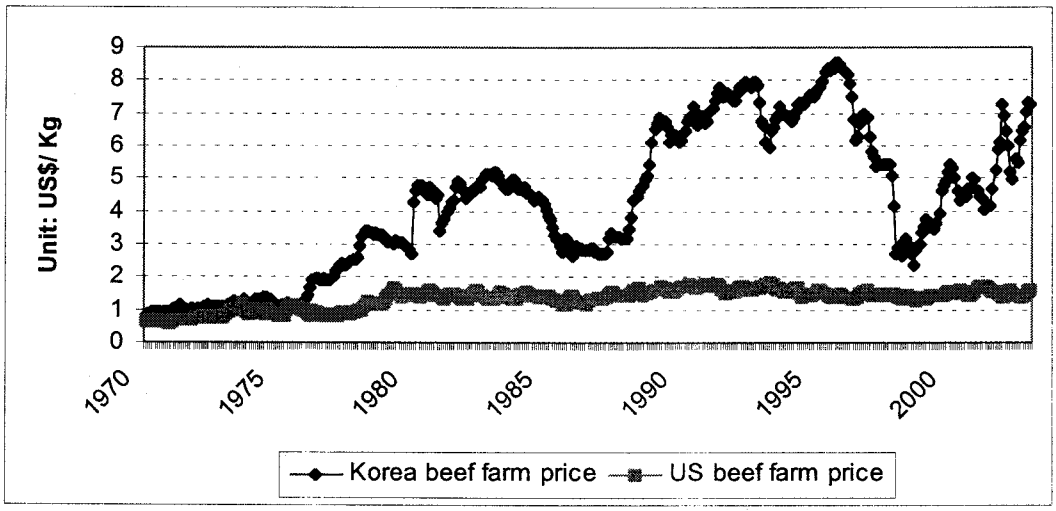


표 13 한국과 미국, 일본의 농판가격 비교, a/

a) Korea Farm Price / U.S. Farm Price		
	1970	2000
Corn	3.80	6.58
Soybean	2.59	14.00
Barley	3.25	6.92
Rice	0.92	5.92
Beef	1.32	3.53
Pork	0.85	2.12
Chicken	1.94	1.48
b) Korea Farm Price / Japan Farm Price		
	1970	2000
Soybean	0.96	1.16
Barley	0.89	0.53
Rice	0.62 (1977)	0.78 (1999)

a/ Korea and U.S. farm prices are data for January, 1970 and 2000. Japan farm prices are annual data.

○ 농판가격과 소매가격 사이의 가격전이 탄성치는 쌀과 쇠고기에서 높게 나타났으나 돼지고기의 경우 매우 낮게 나타남. 돼지고기 가격이 유통과정에서 결정되어지는 경향이 가장 강한 것으로 분석됨.

표 14 농판가격과 소매가격 사이의 가격전이 탄성치, a/

	Constant	β^a	R^2	D2
Rice	0.96	0.89	0.92	
	(4.42)	(30.83)		
Beef	2.34	0.86	0.75	0.07
	(3.91)	(12.17)		(2.09)
Pork	8.23	0.04	0.83	0.46
	(12.41)	(0.50)		(19.7)

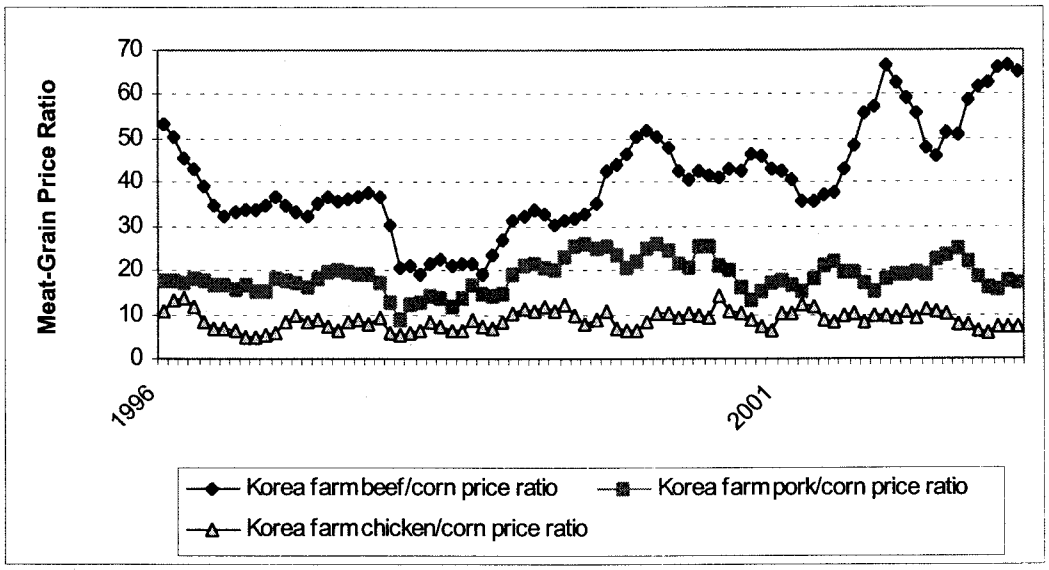
a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D2 represents a binary variable for structural change in the meat market following the financial crisis, for the period February 1999 through December 2002.

○ 산출물/투입물 가격비 비교: 육류가격(kg당)/사료가격(kg) 비율은 같은 품목 내에서는 수익률과 직결되는 것으로 쇠고기의 경우 우리나라가 미국에 비해 높은 것으로 나타남. 그러나 돼지고기와 닭고기는 미국과 우리나라가 비슷한 수준으로 나타남.

- 산출물가격/투입물가격 비율은 우리나라의 경우 육류 가운데 쇠고기(0.4-0.5), 돼지고기(0.2), 닭고기(0.1) 순으로 크게 나타남.

- 외환위기 기간에 이 비율은 크게 낮아져 수익성이 악화된 것으로 나타남.

그림 4 한국의 축산물 산출/투입 가격비



Executive Summary

Price transmission refers to price relationships and the degree of co-movement between markets. It has important implications for agricultural policy makers, in terms of competitiveness, resource allocation, market efficiency, market integration, liberalization, macroeconomic effects, financial crisis, structural change, and imperfect competition. The study begins with an introduction, followed by data and methodology, then policy background for price transmission, and then results.

One of the goals of Korean agricultural policy is improving the competitiveness in the Korean agricultural economy. Given the importance of efficient pricing and optimal price levels in the agriculture, the objectives of this study are as follows:

Objectives Summary

The first objective is to examine price transmission for Korean import prices and various other agricultural prices. For example, the impact of U.S. farm prices on Korean agricultural import prices is examined. The extent that Korean import prices change when U.S. farm prices change is an illustration of price transmission. Under free trade and the law of one price theory, a one percent change in world farm price should be met with the same corresponding one percent change in Korea, assuming no price rigidities across time, form, and

space. This would imply a price transmission elasticity coefficient of one and fully integrated and liberalized markets. However, real world economics dictates that the law of one price does not generally hold and that the price transmission elasticity coefficient is not equal to one. This implies price rigidities across time, form, and space, and some pricing inefficiencies. If pricing inefficiency occurs, then some agricultural resource misallocation and loss of welfare may occur. Selected Korean prices at the farm, retail level, and some wholesale are compared with those in the U.S, and the price transmission and pricing efficiency is compared between the various markets. As well, causality is also used to measure time lags for price transmission between U.S. and Korean markets, with a shorter lag times indicating higher pricing efficiency. Econometric price transmission models are used to estimate the price transmission elasticity coefficient.

The second objective is to examine macroeconomic impacts on agricultural prices, such as exchange rates and inflation, in the context of price transmission. Agriculture is heavily dependent on macroeconomic policies, and large macroeconomic price shocks have impacted the Korean agricultural economy in recent years. If Korean import price is directly linked to world price, then a one percent devaluation in the exchange rate should lead to a one percent change in Korean import price, for example. Econometric transmission models are used for the macroeconomic impact analysis as well.

A third objective is to examine agricultural price ratios over time. For example, ratios of Korean farm prices to U.S. and Japanese grain prices are compared for selected commodities. As well, output/input price ratios for the Korean livestock are compared with U.S. livestock

e.g. the beef price divided by the corn price. However, prices between markets over space may not converge or sufficiently transmit information for a number of reasons. These include: (1) Producer subsidies or consumer subsidies (2) Trade policies and industry protection (3) Imperfect competition (4) Vertical integration with administrative pricing (5) Time lags or logistical problems in international trade, transportation, and transfer, (6) Poor information flows across markets.

Data Summary

Data includes Korean monthly prices for import, farm, retail, and some wholesale. Commodities included in the study are corn, soybeans, wheat, barley, rice, beef, pork, and chicken, in both Korea and the U.S. for comparison. The U.S. price is an approximation to world price, and a considerable share of Korea's agricultural imports are from the U.S. Some Japanese data is also used for comparison, given similarities to Korea in terms of production, consumption, and food security. Import markets including corn, wheat, soybeans, beef, and pork are given the main interest, because of Korea's dependence on these sizable imports, and structural change in markets such as beef and pork. Most of the econometric analysis in the study is from 1996-2002, in order to present current results and changes in various markets. However, some caution should be used in interpreting results as two commodities in two different markets can often differ by variety, grade, standard, level of processing, and value added, and so may not be directly comparable.

Statistical and Econometrics Test Summary

Equation F, Coefficient T, R^2, Stationarity (Augmented Dickey Fuller), Cointegration (ADF), Wald F, Fisher's Kappa, Kolmogorov-Smirnov, Akaike's Information Criterion (AIC), Durbin-Watson, and heteroskedasticity tests.

Results Summary

U.S Farm price to Korean Import Price Results (5.2)

The findings below indicate efficiency in the import grain markets. This is important because Korea imports a large amount of feed corn and soybeans for the livestock industry, and is quite dependent on grain import markets.

Korean grain import prices show relatively high price transmission from U.S. farm grain markets, indicating efficient markets for grain imports. Price transmission elasticity coefficients for corn, soybeans, and wheat were .74, .82, .62, along with fairly high R^2 goodness of fit levels at .76, .87, and .81 levels. A coefficient of .74 for corn import price means that when U.S. farm corn price increases by one percent, then Korean import corn price increases by .74 percent. Korean grain import prices appear to have converged to closer U.S. levels after allowing for transfer cost and other costs, indicating increasing liberalization of the market.

All three grains were found to have a two month lag time for price

information to flow fully between the U.S. farm market and the Korean import market, according to the AIC and causality equation results. For example, U.S. farm corn price is found to lead or "cause"Korean corn import price by two months. This two month period is within range of others findings for U.S. to Europe, and is reasonable since Korea has a greater transportation distance from the U.S. than does Europe. Corn price was found to be determined primarily on the exporter side or supply side (U.S. side). This is likely the result of the large U.S. corn exports, and resulting influence on the world corn export price.

The Korean beef market appears to have undergone considerable liberalization in terms of price levels. The Korean beef import price to U.S. farm price ratio dropped from about 2.2 in 1997/98 to about 1.8 in 2000. For pork, the ratios fell from 2.3 to 1.9, also indicating considerable liberalization as well, and findings for chicken were similar. However, there is still fairly low price transmission from U.S. beef, pork, and chicken to Korean import prices for these meats, compared to grains. This especially true for beef, which had a price transmission elasticity coefficient of only a .04. This low price transmission likely indicates that some rigidities remain between the two markets. This may be due to border measures and the meat import market structure in Korea. However, some caution should be used when comparing U.S. farm meat price levels with Korean meat import price levels, because the U.S. price represents live animals, whereas the Korean import price is for meat that has been processed, so is of higher value.

Korean Import Price to Korean Farm and Wholesale Price Results (5.3)

Results show that price transmission for grains from Korean import price to Korean farm price is fairly low. For example, price transmission coefficients are .39 and .09 for corn and soybeans. This indicates that import price or world price has quite limited influence on Korean farm price.

In contrast, Korean beef import price appears to quite strongly influence Korean farm beef prices. Korean beef import prices showed a relatively close connection to Korean farm prices, with a price transmission elasticity of .97 and an R^2 with a .60 value. This indicates that Korean beef producers are competing directly with imported products and highlights the importance of improving competitiveness of Korean beef production. This is in contrast to grain production, where Korean farm prices are not heavily influenced by import price. Import chicken and import pork markets in Korea appeared less linked to Korean farm prices than beef, with coefficients of .45 and .39.

The financial crisis from October 1997 through January 1999 appears to have a major impact on Korean farm prices, measured in U.S. dollars. Price transmission from Korean import price to Korean farm price for corn, soybeans, beef, pork, and chicken showed a statistically significant large drop in Korean farm prices relative to import prices. This was due to lower exchange rates, and also lower demand in the case of meat, due to lower consumer income. The financial crisis also showed statistical significance for Korean import price to Korean wholesale price, measured in U.S. dollars, for soybeans, beef, pork, and

chicken.

Macroeconomic Results (5.4)

i) Exchange Rate to Korean Import Price Results

The exchange rate pass through during the 1997-98 financial crisis (data October 1997- January 1999) shows very high exchange rate pass through coefficients. All coefficients are above 1.0, are statistically significant, and most have relatively high R^2 values. In other words, Korean import price changes are larger than changes in the exchange rate, which is unexpected, as the coefficients would be expected to be well below one. This indicates that the exchange rate has a very large and excessive impact on import prices during the financial crisis. This may be due to merchants anticipating the exchange rate, and then over reacting due to the crisis and adjusting import prices by amounts larger than the actual exchange rate changes. This excessive exchange rate pass through indicates the extent of over reaction, uncertainty, and excessive import price volatility brought on by the financial crisis, and the disruption to the import markets.

In contrast, exchange rate pass through during the entire 1996-2002 period was relatively low and below .40 for all commodities, except for beef, which was .75. These lower pass through rates appear much more expected than behavior during crisis. The high beef exchange rate pass through value may result partly because beef retailers may have been able to fairly easily pass on beef price increases to retail consumers.

ii) Inflation to Korean Farm and Retail Price Results

Results for transmission from consumer price index to Korean farm prices show that farm prices for corn, soybeans, barley have kept up with inflation over the period. Price transmission coefficients are 1.08, 1.56, 1.25, and with reasonable R^2 values. However, rice did not keep up with inflation, as evidenced by a coefficient of .81. Farm beef, pork, and chicken prices showed relatively low correlation with inflation, and appear to be increasing at less than inflation except for beef, with a 1.39 coefficient.

Farm prices for the three grains have kept up with inflation because of government support. However, the rice coefficient is lower than others, as rice prices began to drop around 2001 because of changes in rice policy. Both farm pork and chicken show very low coefficients on of .04 and .21 and low R^2 values, indicating that these meat prices did not keep up with inflation. This is likely because these commodities have been liberalized considerably, and are no longer supported like the grain sector. As a result, meat prices of chicken and pork have adjusted more downward toward world price levels.

Results for retail prices show that beef and pork have fairly high price transmission from the consumer price index, with coefficients of 2.15 and 3.25, respectively. This indicates that retailers have been able to pass on price increases to consumers at rates greater than inflation. However, the rice coefficient is .82, indicating that retail rice price increases have been lower than the inflation rate.

U.S. to Korea Farm Results (5.5)

Price ratio results are presented rather than price transmission elasticities, as there is limited price transmission between U.S. farm prices and Korean farm prices, especially for grains. One reason for the limited transmission is the relatively high priced Korean grains due to government support. Korean farm prices are well above U.S. levels, as objectives of Korean policy include providing farmer welfare consistent with urban welfare and also providing sufficient food security.

In 1970, Korean farm grain prices were about 3 times higher than U.S. grain prices. However, rice price was about the same level as in the U.S. Korean beef and pork price were roughly the same level as in the U.S., though chicken was twice the U.S. price. But by 2000, Korean farm price levels for rice, corn, and barley were about 5-7 times higher than for the U.S. Soybean prices were 14 times higher than the U.S.

By 2000, Korean beef and pork prices had increased to 3.5 and 2.1 times the U.S. price. However, chicken had fallen to 1.5 times the U.S. price, from about twice the U.S. price in 1970. This indicates that Korean chicken is priced competitively relative to world levels. In comparison with Japanese farm prices, Korean price for soybeans is about 20 percent less, 50 percent less for barley, and about the same for soybeans. Overall, Korean prices are closer to higher Japanese levels than the lower U.S. levels. This reflects Korea's similar situation to Japan, in terms of food security, available land, desire for rural welfare, and resulting agricultural policies.

Farm Price and Retail Price: U.S. and Korea Results (5.6)

Rice, beef, and pork prices were analyzed at the retail level. Korean rice shows a very high price transmission farm level to retail level, with a .89 coefficient and a high .92 R^2 value. This is likely consistent with the goals of Korean agricultural policy, to ensure that farm price increases are consistent with retail price increases, in order to ensure that rice farmer welfare is linked to urban welfare.

Both beef and pork markets show structural change in the retail market, following the financial crisis. This is confirmed by findings of a statistically significant binary variable for the period February 1999 through December 2002. Retail prices for beef and pork show a substantial increase relative to farm level prices for this period of structural change that occurred following the financial crisis. This may result from increasing concentration of firms in the retailing industry. A number of the major trading companies have vertical integration in the food supply chain, having ownership or business relationships with retail chains, beef trading and processing.

U.S. Retail Price to Korea Retail Price Results (5.7)

Results show a reasonable amount of price transmission from U.S. retail prices to Korean retail prices. Price transmission coefficients for rice, beef, and pork were 1.24, .48, and .95. Inflation has likely provided some common linkage for the retail prices, which have increased in both countries. However, an important finding is the effect of the financial crisis. The binary variable representing the Korean financial

crisis is statistically significant in all cases for rice, pork, and beef. When analyzed in U.S. dollars, Korean food prices faced a large price drop relative to U.S. levels during the financial crisis.

Output price/Input price ratios for Livestock Results (5.8)

The financial crisis of October 1997 through January 1999 placed a large stress on livestock profitability in Korea, especially for beef. During the later months in 1997 the output price($/kg) to input price($/kg) ratio for beef dropped from about 40 to 20 in a period of about two months. The crisis caused corn import price to increase substantially in value, due to the devaluation of the Won. At the same time beef price dropped due to less demand from lower consumer income and credit during the crisis. Some beef producers were forced to stop raising livestock as they were unable to afford feed and other imported inputs. Pork and chicken output/input ratios behaved similar fashion to beef, and these industries were also significantly impacted by the financial crisis.

Beef output/input ratios are higher for Korea than the U.S,, and this may be one indicator that is favorable for Korean producers. However, pork and chicken output/input ratios are much lower and closer to U.S. levels. Corn prices paid by Korean and U.S. producers are somewhat similar, so it appears that the higher beef prices received by Korean producers are the main factor causing the higher beef output/input ratio for Korea compared to the U.S. Overall, it would appear that the Korean beef producer has received favorable output input price ratios, however, increased imports from liberalization could drop beef prices and put downward pressure on the beef output/input ratio. Therefore,

beef producers will need to continue to enhance their competitive position in beef production in order to cope with possibly lower output/input price ratios.

Additional Observations

Beef producers and rice producers may face challenges in future due to beef and rice prices above world levels. On the feed side, results show efficiently priced and liberalized feed grain import markets. This assists the livestock market, as it is dependent on imported feed. Pork and chicken markets appear to be priced relatively competitively in relation to world markets, due to removal of quotas and more liberalization. If lower rice prices and diversion away from rice brings some increased grain production, then livestock producers may benefit. However, beef price levels appear relatively high compared to world levels. To attempt to sustain prices, beef producers will likely have to differentiate their product from imported beef, according to higher quality, food safety, and other premium attributes. Per capita consumption of beef will likely continue to increase along with income in Korea, but domestic beef producers will have to provide a superior product to imported beef if they are to benefit from the increased beef consumption.

The financial crisis was very difficult for beef producers, who were caught in a price-cost squeeze. Lower consumer income brought reduced demand for income sensitive beef, and therefore lower prices. On the cost side, feed grain imports and other imported inputs raised costs. The problem was compounded with high exchange rate pass through of costs to producers. At the retail level, beef price appears to

have been increasing relatively quickly, compared to Korean farm price, U.S. farm price, and import price. The increasing concentration in the beef retail market and higher prices raises the possibility of some imperfect competition in the beef retail market.

Rice producers are likely to face challenging times in future. Decreasing consumption, excess supplies, more imports, and lower prices are likely to force some producers from the industry if they cannot diversify to some other alternatives. Further, rice prices are well above world levels, and similar to Japanese levels. With Korean producers facing some of the same difficulties as European and Japanese producers, such as small farm size and high costs, some similar strategies may be of interest. A number of European countries, Japan, and others are focusing on multifunctional benefits related to agriculture, such as conservation, and preservation of rural life and landscape. Korea may find that a multifunctional approach for rice policy may be worth considering for maintaining rice farmer welfare and food security.

Methodology Summary

Method one shown below relates to objective one and examines the price transmission between markets such as farm, import, retail, and some wholesale, for Korea and the U.S. The model used here is based on models such as Boyd and Brorsen (1986), Goodwin and Schroeder (1991), as well as Gardner and Brooks (1994), Goodwin and Holt (1999), Goodwin and Grennes (2002), Baulch (1997), and Asche, Bremnes, and Wessells (1999). Bivariate (two variable) models are used in the bulk of price transmission models, because adding more

variables such as highly correlated prices would add multicollinearity to the models, and may make individual coefficient estimates less reliable (Goodwin and Schroeder, 1991). Other widely used examples of bivariate economic models include hedge ratios, stock market Betas, and cointegration models. The price transmission model used here can be summarized with a log-log model form in time t:

$$log(P^K) = a_1 + b_1 log(P^W) + e$$

where: P^K = *Korea Import Price*

P^w = *World Farm Price (e.g. U.S. farm price)*

b_1 = *price transmission coefficient*

e = *error term*

Additionally, the equation is used with various combinations of farm, retail, import, and wholesale price combinations between U.S. and Korea, and within each country. As well, binary variables are added in a number of cases to isolate the impacts of the financial crisis and structural change in markets.

Equations below are specified to determine causality (Granger) and lag times (Akaike) between markets. The following bivariate model is found to have two period lag in this example, with variables being U.S farm price and Korean Import Price:

$$K\ Import\ Price = f(K\ Import\ Price_{t-1},\ K\ Import\ Price_{t-2},\ US\ Farm\ Price_{t-1},\ US\ Farm\ Price_{t-2})$$

$$US\ Farm\ Price = f(K\ Import\ Price_{t-1},\ K\ Import\ Price_{t-2},\ US\ Farm\ Price_{t-1},\ US\ Farm\ Price_{t-2})$$

The number of lags or price transmission time to be included in the model is selected using Akaike's Information Criterion (AIC) (Akaike, 1976).

Method two shown below relates to objective two and uses a macro price transmission model for analyzing the impacts of macro variables on farm prices and other prices. This macro transmission model example can be summarized in log-log form, in time t:

$$log(P^K) = a_2 + b_2 log(P^{mv}) + e$$

where: P^K = *Korea import price level for a given commodity*

P^{mv} = *macro variable for Korea or (other country), such as exchange rate*

$b2$ = *price transmission coefficient*

e = *error term*

Method three shown below relates to objective three and is based on Kwiecinski and Quaisser (1993). For case of international farm price ratios, and relative comparisons of farm prices across countries, the price ratios are computed in time t as:

$$R^{wK} = P^K / P^W$$

where: R^{kw} = *domestic price to world price ratio*

P^k = *Korea farm price level for a given commodity*

P^w = *Other country farm price level (e.g. U.S, Japan, for a given commodity)*

For meat, output/input price ratios are computed in a similar fashion

for both Korea and U.S, for both beef, pork, and chicken:

$$RLF = PL/PF$$

where: R^{LF}= *livestock output/input ratio e.g. beef price to corn price ratio*

P^{L}= *livestock price e.g. beef pric*

P^{F} = *feed price e.g. corn price*

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Chapter 1. Introduction

Section 1. Reasons for the Study

Price transmission can be described as the relationship and co-movement between markets over time, form, and space. In the Korean context, agricultural policy makers are faced with the goal of improving agricultural competitiveness while at the same time ensuring sufficient food security and farmer welfare. The competitiveness of the Korean agricultural sector, along with production and consumption decisions, is linked to resource allocation policies. A key to improved resource allocation is proper pricing efficiency and optimal price levels for products, so they can be more competitive in the Korean agricultural sector.

This study provides insight into the price linkages within the Korean agricultural sector, and provides an analysis of price transmission and pricing efficiency between markets. As well, price levels and price ratios between markets are examined, along with the impacts of macroeconomic variables and financial crisis impacts on Korean markets. Some attention is given to identification of structural change within Korean livestock markets. Much of the emphasis in this study is placed on import markets, such as corn, wheat and soybeans. This is because Korea is heavily dependent on a variety of feed imports for the livestock industry, as well as imports for human food consumption imports such as wheat. However, meat imports are also given

considerable attention, since a large amount of beef is imported. Insight into the Korean domestic beef market is important as it attempts to become more competitive in relation to imported beef. While Korean and import markets are a main focus of the study, some attention is given to retail prices in order to examine the pricing mechanism between farm and retail, though less focus is provided on the wholesale sector. Korean prices are compared with world market prices. U.S. prices are used as an approximation for world prices in this study. Since U.S. prices were found closely linked to Canadian prices, and a considerable share of Korean agricultural imports come from the U.S., comparisons are made between U.S. and Korean prices. Some limited attention is given to Japanese farm prices and policy for comparison, given some similarities between Korea and Japan, in terms of food security and trade issues.

Price transmission has important implications for agricultural policy makers, in terms of competitiveness, resource allocation, market efficiency, market efficiency, liberalization, macroeconomic effects and financial crisis, and imperfect competition. First, agricultural price transmission plays an important role in resource allocation because it can measure the extent to which one price change will impact another price in the agricultural sector. Since prices influence production and consumption as well as imports, price transmission ultimately impacts resource allocation. Price transmission therefore impacts what a country will produce and consume, and when it will do so. Secondly, price transmission plays an important role in the efficiency of market pricing and market efficiency. Speed of price transmission from one market to another is not generally immediate, especially at the international level from export to import markets. Faster price

transmission is desirable and is associated with more efficient pricing in markets.

Thirdly, agricultural price transmission has implications for liberalization of markets. As markets become more liberalized and integrated, the law of one price dictates that all prices should converge closer to the same international price level, after accounting for changes in time, form, and space. Therefore, as particular domestic commodities become more liberalized, price transmission analysis should be able to confirm that which liberalization has actually been taking place. Prices should be observed to begin to drop down toward world levels if liberalization efforts are successful, and the Korean market would become more integrated with the world market.

Fourthly, price transmission has important implications for macro impacts on agricultural markets, such as the Asian financial crisis. Changes in the exchange rate, for example, can have large impacts on import prices. Price transmission analysis can determine the extent to which the changing value of the exchange rate is passed on to import prices. This relationship is important, because in times of financial crisis, livestock producers may face large and unexpected increases in feed grain prices and other imported inputs, and reduced credit. At the same time, lower consumer incomes may cause decreased consumer demand to drop, and therefore reducing livestock prices. The end result is both a price and cost squeeze that can add excessive financial stress to the individual livestock producer and to the livestock sector. Fifthly, price transmission has important implications for identifying structural change in agricultural markets. For example, price transmission analysis can quantify structural changes, such as those that have been

taking place in the Korean livestock markets. Sixthly, there may be implications regarding imperfect competition associated with an increasing concentration and fewer firms at the retail level, for commodities such as beef.

Section 2. Main Objectives of the Study

Given the importance of improving competitiveness in the Korean agricultural economy and the importance of efficient pricing and optimal price levels, the objectives of the study are as follows:

Objective One:

The first objective is to examine Korean import prices with respect for price transmission. For example, the impact of U.S. farm prices on Korean import prices is examined. The extent that Korean import prices change when U.S. farm prices change is an example of price transmission elasticity. Under free trade and the law of one price theory, a one percent change in world farm price should be met with the same corresponding one percent change in Korea and other countries, assuming no rigidities across time, form, and space. This would imply a price transmission elasticity coefficient of one and fully integrated markets. Under this theoretical free trade case, perfect price transmission occurs. However, real world economics dictates that the law of one price does not generally hold and the price transmission coefficient is not equal to one. This implies rigidities across time, form, and space, and some pricing inefficiencies. If pricing inefficiency occurs, then some agricultural resource misallocation and loss of welfare may result. Selected Korean prices at the farm, retail level, and some

wholesale are compared with those in the U.S, and the price transmission and pricing efficiency is compared between the various markets.

As well, causality is also used to measure time lags for price to travel from U.S. markets to Korean markets, for example, as a measure of pricing efficiency. Under free trade, price transmission implies that world farm price changes are instantly transferred to South Korean prices. However, price rigidities such as reduced price information flows or Korean trade policy, may result in a number of time lag periods before prices are transferred from world levels to Korean levels. If this slower price transmission occurs, then resource allocation may be slower, and this could result in welfare losses. However, market liberalization should result in improved price transmission and corresponding improved price transmission, and improved welfare. Overall, selected Korean prices at the farm, retail level, and some wholesale are compared with those in the U.S., and the price transmission and pricing efficiency is compared between the various markets. Issues of interest include possible structural change in the meat retail sector. Where appropriate, the impacts of the financial crisis will also be identified.

Objective Two:

The second objective is to examine macroeconomic impacts on agricultural prices and price transmission. Agriculture is heavily dependent on macroeconomic policies, and large macroeconomic price shocks have impacted the Korean agricultural economy various agricultural economy in recent years. For example, the 1998 economic crisis with a lower valued exchange rate was difficult for Korean

livestock producers, because it meant higher priced grain inputs for their livestock. The extent to that changes in exchange rates are passed on to Korean import prices is known as the exchange rate pass through, and is examined in this study. If Korean import price is directly linked to world price, then a one percent devaluation in the exchange rate should lead to a one percent change in Korean import price.

This objective also includes examining the impact of inflation (consumer price index), on Korean prices, such as farm level prices and selected retail food prices. The extent that farm prices have changed in relation to inflation has implications for farmer welfare. Inflation is also examined for its relationship to selected retail food prices, to see if food prices are consistent with the general price level (CPI).

Objective Three:

A third objective is to examine agricultural price ratios over time, in order to understand relative price levels. For example, ratios of Korean farm prices to U.S. and Japanese grain prices are compared for selected commodities. As well, output/input price ratios for the Korean livestock are compared with U.S. livestock e.g. the beef price divided by the corn price. The levels and variability of these price ratios can provide an indication of risk, profitability, and price behavior of the various commodities over time.

Section 3. Price Transmission Theory and Literature

Price transmission refers to the price relationships between markets and the degree of co-movement between the markets. Most studies have focused on spatial markets, and international cross border price transmission studies, including include Boyd and Brorsen(1986), Palaskas(1995), Mundlak and Larson(1992), and Boyd and Christie (2000). Agricultural price transmission literature begins with early studies such as Lele(1967) and Blyn(1973), who examined correlation between agricultural prices in India. Later domestic studies include Boyd and Brorsen(1985, 1988), Punyawadee, Boyd, and Faminow(1991), Gravelines and Boyd(1999), Colman(1985), Ravillion(1986), Ardeni(1989), Faminow and Benson(1990), Goodwin and Schroeder(1991), and Goodwin(1992). More recent studies include Gardner and Brooks (1994), Goodwin and Holt(1999), Goodwin and Grennes(2002), Baulch(1997), and Asche, Bremnes, and Wessells(1999).

The above literature assists in building a framework to examine the performance of the agricultural pricing mechanism in Korea and pricing efficiency. This is of interest terms of resource allocation and efficiency, and Kwiecinski and Quaisser (1993) argue that liberalization will lead to improved pricing performance.

Price may be transmitted through the dimensions of time, form, or space, however, space is the main dimension of interest here. In the case of space, prices will differ between markets due to transfer cost of getting the product from one location to another, but prices will differ as well for other reasons explained below. The law of one price implies that prices between markets should differ only according to

differences in time, form, and space. If the price in one market increases by one percent, then the price for the same commodity in another market should also increase by one percent according to the law of one price, after accounting for differences in time, form, and space. If the law of one price holds, then markets are defined as fully integrated. This corresponds to a price transmission elasticity of one, which is theoretically a highly efficient pricing mechanism, assuming there are competitive markets, no collusion, and no interference.

If prices are not transmitted properly between markets, then they are considered to be segmented (Boyd and Christie). This means they are not highly related and not economically integrated. Prices may be segmented or disconnected between markets for a number of reasons, according Boyd and Christie (2000). These include (1) Producer subsidies, consumer subsidies, or other internal policies (2) Trade policies and industry protection (e.g. quotas, tariffs) may segment price (3) Imperfect competition, such as at the processor or retail (4) Vertical integration with administrative pricing (5) Time lags or logistical problems in international trade, transportation, and transfer (6) Poor information flows segmentation.

Relatively limited literature is available regarding macro price transmission impacts on agriculture, as this concept is somewhat new and unexplored in price transmission research. The main study of this nature that relates to macro price transmission impacts is Palaskas (1989).

The third objective, of constructing rice ratios for comparison over time, is also relatively unexplored in the literature, except for Kwiecinski and Quaisser (1993).

Section 4. Strengths of Model and Contribution Beyond Previous Models:

This model used in this study has a number of advantages over earlier studies on international price transmission. It includes a macro price transmission model that provides information regarding macroeconomics impacts on agricultural prices. Understanding macro price transmission impacts on agriculture has become increasingly important, given the 1998 financial crisis, and an increased reliance on trade, both on the importing and exporting side. For example, exchange rates can have a significant impact on a country's importing food sector, as evidence by the 1998 financial crisis shocks. Particular macro impacts on agriculture, such as the 1998 financial crisis, can be also be measured and analyzed by using a binary variable in the macro price transmission model during the period of the crisis.

The second method included is analysis of price ratios, such as Korean farm price to U.S. or Japanese price. These Korean to world price ratios will provide a very useful indication of the extent the agriculture sector is converging to world levels in terms of prices over time. This will be complemented by the use of output/input price ratios for livestock (e.g. beef price to corn price). As well, lag periods between variables will be analyzed as appropriate, to determine how long it takes for a price change in the U.S., such as corn price, to impact the Korean corn import market.

Chapter 2. Data and Methodology

Section 1. Data

A main focus of the study is Korean import markets, as well as farm, retail, and some wholesale. The main focus on commodities is corn, soybeans, wheat, barley, rice, beef, pork, and chicken. Corn, wheat, soybeans, beef, and pork are given the main interest, including import markets. Corn, soybeans, and wheat are of interest because of Korea's dependence on these sizable imports. Beef is of interest due to high the structural changes and liberalization in the market, and efforts to improve the competitiveness of Korean beef.). Korean prices are used, along with world prices, approximated by U.S. prices, and selected other country prices for comparison. Data is converted to US dollars when comparing across countries, and monthly data is used for the time series analysis. However, annual data is used for price ratios when comparing Korea with Japan. Data includes farm, wholesale, retail, and import markets. The U.S. prices are from U.S. Department of Agriculture, while Korean agricultural prices are mostly obtained from KREI and KATI (Korean Agricultural Trade Information). Macro data is obtained from the finance ministries of each country of interest. Most of the for the study data begins in 1970, though the bulk of the econometric analysis presented in this study is from 1996-2002, in order to present most current results and changes in various markets. Statistical tests and measures carried out for the econometrics include Equation F, Coefficient T, R^2, Stationarity Augmented Dickey Fuller

(ADF), Cointegration ADF, Wald F, Fisher's Kappa, Kolmogorov-Smirnov, Akaike's Information Criterion (AIC), Durbin Watson, and heterosskedasticity tests.

Section 2. Price Transmission Methodology

1. Method One:

Method one, relating to objective one, examines the price transmission between markets such as farm, import, retail, and some wholesale, for Korea and the U.S. The model used here is based on models such as Boyd and Brorsen(1986), Goodwin and Schroeder(1991), as well as Gardner and Brooks(1994), Goodwin and Holt (1999), Goodwin and Grennes(2002), Baulch(1997), and Asche, Bremnes, and Wessells (1999). It explains what percentage of price is one market is transmitted to another market. For example, if the U.S. corn farm price changes by one percent, the model will provide an estimate of the estimate of the percentage change in Korean corn import price, known as the price transmission elasticity coefficient. This provides an indication whether particular country's markets tend to be more integrated or segmented relative to world markets, and provides a measure of pricing efficiency. An econometric model is used and specification assumes there is a market, where price is first determined and then passed on to another market. This can be summarized with a log-log model form in time t:

$$log(P^K) = a_1 + b_1 log(P^W) + e \qquad (1)$$

where: P^K = *Korea Import Price*

P^w = *World Farm Price (e.g. U.S. farm price)*

b_1 = *price transmission coefficient*

e = *error term*

Additionally, equation (1) is used with various combinations of farm, retail, import, and wholesale price combinations between U.S. and Korea, and within each country. As well, binary variables are added in a number of cases to isolate the impacts of the financial crisis and structural change in markets. The main result of equation (1) is that $b_1$is the price transmission elasticity coefficient. If b_1=1, then a one percent change in U.S. farm price results also in a one percent change in Korean import price. This means the world farm to Korean import price transmission is one. Therefore, world and individual country prices are fully integrated, assuming competitive markets. But if $b_1$is zero, this indicates there is no relationship between world and Korean import prices. The closer the R^2 value is to 1, the better the fit of the model. Also, the disturbance term, e, is likely to exhibit at least some autocorrelation and non-stationarity since price levels are used to preserve long-term market information (except for the causality analysis below), so caution should be used in interpreting statistics related to standard errors (Goodwin and Schroder, 1991). Bivariate (two variable) models are used in the bulk of price transmission models, because adding more variables such as highly correlated prices would add multicollinearity to the models, and may make individual coefficient estimates less reliable (Goodwin and Schroeder, 1991). Other widely used examples of bivariate models include hedge ratios, stock market Betas, and cointegration models.

High levels of price transmission, near one, assuming a competitive market, correspond to markets that are highly related to each other. Put another way, they are market sensitive to market signals and information, and have a very efficient pricing system relating the two markets. Such related markets are also called integrated markets. In some cases, markets may be found to be very closely related, or cointegrated(Engle and Granger, 1987). Tests will be completed for cointegration. However, the finding of cointegrated markets is unlikely in this study, as cointegration between markets most often occurs only when markets differ by a short space or distance. However, markets in this study tend to vary by long distance (international price transmission), or by different form (e.g. farm to retail).

Causality and time lag procedures are based on Granger(1969), Akaike(1976), Boyd and Brorsen(1986), Colman(1996), Copeland and Copeland(1998), Frino, Walters, and West(2000). They are used to analyze the causality and time lags between the U.S. farm price and Korean import price for corn, soybeans, and wheat, because the time lags between these international markets are of interest. These price relationships and their pricing efficiency are important given the large imports of grain by Korea for feed and human consumption. Percentage price changes are used for the causality and time lag analysis rather than price levels, as it is short-term price changes rather than long-term levels that are of interest. As well, multicollinearity is minimized because of using price changes rather than price, and so using more than one independent, such as a number of lagged variables, is acceptable. A series of bivariate autoregressive (AR) models are constructed. These are used in the causality tests that follow. The number of lags included or price transmission time is

determined using Akaike's Information Criterion (AIC) (Akaike, 1976). The bivariate model can be written as

$$P_t = \sum_{i=1}^{p} AP_{t-i} + e_t,$$

where,

$$P_t = \begin{bmatrix} P_{1t} \\ P_{2t} \end{bmatrix}, \quad A = \begin{bmatrix} a_{11}(i) & a_{12}(i) \\ a_{21}(i) & a_{22}(i) \end{bmatrix}, \quad and\ e_t = \begin{bmatrix} e_{1t} \\ e_{2t} \end{bmatrix} \qquad (2)$$

and P_{1t} and P_{2t} are the Korean import price and the U.S. farm price for grain, the e_t's are residuals, and the a's are coefficients to be estimated. Residuals of the bivariate autoregressive models are checked for white noise and if the true AR model is selected and the residuals are white noise, then consistent and asymptotically efficient estimates of the parameters and standard errors are obtained by least squares techniques.

The concept of Granger (1969) causality is used to determine the direction of dynamic price adjustments. A variable X does not cause variable Y if Y cannot be predicted better by using past values of X than if past values of X are not used. If X causes Y and Y does not cause X, then X is said to unidirectionally cause Y. Bivariate causality occurs when X causes Y and Y causes X. This is called a feedback relationship. Unidirectional causality has implications for price discovery. For example, if U.S. farm grain prices cause Korean import grain prices, then it would imply that prices are first discovered in the U.S. farm market.

The test for causality running from X to Y is performed by testing the significance of the coefficients as a group rather than individually. This test is conducted with the Wald F statistic. This test procedure is a variant of Granger's test which Monte Carlo studies have shown to be more powerful than the causality tests of either or Haugh or Sims.

Two equations are used for the following bivariate model that is found to have two period lag in this example, with variables being U.S farm price and Korean Import Price: ,

$$K\ Import\ Price = f(K\ Import\ Price_{t-1},\ K\ Import\ Price_{t-2},\ US\ Farm\ Price_{t-1},\ US\ Farm\ Price_{t-2}) \quad (3)$$

$$US\ Farm\ Price = f(K\ Import\ Price_{t-1},\ K\ Import\ Price_{t-2},\ US\ Farm\ Price_{t-1},\ US\ Farm\ Price_{t-2}) \quad (4)$$

For example, if adding the past US farm corn prices adds significant explanatory power to the Korean import corn price in equation (3), as measured by the use of the F-test, then the US farm corn market "causes"or leads the corresponding Korean import corn market. Likewise, if the past Korean import corn price adds significant explanatory power to US farm corn price in equation (4), as measured by the use of the F-test, then the Korean import corn price "causes"or leads the corresponding US farm corn price. However, the Korean import corn market leading the US farm corn market would be unlikely, given the relatively large size of US corn market and its influence on world price and Korean price.

2. Method Two:

Method two, relating to objective two, uses a macro price transmission model for analyzing the impacts of macro variables on farm prices and other prices, and is relatively new and unexplored in research. The only relevant study of this nature that relates to macro price transmission impacts is Palaskas(1989). This methodology used here is a model that attempts to explain what percentage of a change in a macro variable (such as exchange rate, inflation, etc) is transmitted to the Korean import price, for example. It indicates the degree that particular macro variables affect the agricultural sector. It examines whether particular country markets tend to be more integrated or segmented relative to the macro economy and macro impacts. An econometric model is used and specification assumes there is a macro variable with changes that can impact the agricultural sector through farm prices. This macro transmission model can be summarized in an example in log-log form, in time t:

$$log(P^K) = a_2 + b_2 log(P^{mv}) + e \qquad (5)$$

where: P^K = *Korea import price level for a given commodity*

P^{mv} = *macro variable for Korea or (other country), such as exchange rate*

b_2 = *price transmission coefficient*

e = *error term*

The main result of equation (5) is that (b_2) is the macro price transmission elasticity coefficient. If b_2=1, then a one percent change in the macro variable (e.g. exchange rate) level results also in a one

percent change at the import price level. This means that the macro to import price transmission is one, so the macro and agricultural variables are fully integrated, given the particular commodity. But if b2is zero, this indicates there is no relationship between the macro variable and commodity prices. Again, the closer the R^2 value is to 1, the better the fit of the model, and the disturbance term, e, is likely to be autocorrelated, as it may capture some supply and demand factors that are unexplained by the macro variable alone.

3. Method for Objective Three:

Method three, relating to objective three, is based on analyzing price level ratios as presented in Kwiecinski and Quaisser(1993). For case of international farm price ratios, and relative comparisons of farm prices across countries, the price ratios are computed in time t as:

$$R^K = P^K/P^W \qquad (6)$$

where: R^{kw} = *domestic price to world price ratio*
P^k= *Korea farm price level for a given commodity*
P^w= *Other country farm price level (e.g. U.S, Japan, for a given commodity)*

For meat, output/input price ratios are computed in a similar fashion for both Korea and U.S, for both beef, pork, and chicken:

$$RLF = PL/PF \qquad (7)$$

where: R^{LF} = *livestock output/input ratio e.g. beef price to corn price*

ratio

P^L= *livestock price e.g. beef price*

P^F = *feed price e.g. corn price*

Chapter 3. Policy Background for Price Transmission

Section 1. Rice Sector in Korea

1. Korea Rice Consumption

This chapter on policy background for price transmission provides a perspective on Korean agricultural policy in the context of price transmission. Since Korean agriculture has similarities with Japan, as well as the European Union, some background is provided for these regions. Since U.S. prices are used as an approximation for world prices, some background is also presented on U.S. grain policy, as much of U.S. agricultural policy focuses on the grain sector.

Per capita rice consumption in South Korea continues to decline. After reaching a peak of 135.6kg in 1979, it has declined each year by an average of 2 to 3 percent. By 2002 per capita rice consumption had decreased to 85.5kg.(Table 3.1). This translates into total overall consumption of 4.1 (million metric tons) MMT in 2003. The decrease in Korean rice consumption can be attributed to increasing consumption of meats, fruits and wheat-based products. With higher income and less time to spend on home food preparation, rice consumption by urban residents continues to decrease annually. The declining trend per capita rice consumption is likely to continue in South Korea as consumers strive to diversify their food sources to improve their dietary intake.

Table 3.1 Rice Consumption and Utilization Pattern (unit: 1000 MT) a/

ar	Table Rice	Processing	Per Capita Consumption (Kg) b/
1991	4,930	285	112.9
1992	4,855	347	110.2
1993	4,814	351	108.3
1994	4,777	228	106.5
1995	4,747	200	104.9
1996	4,710	111	102.4
1997	4,671	115	100.4
1998	4,640	110	96.9
1999	4,425	175	93.6
2000	4,209	183	88.9
2001	4,145	336	87.0
2002	4,100	400	85.5

a/ Ministry of Agriculture and Forestry (MAF)

b/ Table rice basis, Kg

Korean consumers have a strong preference toward the high quality domestic Japonica rice variety. In the past, Ministry of Agriculture and Fishery (MAF) attempted to promote a better-yielding Indica variety rice, known as "tongil" (Table 3.2) in the Korean market to ensure self-sufficiency, however, the Korean consumers never accepted this variety as table rice. Consequently, Indica rice is mainly used for food processing in South Korea.

2. Korea: Rice Production

Since the 1970s South Korea has achieved a high level of self-sufficiency in rice and rice production is the largest of grain in Korea. Particularly, after the introduction of tongil rice, cross-bred

from indica and japonica rices, rice production in South Korea increased significantly. Tongil rice has higher yield than japonica rice and farmers responded to this new variety by shifting their production mostly to tongil rice. However, bad weather in 1980 resulted in an extremely small rice harvest, creating a large deficit in rice supplies. Because of consumers resistance to tongil rice, its production ceased in 1993 (Table 3.2). Since then Korean rice production has consisted of mostly japonica rice.

Table 3.2 Rice Acreage, Yield and Production (milled basis) a/, b/

Year	Indica (Tongil)			Japonica			Total	
	Acreage	Yield	Prod	Acreage	Yield	Prod	Acreage	Prod
1985	343	5,040	1,729	894	4,370	3,897	1,237	5,626
1986	272	4,720	1,286	964	4,490	4,321	1,236	5,607
1987	247	4,570	1,128	1,016	4,310	4,369	1,263	5,497
1988	225	5,360	1,205	1,035	4,690	4,848	1,260	6,053
1989	182	5,110	931	1,074	4,630	4,967	1,256	5,898
1990	138	5,196	720	1,106	4,426	4,886	1,244	5,606
1991	49	4,940	240	1,160	4,440	5,145	1,209	5,385
1992	1	5,570	4	1,156	4,610	5,327	1,157	5,331
1993	-	-	-	1,136	4,181	4,750	1,136	4,750
1994	-	-	-	1,102	4,591	5,059	1,102	5,059
1995	-	-	-	1,056	4,450	4,694	1,056	4,694
1996	-	-	-	1,055	4,600	4,853	1,055	4,853
1997	-	-	-	1,052	5,180	5,449	1,052	5,449
1998	-	-	-	1,059	4,814	5,097	1,059	5,097
1999	-	-	-	1,066	4,937	5,263	1,066	5,263
2000	-	-	-	1,072	4,936	5,291	1,072	5,291
2001	-	-	-	1,083	5,092	5,515	1,083	5,515
2002	-	-	-	1,053	4,679	4,927	1,053	4,927

a/ Source: MAF.
b/ acreage unit: 000 hectares (HA), yield unit: Kg/HA, Production unit: 000 MT.

Since the mid 1980s, rice acreage has gradually declined at an annual average rate of 3 to 4 percent. This decline is due to several factors. First, farmers chose to shift land at the margin to other crops, which are more profitable such as fruits and vegetables. Also, rising land and labor costs in rural Korea made farming less attractive for small farmers and increasing urbanization process contributed to reduction in rice planting acreage (Table 3.2).

Rice has political and social significance in South Korea as consumers consider that self-sufficiency is important to their welfare and security. Korean farmers' welfare is one of the main criteria to determine success of the Korean agricultural policy. Thus, MAF has devoted a substantial amount of agricultural extension-type resources towards encouraging farmers to maintain or expand planted rice acreage over the past two decades. The government has also attempted to convert idled area to rice production. Planted acreage has increased as a result. As a result, in 1997 planted area for rice production reached 1.053 million hectares (Table 3.2).

In 2000, rice accounted for some 51 percent of total planted area and for 90 percent of the total national grain production. It was also by far the most important crop in terms of the value of production, accounting for 52 percent of agricultural income and 25 percent of farm household income.

In the late 1990s, the Korean rice sector had surplus of rice production in excess of consumption (Table 3.3). In order to cope with the structural problem of over supply and to restructure the sector before 2004, when the current Uruguay Round agreement becomes fully

implemented, the MAF introduced "A Comprehensive Plan on the Rice Industry" in April 2002.

In order to stabilize and reduce the surplus the MAF plans to reduce total rice acreage to 953,000 ha by 2005 from 1.083 million ha in 2001 (12 % reduction). The programs to achieve this goal include:

- Reduction in rice prices via market mechanism instead of government intervention;
- Encourage crop conversion away from rice with financial support
- Encourage the production of high quality rice that has lower yields

The MAF has proposed to use the Direct Payment System (DPS) to provide compensation to farmers who reduce rice acreage. The effectiveness of rice area reduction is critical to the ongoing WTO negotiations. A reduction in the rice supply will stabilize the current imbalance of supply and demand and reduce the price differential between domestic and international prices.

Following the signing of the Uruguay Round agreement in December 1993, the MAF has budgeted a substantial amount of funds for the rice sector aiming to improve the competitiveness of the rice sector. The main objectives of these efforts were to improve rice quality and to reduce rice production costs. In preparation for the gradual rice market opening, the MAF initiated several policies including land ownership reforms, direct income support, rural pension funds for elderly farmers' retirement, rural infrastructure investment and agricultural export support.

Table 3.3 Supply and Demand of Rice Sector in South Korea (Unit: 000 MT)

Year	Beginning stocks	Total Imports	Total Supply	Total Dom. Consumption	Ending Stocks
1993	1,829	1	6,580	5,300	1,279
1994	1,169	1	6,230	5,257	822
1995	680	115	5,490	5,245	245
1996	245	21	5,589	5,079	510
1997	497	75	6,022	5,216	806
1998	807	99	6,004	5,112	892
1999	722	106	6,091	5,012	1,079
2000	1,057	84	6,432	5,000	1,432
2001	1,432	198	7,145	5,000	2,145
2002	2,145	180	7,525	5,000	2,525

3. Korea's Rice Production and Price Policies

Throughout 1990s, the Korea government encouraged rice production with support prices for domestic rice farmers. The Korean government used a two-tier pricing system. The MAF purchases domestic rice from the farmers at a specified purchase price and resells the rice to distribution channels at a lower price (Table 3.4). These purchases have been made at prices above the prevailing private-sector prices. Purchase price and quantity decisions are set annually at the National Assembly, after rice harvest.

Table 3.4 Korean Government Program for Rice Purchases a/

Year	Purchase (1,000 MT)	Purchase Price b/ (Won/Kg)	Release Price b/ (Won/Kg)
1990	575	1,393	1,317
1991	1,033	1,490	1,234
1992	1,382	1,580	1,208
1993	1,436	1,660	1,263
1994	1,512	1,660	1,306
1995	1,375	1,660	-
1996	1,267	1,725	1,562
1997	1,224	1,818	1,650
1998	928	1,911	1,850
1999	876	2,016	-
2000	906	2,097	-
2001	828	2,097	-
2002	789	2,097	-

a/ Source: MAF

b/ # 1Grade Japonica Variety Rice

Due to required reductions of the aggregate measure of support (AMS), as a result of the WTO agreement, the government has decreased its purchases by 17 percent in 2000. In 2001the government introduced a direct payment program under which farmers are paid money per hectare for paddy fields that they cultivate using environmentally friendly methods.

Purchased quantities and price supports are limited by Korea's Aggregate Measurement of Support (AMS) commitment under the WTO. South Korea's AMS commitment for the rice sector includes the annual government purchase of rice production. South Korea agreed to reduce the AMS over 10-year period(1995-2004) to 86.7 % of its base period(1989-1991) AMS (Table 3.5). Traditionally, rice accounts for

approximately 95 percent of total domestic support within Korea's agricultural sector.

Government procurement of rice consisted of an average of 26 % of total rice production between 1990 and 1997. By 2001 this share decreased to 15% of total rice production. Under the WTO, Korea's AMS yearly commitment will decline in increments until it reaches its bound rate of Korean won 1,490 billion in 2004. In 1992, the Korean government has stopped purchase of Indica varieties completely and only purchased Japonica varieties rice.(Table 3.2). The government purchase price has been continuously increased in the past decade, while the gap between the purchase price and resale price has narrowed.

Table 3.5 Korea's Policy Reforms: Minimum Market Access and Aggregate Measure of Support

Year	Minimum Market Access (MT)	Aggregate Measure of Support (billion won)
1995	51,037	2,183
1996	64,134	2,106
1997	76,961	2,029
1998	89,787	1,952
1999	102,614	1,875
2000	102,614	1,798
2001	128,268	1,721
2002	153,921	1,644
2003	179,575	1,567
2004	205,228	1,490

The government purchase price increased by 26.4% since 1994, so by 2001 the purchase price of rice was 4.8 times higher than US rice price, 5.8 time higher than Chinese rice price, and 8.1 times higher than Thai rice price. Given the imbalance in the supply and demand of rice and substantial price difference between Korean rice and foreign rice, the MAF shifted its focus on rice production from expansion to reduction in 2002.

The MAF will gradually decrease its involvement in rice policy and encourage private markets. Concurrently, the MAF plans to reduce the price difference between domestic and foreign rice to enhance market competitiveness of Korean rice sector and provide a soft-landing for the rice market liberalization. This transformation of the rice sector is expected to result in some income loss of rice farmers and the MAF is preparing to compensate the farmers with the DPS of rice paddy files.

The DPS makes it possible to eliminate the discontinuity between the prices paid by consumers and those received by farmers. The DPS has several advantages over border measures such as tariffs and import quotas in managing commodity markets. By paying the rice producers direct payments, production of alternative crops can be encouraged, while income of the rice farmers is maintained. Livestock producers and consumers benefit from reduced price of alternative crops due to increased production. Exporters are also less adversely affected by the direct payment scheme than by tariffs or import quotas as the market price of grain commodities is note distorted and consumption increases with lower prices.

In order to increase the competitiveness of the Korean rice sector,

the MAF is also encouraging production of high-quality rice to create a premium market segment for Korean consumers. Quality differentiation and branding of high-quality rice will be promoted. Diversification of rice distribution channels will be promoted through the private distribution system. The MAF established a new "supergrade"specification for rice, which is a higher quality grade than Korea's No. 1 grade. This "supergrade"was introduced to differentiate high-quality rice marketing and production.

Until 1996 the MAF stabilized the domestic rice retail price through government-held stocks. So the rice retail price level reflected government policies to stabilize the rice prices. Storage programs are designed to reduce price fluctuations rather than to raise the average level of farm prices (Tomek and Robinson 1990, p 281). A storage program also helps rice producers cope with income instability associated with price fluctuation. However, by stabilizing the rice price in the market, the MAF could encourage the risk averse farmers to continue or expand the rice production and as well as give them a higher income. However, substantially large ending stocks in recent years (Table 3.3) caused by oversupply and led to change in the MAF policy for retail rice marketing.

Marketing and distribution of rice at retail level was restricted to licensed rice vendors in order for MAF to effectively manage the rice sector. However, this management of retail sales and price of rice was discontinued in 1997 in order to enhance flexibility of rice marketing system in South Korea. Under the revised system, any retail outlet was allowed to sell bagged rice of up to 20kg.

Also, the rice farmers were allowed to participate in the government purchase program by signing forward contracts with the government. Under the new system, rice farmers can sign forward contracts with the government at the previous year's purchasing price. The contracts would be signed during the planting season. Farmers would then be eligible to receive up to 40 percent of total value in advance. After harvest, farmers would have the option to sell the rice to the government or to cancel the contract at no penalty except the interest charges.

4. Korea : Rice Imports

Prior to 1995, Korea did not import any significant amounts of rice. The exception is the period , 1981-1982, where imports occurred as a result of severe underproduction in 1980 caused by unseasonably cold weather. The Uruguay Round agreement in 1994 resulted in a minimum market access (MMA) rate that required South Korea to import rice equal to 1 to 2 % of domestic consumption for the period 1995 to 1999 and 2 to 4 % for the period 2000 to 2004. This translated into rice imports of 50,000 MT in 1995 gradually increasing to 200,000 MT in 2004. Rice trade remains strictly under government control from 1995 to 2004 (Table 3.5).

The potential for Korea to import rice above annual minimum access commitments depends on a number of variables. First, the Korean government keeps a minimum four-month reserve stock of rice for both price stabilization and food/military security reasons. Any shortfall from a projected rice harvest will be made up in imports during the year. So bad weather conditions that severely reduce rice production

could result in increased rice imports. Thus, the rice stock situation is an important factor determining quantity of imports above annual quotas. The second important factor is the domestic rice price. If domestic wholesale prices begin to rise substantially, the government may import more rice to stabilize the wholesale price of rice. Other factors such as the government's position on rice processing, the political environment are also important in projecting the potential for rice imports to South Korea.

Until 1980s, rice processing was strictly forbidden in order for the MAF to achieve its policy of self-sufficiency for table rice. During the 1980s, restrictions on the use of rice were gradually lifted. Currently, the imported rice is mostly sold to processing sectors to produce alcoholic beverages. This is partly due to Korean consumers' strong preference for domestic japonica rice, which translates to consumers' willingness to pay a premium on domestic rice and create a wedge between domestic rice prices versus imported rice price. Consequently, food processors choose imported lower priced rice to process alcoholic beverages.

In terms of competition among rice exporters, China has rice varieties that meet Korean consumer taste preferences. China is also competitive in terms of its price and low transportation costs due to close proximity to South Korea. The Chinese rice price ranges from about one fifth to one eighth the price of similar rice produced in Korea. Other competitors include Vietnam, Thailand, Australia and the U.S. Currently, South Korea imports MMA rice mainly from China and the U.S. and Australia.

Table 3.6 The price comparison between domestic and imported rice after tariffication in Korea a/

		2004	2005	2006	2007	2008	2009	2010
Domestic (A)	$/ton	2,125	2,125	2,125	2,125	2,125	2,125	2,125
Imported (B)	Fob($/ton)							
	- Japonica	432	432	432	432	432	432	432
	- Indica (Thai)	329	329	329	329	329	329	329
	Tariffication (-20% in 6 years)	400%	387	374	360	347	334	320
	Costs & profits (20% of FOB)	20%	20	20	20	20	20	20
	Sale prices							
	- Japonica (US)	2,246	2,190	2,134	2,074	2,017	1,961	1,901
	- Indica (Thai)	1,710	1,668	1,625	1,579	1,536	1,494	1,448
A/B	Japonica (US)	0.95	0.97	0.99	1.02	1.05	1.08	1.12
	Indica (US)	1.24	1.27	1.31	1.35	1.38	1.42	1.47

a/ Forecast by Lee Jun Won (2002).

Lee (2002) simulated the possible impacts of a possible new WTO agreement on the price of domestic rice under assumptions that Korea only protects its rice market with a tariff equivalent and reduces the tariff by moderate amount during the implementation period. Table 3.6 reports his simulation results. Table 3.6 suggests that the Korean Japonica rice price would be much higher than international Japonica price, lowering Korea's price competitiveness significantly after the tariffication process. This would increase demand for imported rice and concurrently, destabilize income of the Korean rice farmers.

Korea's rice sector is currently faced with considerable challenges an oversupply of domestic rice, increasing imports and declining consumption, all of which will put downward pressures on rice prices and farmers' income, Consequently, this heightens the MAF's budgetary burden of subsidizing the domestic rice sector. With gradual opening of the rice market under the WTO agreement, a successful soft landing of the rice sector in South Korea will heavily depend on how effectively the MAF's comprehensive reform plan (e.g. expansion of farm size and farmers' income stabilization through DPS) will be implemented during the liberalization process, and how the Korean rice farmers maintain a premium image of domestic rice compared to imported rice. It is expected that outcomes of the next round to WTO negotiations will critically influence the transition of the Korean rice sector.

Section 2. Grain Sector in Korea

After the URAA in 1994, the Korean government opened several agricultural commodity markets that are heavily dependent on imports. Currently the feed grain markets are extensively privatized and primarily driven by price competition. Corn and barley imports are managed with a tariff rate quota (TRQ), while wheat imports are subject to a tariff. Demand for feed grains is tied closely with the Korean livestock industry. With the exception of rice bran most of the feed stuffs used for livestock and dairy farming are supplied by imports. The feed grain market is highly price sensitive with high positive cross-price elasticities. So the market prices of competing feed grains will dictate the level of substitution among imported feed grains.

Soy meal and rye are other substitutes in the feed grain market in South Korea (Table 3.7). Feed stuffs are produced with mixture of feed grains in different proportions.

Table 3.7 Korea: Feed Ingredient Use for Compound Feed Production

	1999	2000	2001	2002	2003 a/
Wheat	1,014	1,000	1,100	1,500	1,500
Corn	6,543	6,600	6,800	6,700	7,000
Rye	407	200	200	100	100
Barley	2,131	2,200	2,200	40	40
Soy meal and others	5,041	5,000	5,000	2,100	2,200

a/ FAS/ Seoul forecast.

Source: Korea Feed Association (KFA)

1. Korea's Wheat Supply and Demand

While per capita wheat flour consumption is significant in the Korean diet, South Korea does not produce significant amounts of wheat, (Table 3.8). So the Korean wheat market is dependent on import supplies and exhibits stable demand for wheat demand for wheat-based food products. There are three major suppliers of wheat, exporting wheat to South Korea. The U.S. market share of total Korean wheat imports stood at 53.2 percent, Australia at 40.8 percent and Canada at 10.0 percent in 2002 (KOFMIA). Wheat flour consumption in South Korea consistently increased in the 1980s and 1990s with rapid growth in the Korean economy and with the ongoing westernization of the Korean diet.

Increased female work force participation raised the importance of convenience in diet. This translated into increased demand for fast foods that include wheat based food products such as bread, noodle and pasta. Wheat flour usage consists of the following categories: noodles (48%), bread and confectionary (24%), and others (28%) (Figure 3.1). Korean consumers have a particularly strong affinity for instant noodles because of the taste and convenience. Consumption of wheat flour in the form of noodles has increased from 23.6 percent of total flour consumption in 1981 to 50 percent in 1998 in South Korea (KOFMIA, 1999).

Table 3.8 Korean Wheat Consumption and Production (unit: 1,000 MT)

Year	Total Consumption (1,000 MT)	Per Capita Consumption(Kg/year)	Total Production (1000 MT)
1996	1,618	34.4	10.9
1997	1,708	35.6	7.4
1998	1,632	33.6	4.8
1999	1,770	36.0	5.6
2000	1,803	35.5	2.3
2001	1,779	34.1	2.8
2002	1,778	34.1	5.8

Data include animal feed use ranging from 85,000 to 86,000 MT annually prior to CY2000.

Source: Korea Flour Mills Industrial Association (KOFMIA)

Total annual per capita consumption of instant noodles in South Korea was estimated to be about 83.4 servings between 1988 and 1998, which is one of the highest consumption levels in the world (Samyang, 1999). In addition demand for Korean instant noodles in oversea markets continues to increase, which contributes to increases in the

derived demand for wheat. Instant noodles were one of the top three Korean agricultural products that were exported to the U.S. in 2000 (Table 3.9).

Table 3.9 Korean Noodle Exports to the U.S.

	2000	2001	2002
Quantity	5,460	6,724	7,035
Value (US$)	10.7 M	12.7 M	13.2 M
Unit Value (US$)	1,965	1,892	1,881

Source: USDA ERS, Foreign Agricultural Trade of the U.S. (FATUS).

Korean consumer demand for wheat-based food products is becoming more sophisticated with a larger share of wheat based food in the diet. In other words they have willingness to pay a premium for higher quality wheat based food products. Every year instant noodle manufacturers in South Korea are responding to this consumer trend by introducing several different new instant noodle products and are attempting to create a premium niche market. The competition among instant noodle manufacturers in South Korea is intensifying with heightened marketing efforts extensive product differentiation and improvement of aesthetic and functional aspects of product packaging (Kim 2001).Quality competition of the noodle manufacturers affects competition among wheat suppliers as the demand for food wheat in South Korea is highly differentiated by end usage. Thus, quality characteristics of wheat variety are important in determining derived demand for wheat.

There are approximately 12 different varieties of imported wheat that

are used in processing wheat based food products (Figure 3.2).The U.S. currently exports three different wheat classes to South Korea: WW/SW, HRW and DNS. Canada exports one type class of wheat, Canadian Western Red Spring (CWRS), with 13.5% protein content, to South Korea (Kim 2001). Australia markets five different wheat classes in South Korea: Australian Standard White (ASW), Australian Soft (AS), 100% Australian Noodle Wheat, Australian Prime Hard (APH) and Australian Hard (AH).

Millers in South Korea categorize imported wheat into three categories: hard wheat, medium wheat and soft wheat based on protein content. U.S. DNS, Canadian CWRS and Australian AH and APH fit in the hard wheat category, while Australian ASW and U.S. HRW fit into the medium wheat category. The Soft wheat category includes WW/SW from the U.S. and AS from Australia. Depending on type of end products, millers blend different proportion of wheat varieties to producer certain quality characteristics of wheat flour.

2. Korea's Wheat Imports

Wheat imports to South Korea were privatized in 1990. An import quota was replaced with a tariff. Trade liberalization for milling wheat imports began in 1983 and was completed by 1990. During this liberalization period, the wheat import quota gradually increased from 2.28 MT in 1989 to 2.3 MT in 1990. In 1990, the fixed import quota of 2.3 MT was eliminated and replaced with a 5% tariff on imported wheat. The wheat tariff is to be reduced to 1.8% by 2004 (Table 3.10). Following trade liberalization, South Korean millers have used two routes to import wheat. Millers can negotiate directly with exporters;

or wheat can be purchased by tender from the Korean Flour Mills Industrial Association (KOFMIA) which was formerly a Korean government central buying agency.

Table 3.10 Schedule of Import Tariffs on Wheat and Wheat flour in South Korea, 1980-2004

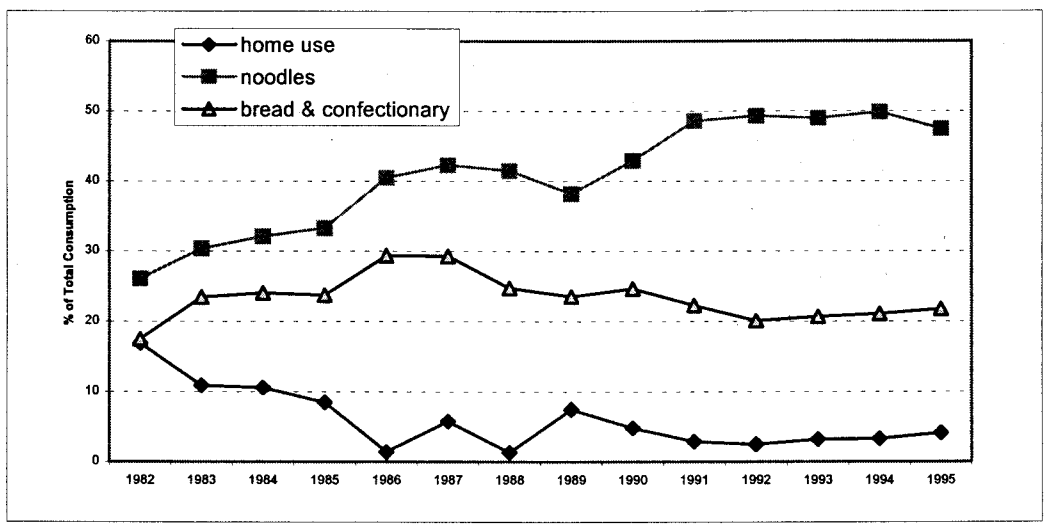
Year /a	Wheat (%) /b	Wheat Flour (%) /b
1980	5	N/A
1981	5	N/A
1982	5	N/A
1983	5	N/A
1984	5	N/A
1985	5	N/A
1986	5	N/A
1987	5	N/A
1988	5	N/A
1989	5	10
1990	5	10
1991	5	9
1992	5	7
1993	5	5
1994	5	5
1995	2.88	5
1996	2.76	5
1997	2.64	5
1998	2.52	5
1999	2.4	5
2000	2.28	5
2001	2.16	5
2002	2.04	4.76
2003	1.92	4.48
2004	1.8	4.2

/a Source: Korea Flour Mills Association (KOFMIA), 1996.

/b Note that tariff rates are ad valorum rates.

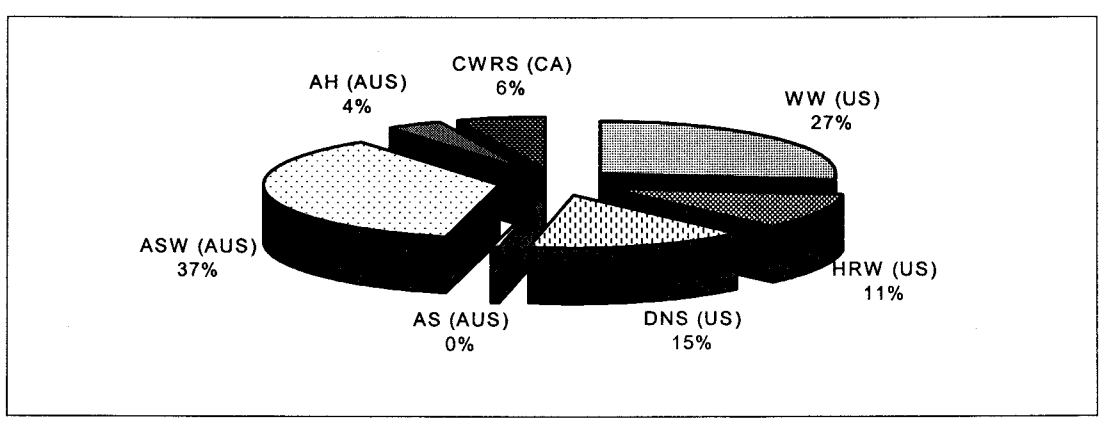
The Korean food wheat market is driven both by price and quality competition, which are reflected in the price differentials among different wheat varieties, while feed wheat market is driven by Korean livestock production and price competition of substitutes.

Figure 3.1 Korean Wheat Flour Consumption by End-use



Source: Korea Flour Mill Association (KOFMIA), 1996.

Figure 3.2 Market Share of the U.S., Australia and Canada in South Korea



Source: KOFMIA (2002).

3. Corn Supply and Demand

Corn production in South Korea is relatively insignificant, with an average of 73,000 MT between 1996 and 2003 (Table 3.11). This is partially due to the MAF's agricultural policy promoting rice production for the past two decades. With MAF's 2002 rice reduction program corn production may increase as rice farmers have incentives to convert their crop cultivation. However, given that return from corn is much smaller than rice, change in corn production is not likely to be significant. Almost 99 % of corn requirements for feed and processing is supplied with imports.

Corn makes up the largest proportion in feed stuff production (Figure 3.3), and almost 75% of imported corn is used to produce feed stuffs. Thus demand for imported corn is highly influenced by the production of livestock industries in South Korea. For example, international food safety issues such as BSE decreased Korean consumer demand for imported beef, while demand for domestic beef has increased. This also increases demand for feed grains that are used in the Korean livestock industry.

4. Biotechnology and Labeling Regulation

Biotechnology is an important subject in the Korean corn market. In November 2000, the Korean Food and Drug Administration (KFDA) detected trace amounts of "Starlink"in U.S. origin food grade bulk corn. It detained 125,000 MT of shipments over the period, which were used later as non-food industrial purposes (USDA 2001).Korean corn processors and buyers responded to this incident by purchasing corn

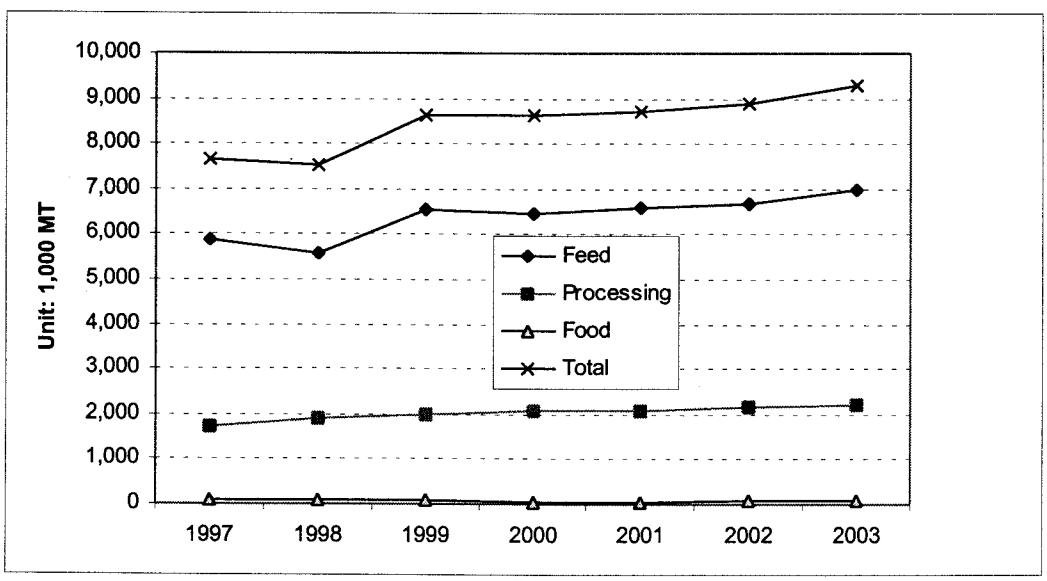
from alternative suppliers. This incident was highly publicized in the Korean news media and resulted in reinforcing Korean consumers' resistance toward biotech-enhanced food products.

Table 3.11 Changes in Corn Supply and Consumption, South Korea a/

	1996	1997	1998	1999	2000	2001	2002	2003
Domestic Production	72	87	80	82	64	57	73	70
Total Imports	8,336	7,700	7,514	8,691	8,723	8,602	8,900	9,200
Total Supply	9,374	8,877	8,826	9,873	10,033	10,076	10,314	10,611
Feed Consumption	6,296	6,200	5,560	6,541	6,460	6,584	6,700	7,000
Total Consumption	8,284	8,074	7,526	8,640	6,584	8,735	8,973	9,270

Source: NLCF (National Livestock Cooperative Federation), Livestock Price and Supply Data. a/ unit: 1,000 MT

Figure 3.3 Koreas Corn Utilization



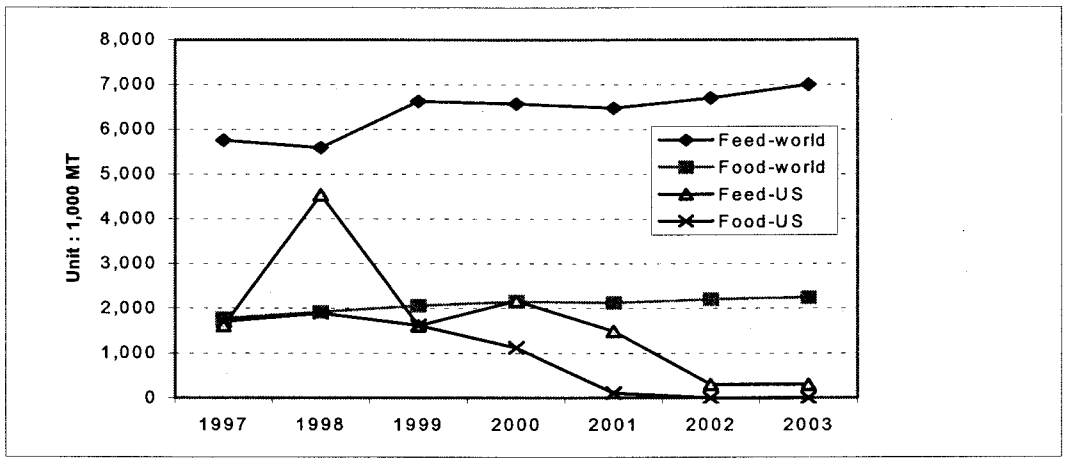
Source: Korea Feed Association (KFA) and Korea Corn Processing Industry Association (KOCPIA)

In March 2001, the MAF established mandatory labeling on biotech-enhanced commodities such as corn, soybeans and bean sprouts, however there is no restriction on the use of biotech enhanced grains in animal feed. Test supported certification is required to prove that shipped commodities comply with new labeling requirements.

China and the U.S. are the main suppliers of corn to South Korea. Prior to the Starlink incident, the U.S. had a dominant position in the Korean corn market. For example, the Korean feed millers were willing to pay a premium of $10 to $12 /MT for U.S. corn over other feed grains, including feed wheat, rye, barley. Korean corn processors were willing to pay a premium of $7 to 10 / MT for U.S. corn vis-a vis Chinese corn for better quality. Chinese corn is considered to contain high levels of foreign materials and broken kernels.

The Starlink case placed China and Brazil in an advantageous position relative to the U.S because Korean corn processors prefer to purchase corn from suppliers who are "perceived"not to be supplying biotech-enhanced corn. The U.S. corn suppliers have made efforts to improve quality assurance of their products with non-GM/identity preserved (IP) corn, which requires a substantial price premium for IP processing. U.S. IP processed corn is not price competitive with highly subsidized Chinese corn. Consequently, the U.S. market share in the Korean corn market has decreased notably due to this food safety issue (Figure 3.4). For example, Korea's corn imports from the U.S. for food and industrial usage have decreased from 1.1million MT in 2000 to 111,000 MT in 2001 and none in 2002 and 2003.

Figure 3.4 Korean Corn Imports- Feed and Industrial/ Food Usage



Source: Korea Customs Service (KCS)

The increasing importance of food safety issues and biotechnology concerns suggests that the prospects of food grain imports in South Korea will depend on how consumers, processors and livestock producers respond to these issues. With regard to the demand for feed grains, Korean feed grain millers and feed stuff producers will continue to seek for price competitive grains since they can produce feedstuffs with different proportions of different feed grains depending on relative prices. Thus, demand for feed grains in South Korea will heavily depend on relative prices of feed grains such as corn, wheat, soybean, barley and rye in the international markets.

Section 3. Beef Sector in Korea

1. Korea's Beef Imports

South Korea introduced an import quota system for beef, using the

Livestock Products Marketing Organization (LPMO) as the beef import agency (WTO, 1997). In the context of the Uruguay Round Agreement on Agriculture (GATT), the Government of South Korea agreed to gradual increases in its beef imports from 1993 to 2000 and to discontinue the state trading of beef imports by January 2001. South Korea beef imports became more liberalized through removal of import quotas in the beginning of 2001 after six years of implementing a phased liberalization program by the Korean government.

Table 3.12 Liberalization Schedule for Beef Importation by South Korea

Year	Quota (tonnes retail weight)	SBS Share of Quota (%)	Tariff Rate (%)	SBS Mark-Up (%)
1993	99,000	10	20.0	100
1994	106,000	20	20.0	95
1995	123,000	30	43.6	70
1996	147,000	40	43.2	60
1997	167,000	50	42.8	40
1998	187,000	60	42.4	20
1999	206,000	70	42.0	10
2000	225,000	70	41.6	0
2001	Tariff only	No quota	41.2	0
2002	Tariff only	No quota	40.8	0
2003	Tariff only	No quota	40.4	0
2004	Tariff only	No quota	40.0	0

Source: LPMO (Livestock Products Marketing Organization), 2000.

The Korean government set a schedule to increase the yearly beef import quota from a minimum of 123,000 (MT) in 1995 to 225,000 MT by 2000. This quota expansion program was coupled with tariff reduction from 43.6% in 1995 to 41.6% in 2000. The tariff on imported

beef is to be further reduced to 40% in 2004.

Beef is Korea's highest valued livestock product import, valued at US$481 million in 1997 (KREI, 1999). Imports of beef have accounted for 70 percent of Korean meat imports in recent years (OECD, 1998), reflecting a rapid growth in demand for beef. The Korean beef import market is the third largest beef export market for the United States, accounting, on average, for some three percent of world imports of beef and veal from 1994 to 1998 (USDA, 2001a; Akerman and Dixit, 1999). Although beef imports fell sharply in 1998, reflecting domestic income pressures associated with the foreign exchange crisis that began to affect Korea's economy in late 1997, imports recovered and grew in 1999 and 2000 (USDA, 2001a).

There is a significant market resistance against the supply of live cattle from foreign countries. For example, the first shipment of live cattle from Australia in 2001 faced a strong negative reaction from the Korean farmers and resulted in a financial loss for the importer. This experience led to increase in the price of Hanwoo cattle price and farmers' confidence in the market demand for Hanwoo beef. Australia continues to export live cattle to Korea but these exports are challenged not only by the Korean farm protests, but also by the limited capacity of current quarantine facilities for live cattle imports. Thus, imports of live cattle from foreign countries are not expected to have a significant impact on the domestic beef cattle market.

2. Korea's Beef Consumption

Economic growth in South Korea since the 1980s has induced a

substantial shift in their food consumption patterns away from a staple based diet towards a meat-based diet. For example, per capita rice consumption in South Korea has decreased from 132.4kg in 1980 to 99.2kg in 1998, while per capital meat consumption has increased from 11.3kg to 28.1kg for the same period (the Agricultural Cooperative Yearbook, 1999). From 1990 to 2000, the growth rate of per capita consumption of beef was highest at 7.6 %, while the growth rates of per capita consumption for pork and chicken were 3.4 % and 5.6 %, respectively (Table 3.13). Income elasticity of beef is estimated to be 1.09 (KREI, 2000). This implies that further growth in Korean economy will likely to contribute to an increase in beef consumption in South Korea.

Table 3.13 Major Meat Consumption in Korea, 1970-2000

Year	Total Meat		Pork		Beef		Chicken	
	National Total (000 t)	Per Capita (kg)	National Total (000 t)	Per Capita (kg)	National Total (000 t)	Per Capita (kg)	National Total (000 t)	Per Capita (kg)
1970	165	5.2	83	2.6	37	1.2	45	1.4
1980	433	11.3	242	6.3	100	2.6	91	2.4
1990	850	19.9	505	11.8	177	4.1	172	4.0
2000	1510	31.9	780	16.5	402	8.5	327	6.9
Growth Rate (1970-2000)	7.7	6.2	7.8	6.4	8.3	6.7	6.8	5.5
Growth Rate (1990-2000)	5.9	4.8	4.4	3.4	8.5	7.6	6.6	5.6

Source: MAF 2001, Major Statistics of Agriculture and Forestry 2001, pp316-317.

Since beef is considered to be a preferred meat in South Korea (Choi et al. 2001), more competitive prices of imported beef may lead to a substantial change in the composition of meat consumption for Korean consumers. South Korea has been one of the fastest growing markets for high-value cuts of imported beef; as beef imports grew from 82,000 MT in 1990 to 190,000 MT in 2000, increasing at an annual growth rate of 8.7 percent (Choi et al. 2001). Total consumption of beef in South Korea was 402,300 MT in 2000, and beef imports constituted 47 percent of the total beef consumption (USDA 2002).

3. Korea's Beef Production

A number of Korean cattle producers have responded to the market liberalization by getting out of the beef industry (Choi et al, 2001). However, contraction of the national Hanwoo herd stopped in 2002 as farm gate prices for live cattle reached record high levels. These high prices have been attributed to the liquidation of the Hanwoo herd, a process that begun prior to 2000 in anticipation of market liberalization.

Table 3.14 Changes in Beef Supply and Consumption, South Korea

(Unit: 1,000 MT)

	1990	1991	1992	1993	1994	1995	1996	1997
Domestic Production	94.9	98.5	99.6	129.6	147.3	154.7	173.7	233.0
Domestic Consumption	94.9	98.5	99.6	129.6	147.3	154.7	173.7	233.0
Import Supplies	81.6	129.0	133.0	99.0	120.1	148.1	147.2	167.0
Import Stock	4.2	8.4	9.8	9.8	7.3	8.9	3.8	42.0
Import Consumption	82.1	124.7	103.4	103.4	122.5	146.5	149.2	128.8
Total Consumption (Consumption per Capita: kg)	177.0 (4.1)	223.3 (5.2)	233.0 (5.3)	233.0 (5.3)	269.8 (6.1)	301.2 (6.7)	322.8 (7.1)	361.8 (7.9)

Source: NLCF (National Livestock Cooperative Federation), Livestock Price and Supply Data, 1998.

In 2001 the Korean government introduced the Hanwoo Integrated Measures Program in order to help the Hanwoo farmers to cope with structural change and to increase the competitiveness of the Hanwoo industry. The main objectives of this program are:

- To raise the quality of Hanwoo beef to be comparable to that of the Japanese Wagyu beef
  - o Registration of the national Hanwoo herd to maintain purity and improve breed quality.
  - o A "prime" grade rating on 80 percent of slaughtered steers.
  - o To increase the incentive award given to top grade beef cattle, from 80,000-120,000 won per head in 1999 (around 2.7 billion won) to 100,000-150,000 won per head in 2000 (estimated at 4.1 billion won).

- To initiate branding of the Hanwoo beef .
  - o To increase the number of specialized stores and franchised shops of branded packers.
  - o Increase the number of Hanwoo specialized shops: from 602 shops in 1999 to 2,000 shops by the year 2004.

- To subsidize and maintain the national Hanwoo herd at 2.25 million head (budget allocated up to 2.4 trillion won on the Hanwoo sector). The Korean government provide industry supports for this particular objective in three main areas:

a) Stabilization of Calf Production
  a. A production stimulus package
  b. Setting a new market floor price (minimum standard price)

for calves.

c. Payment of the difference between the market and the minimum standard price, up to 250,000 won per calf, if the market price falls below the standard price.

b) Establishment of Calf Production Base

a. To encourage development of large farm operations specialized in cow/calf production.

b. To establish 10 farms, specialized in this operation, each with a minimum 20 hectares of grassland.

c) Development of Multi-Production of Hanwoo Beef Cattle

a. To encourage retention of Hanwoo breeding stock using an incentive program based on live-Hanwoo calf births.

b. Payments to Hanwoo producers for each Hanwoo calf born to a cow.

These government programs encourage the Korean Hanwoo cattle producers to resume increasing their herd size. The Hanwoo cattle producers are expected to build their inventories for next few years, which will lead to a more stable market and an increase in the cow/calf ratio.

The Hanwoo branding program by the Korean government is intended to differentiate the Hanwoo beef as a high quality beef with strict quality assurance and standard regulation. Branding may lead to the development of a clear niche market for the Hanwoo beef. This may allow the Hanwoo producers to command a price premium compared to lower priced imported beef products. This trend will

increase the producers' confidence level with respect to the future of the Hanwoo beef market and lead to a stable gradual increase in herd size. The Korea beef demand is likely to be segmented by two main sources of beef products: branded Hanwoo beef to accommodate high quality consumption segment versus imported beef to supply more price sensitive market segment.

4. Food safety and Labeling of Meat Products in South Korea

Food safety has become an important competitive factor in livestock marketing and remains a primary focus of government marketing and regulation of livestock products. Unprecedented media coverage of European and North American BSE and domestic outbreaks of foot and mouth disease (FMD) have increased the Korean consumers' concern for the safety of imported meat products. Consequently, consumer preferences for meat have shifted to domestic products. Korean regulators have responded by enhancing inspection and labeling efforts. Also, to restore consumer confidence in meat products, the MAF has initiated some consumer education programs to promote the consumption of meat products from non-infected areas.

Fraudulent sales of meat products selling imported meat as domestic meat -is reported to be a continued problem and this dampens the Korean consumers' confidence in the meat marketing system. Of 2,777 incidents of country of origin mislabeling reported in 2000, pork ranked highest with 1,389 cases followed by beef with 499 cases.

Section 4. Pork Sector in Korea

1. Korea's Pork Consumption

Pork is the leading meat (Figure 3.5) in the Korean consumer market due to its relatively lower price compared with beef. Pork consumption has increased substantially for the past two decades, driven by rapid income growth and price declines. For example, per capita consumption of pork in South Korea has increased from 6.3kg to 16.9 kg from 1980 to 2001. During the same period, per capita consumption for beef and chicken were 2.6kg and 2.4kg, respectively in 1980 and 8.1kg and 7.3kg, respectively in 2001. Thus, pork consumption accounts for 52% of total meat consumption in South Korea.

However, as cheaper imported beef enters the Korean market, consumers may substitute away from pork to imported beef. In addition to price effects, consumer meat consumption is affected by socio-economic factors such as growth in disposable income, urbanization, more female workers and westernized culture and diet. In particular, time constrained urban residents are increasing their consumption of meat products at fast-food restaurants. There are few pork dishes at fast food outlets, while beef dishes and chicken dishes are becoming increasingly popular. With further economic growth and changes in dietary patterns and lifestyle, consumption of beef and chicken may increase relative to pork. For example, the growth rate of pork consumption between 1990-2000 was 3.4%, while the growth rate for beef and chicken consumption for the same period were 7.6 % and 5.6%, respectively.

2. Korea's Pork Production

South Korea is self-sufficient in pork (Table 3.15). Pork and poultry products are produced mostly with imported feed grains, including wheat, corn, soybeans and barley. This makes the hog and poultry sectors to be dependent on international prices of these grains and on the exchange rate. Nonetheless, pork production is becoming increasingly efficient and more responsive to the quality attributes that are highly preferred by the Korean consumers. For example, pork production doubled in the 1980s and grew by over 50% in the 1990s. The number and weight of hogs slaughtered have increased significantly over time.

Figure 3.5 Per Capita Meat Consumption in South Korea (1980-2001)

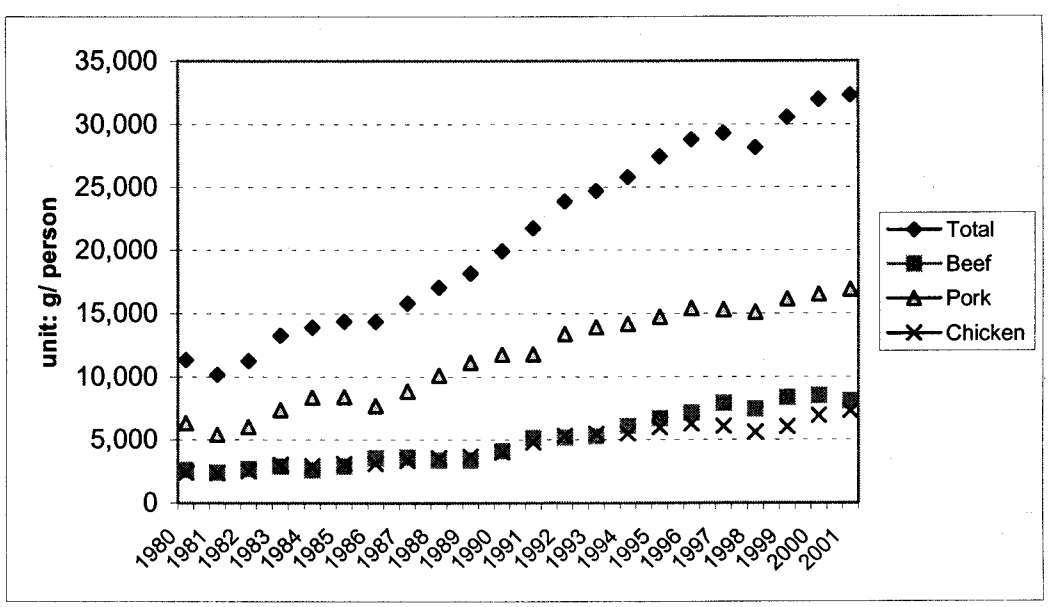


Table 3.15 Changes in Pork Supply and Consumption, South Korea

(Unit: 1,000 MT CWE)

	1996	1997	1998	1999	2000	2001	2002	2003
Domestic Production	865	872	992	950	1004	1077	1153	1270
Domestic Consumption	871	913	940	983	1057	1197	1325	1240
Total Imports	49	106	66	155	172	123	151	160
Total Supply	924	985	1078	1127	1207	1320	1424	1643
Ending Stocks	7	2	22	31	120	120	213	363
Total Exports	46	70	116	100	115	43	14	40

Source: NLCF (National Livestock Cooperative Federation), Livestock Price and Supply Data.

Hog production costs have progressively declined with increased farm size over the last decade. Currently, farms with more than 100 hogs dominate the swine sector, with some farms having more than 10,000 hogs. The MAF identifies the pork industry as one of commodity markets, which is internationally competitive. Thus, the Korean government has been providing support for the sector through expansion of rural infrastructure, export promotion for pork and improved swine genetics. This changed the way pork and chicken products are marketed in the Korean market.

3. Korea: Pork Imports and Exports

Under the 1994 URAA frozen pork and poultry imports to South Korea were liberalized. Since July 1, 1997 the tariff rate has been reduced from 33.4% to 24% in 2004 (Table 3.16). Prior to 1997 chilled pork and poultry imports were free from quotas and had lower tariffs than those for frozen products. Total pork import volume increased

from 49,000 MT in 1996 to 151,000 MT in 2002 (Table 3.15). South Korea prefers imports of specific cuts such as pork bellies and front legs for processing.

Table 3.16 Schedule for Pork Market Liberalization

Year	Quota MT CWE	Tariff Rate Quota (%)	Tariff (%)	Bound Duty(%)
1995	21,930	25	35.8	
1996	29,240	25	34.6	
1997	18,275	25	33.4	
1998			32.2	
1999			31.0	
2000			29.8	
2001			28.6	
2002			27.4	
2003			26.2	
2004			25.0	25.0

Source: MAF

The pork import market has several players such as the U.S., Denmark, Canada, Hungary, Belgium, and some other European countries and Mexico. Canada and Denmark are the big players in South Korea with largest market shares. Exporters from these two countries have smaller operations than other countries which enables them to meet the Korean importers' specific product specifications more precisely. Increasing efficiency and scale of the Korean hog industry has lead to increased pork exports. Particularly, South Korea has exported tenderloin cuts to Japan for several years. For example, the Korean pork exports to Japan increased from 11,150 MT in 1994 to 88,049 MT in 1998, accounting for 75 % of total pork export.

However, two outbreaks of Foot and Mouth Disease (FMD) in 2000 and 2002 put a significant dent in South Korea's pork exports to Japan. The Japanese government responded to these FMD cases by banning pork imports from South Korea. Consequently, the pork producers in South Korea who had increased their production to meet anticipated expansion in the Japanese market incurred a serious financial loss. The loss of export markets due to FMD resulted in a substantial build up of stocks (Table 3.15). For example, ending stocks of pork in the Korean market was 31,000 MT in 1999 and 363,000 MT in 2002. As are result of these development there has been downward pressure on the pork price in South Korea and the hog producers will likely to respond to this price signal by contracting their herd size.

While South Korea mostly exports tenderloins cuts Korean pork imports consist of high volumes of pork bellies. Given relative small price differences between domestic and imported pork and because Korean pork dishes do not place high priority on premium cuts, imported pork are mostly purchased in frozen cuts which are lower priced.

4. Pork Marketing in Korea

Korean meat producers are increasing their marketing efforts to create a premium market for domestic chilled pork. Prior to the market liberalization in 1997, pork products in South Korea were mostly marketed as a commodity instead of a differentiated product. Markets for specific cuts and for quality grades were not effectively established. Pork products were sold mostly in frozen form. However, market liberalization increased the supply of imported pork by six -fold

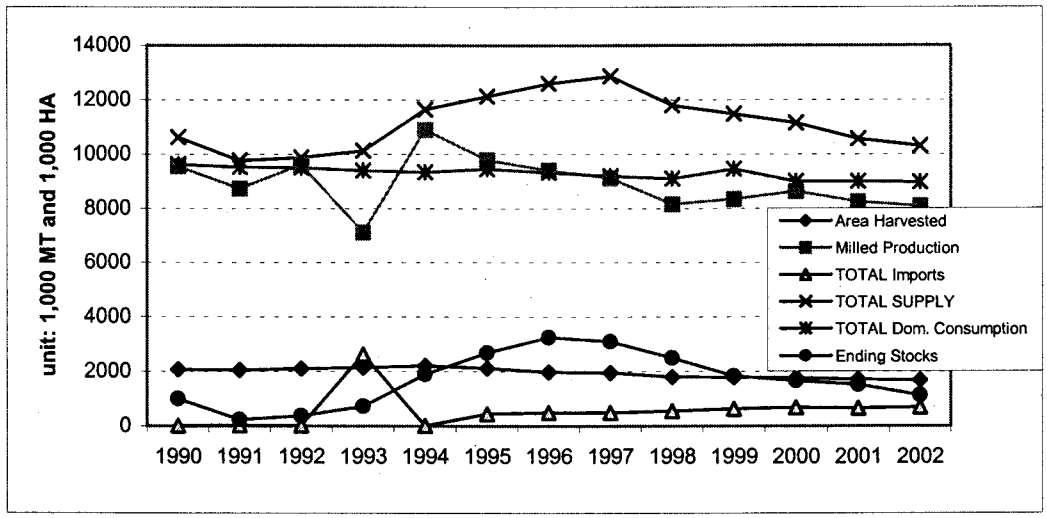
between 1997 to 2002. Imported pork consumption is 18.8 % of the total pork consumption in Korea. With increased competition from international pork suppliers, the Korean pork producers are pushing for brand identification and extensive product differentiation (i.e. specific cuts, chilled and grade). This should enable the Korean pork producers and exporters to market their products with specific premiums. This industry trend is matching the increasing sophistication of Korean consumers' tastes and their preference for convenience and higher quality. The Korean consumers also have an interest in seeing more specific cuts to prepare certain dishes given their time constraints and interest in expanding the variety of foods they eat. As the industry creates several niche markets for pork products, the pork price of some specific cuts is expected to rise above world market price.

Section 5. Rice Sector in Japan

1. Rice Supply and Demand in Japan

Both Korea and Japan consider rice to be a staple food, and the rice situation in Japan has a number of similarities with Korea in terms of food security and farmer welfare. Rice is Japan's principal agricultural product, accounting for around 35 %of the value of all agricultural output and using almost 41 % of the total area devoted to agricultural and fodder crops (MAFF 1999). Japan has been self sufficient in rice production for several decades.

Figure 3.6 Japan: Rice Production, consumption, stocks and trade

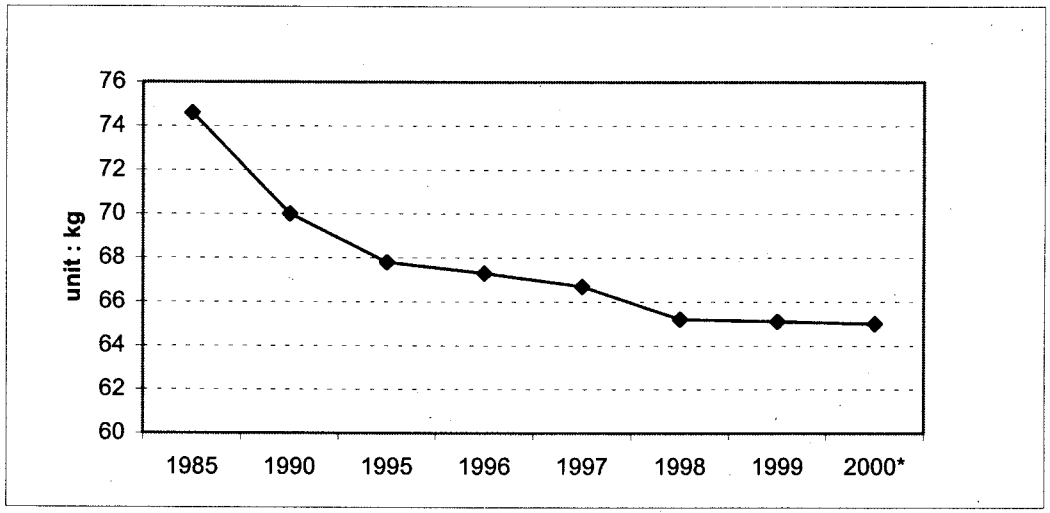


Source: PS&D, USDA 2003.

Total supply of rice in Japan has been usually been greater than the total domestic consumption. Domestic consumption has continued to decrease(Figure 3.6). Ending stocks of rice reached the highest level in 1997 and gradually leveled off as the Japanese government implemented policy changes to improve the chronic imbalance between supply and demand situations in Japan's rice sector.

Rice has been a main food staple for consumers for several decades. With westernization of the Japanese diet, slower growth in population and diversification of eating patterns among the younger generation, per capita rice consumption decreased from 118.3kg in 1962 to 63.6kg in 2002. Annual per capital rice consumption in Japan is expected continue a downward trend(Figure 3.7) as consumers spend less time on preparing rice at home and increasingly eat away from home.

Figure 3.7 Annual Per Capita Rice Consumption in Japan



Source: MAFF 2002.

Japanese consumers pay a high price for rice. For example, Japan's rice price is 2.5 to 3 times higher than U.S. price, although quality and packaging differences make the comparison imprecise (USDA 2003b).

2. Rice Policy Reforms in Japan

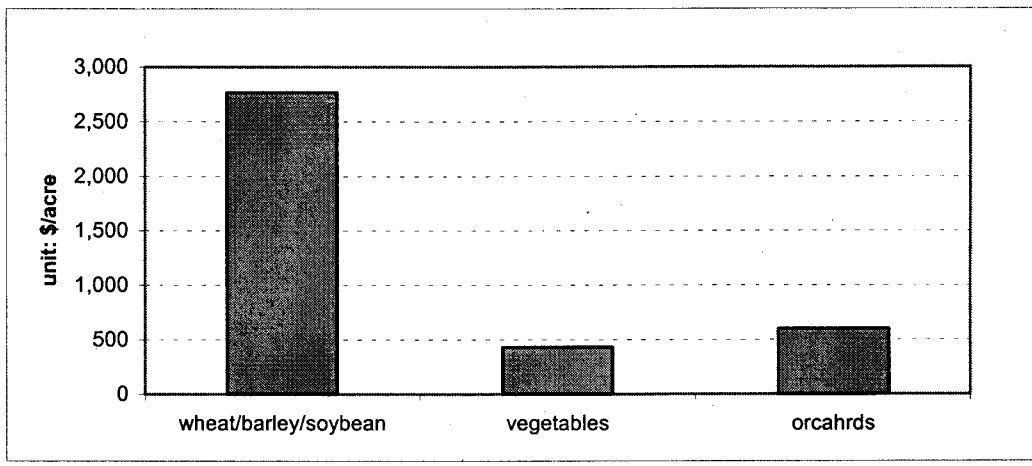
The Japanese government has controlled rice production and distribution under the Food Control Law since 1940s because of its socio-economic and political importance. The Food Control Law authorizes the Ministry of Agriculture, Forestry and Fisheries (MAFF) to guarantee a minimum producer price and to regulate marketing and distribution of rice. Using this price support system, the MAFF managed to insulate its rice sector from the world market and maintained a domestic price at a higher level than world level in order to support rice farmers. This guaranteed price support system for rice

farmers, production subsidies, and advances in rice production technology and infrastructure have resulted in large surpluses. Consequently, the MAFF adopted crop diversion programs to control surplus in the rice sector since 1971, while maintaining the internal price of rice.

Rice reduction program in Japan is called "gentan" and still in effect with a slight modification in its focus. The initial purpose of the gentan program was to reduce rice output by paying rice farmers not to plant rice. This has been modified to encourage the diversion of crop allocation away from rice to wheat and soybeans. Currently, the MAFF pays farmers who switch from rice to other crops. The compensation is based on annual forecasts of how much rice area is needed to bring a balance of supply and demand in the rice sector.

The largest payments are offered to those farmers who converted to wheat, soybean or barley production (Figure 3.8). In the long term, this policy may affect wheat, soybean and barley production so as to decrease the demand for imported wheat and barley. The crop diversion program also includes other alternative crops such as fruit trees, and the diversion to the so-called multifunctional purposes such as landscape conservation. Diversion also includes conservation of paddy fields without cropping, diversion to vegetables, land improvements during the production period, and conservation management (JFA, 1998).

Figure 3.8 Maximum Diversion Payments by Crop 2001 in Japan



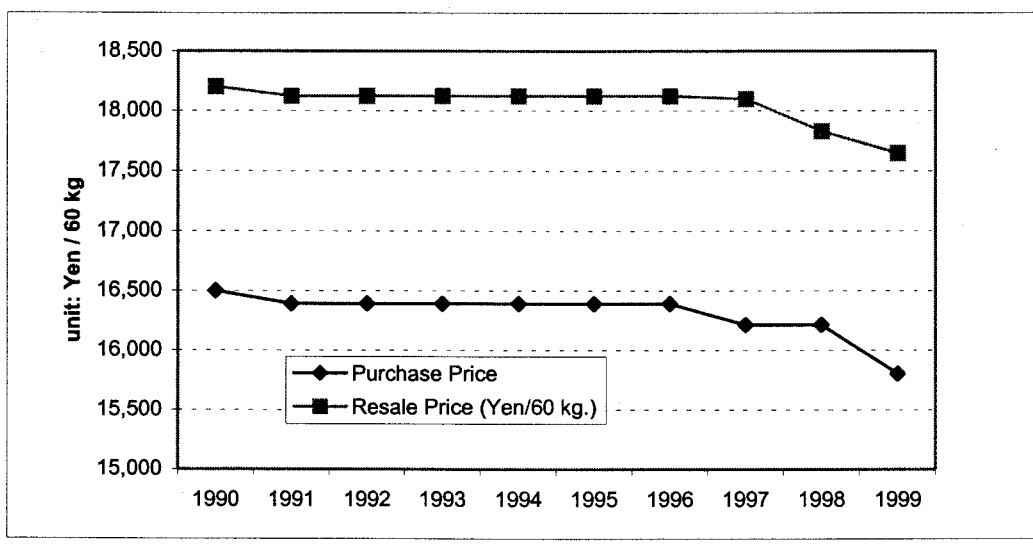
Source: Foreign Agriculture Service (FAS), USDA 2003.

Since the late 1990s, the Japanese government has introduced several policy measures to transform the rice sector to a more open market system, in anticipation of rice market liberalization under the WTO. These new rice policy measures are intended to enhance competitiveness of the Japanese rice sector in coping with increasing competition from foreign suppliers.

The MAFF lowered both the purchase and resale prices of rice in the late 1990s as part of new rice policy initiatives to reduce rice production and reinforce production of alternative crops (Figure 3.9). The Japanese government introduced the Rice Farming Income Stabilization Program in 1998 to provide income compensation for falling rice prices. The rice producers are paid for the difference between the market price and a standard price that is moving average of past prices. This deficiency payment to rice farmers, combined with the crop diversion program allows for a significantly high return for

Japanese farmers. For example, Japanese farmers' return for rice was $113/CWT and U.S. farmers' return for rice was $6.50/CWT. Japanese farmers also received $80/ bushel for wheat, while U.S. farmers received $3.21/ bushel in 2001. Thus, Japanese farmers receive considerably higher returns on crops compared to farmers in foreign countries.

Figure 3.9 Average Japan's Government Purchase and Resale Prices of Rice

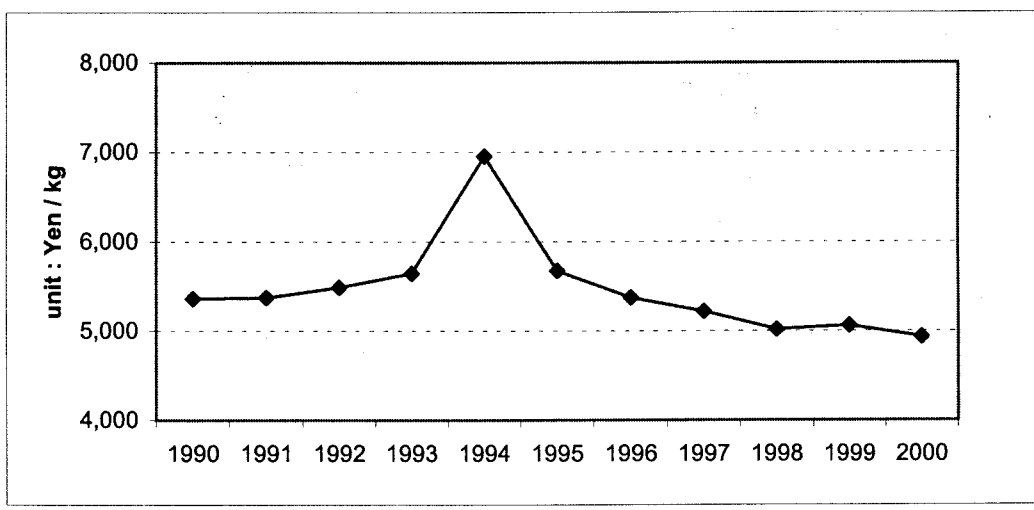


Source: Food Agency, MAF

The Japanese government eliminated restrictions on the marketing and distribution of rice in Japan by allowing farmers to choose among alternative marketing channels. This led to increased competition at the retail and wholesale levels 1 and falling retail and wholesale prices. (Figure 3.10). This relaxation of restrictions on the marketing and distribution of rice has led to increased product differentiation and branding of rice.

In 2002, the Japanese also announced a new framework for Japan's rice sector, in which government control of rice production, distribution and marketing will be completely abolished by 2008 and the rice sector is to become market oriented. As the Japanese government discontinues its production adjustment program by 2008, farmers and farm organizations must decide on production choices. Thus, supply and demand of rice under the privatized system will be determined primarily by price signals.

Figure 3.10 Retail Price of Rice in Tokyo Area



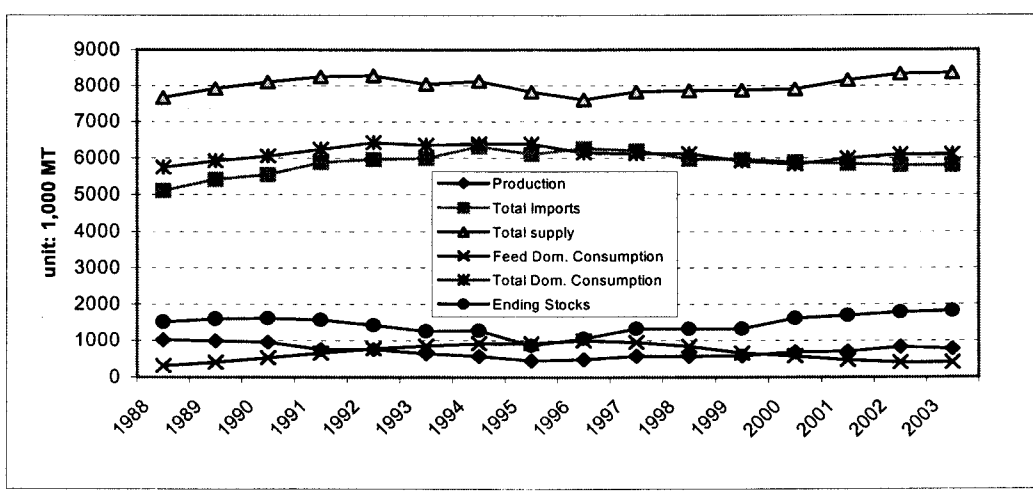
Source: Ministry of Management, Home Affairs, Post & Telecommunications

Since the BSE outbreak in Japan in 2001, MAFF has had a serious interest in implementing "traceability" in the food supply chain. This new focus includes the rice marketing system as part of the traceability implementation. The rice policy reform in 2002 contains a plan for DNA monitoring to guarantee quality assurance in rice and to trace seed varieties, chemical usage and the distribution of rice. Applications of the traceability concept to the rice sector in Japan have the potential to facilitate branding of domestic rice products.

3. Rice Imports in Japan

For the past few decades, Japan imported an insignificant quantity of rice (Figure 3.6). However Japan did agree to open its rice sector to foreign rice in the URAA of 1994. The Japanese government agreed to increase the volume of imported rice over the 1995-2000 implementation period (Table 3.17). Currently, Japan's import quota for rice and rice products is 682,000 MT per year, representing 7.2 % of average consumption in the 1986-88 period. Most of imported rice is imported through simultaneous buy and sell (SBS) system, whereby importers and wholesalers offer tenders simultaneously for the selling and buying prices of each variety of rice. The prices offered by the buyers reflect the market demand and differences between these prices and the prices quoted by importers are the market evaluation of the price differentials on imported rice (ABARE 2001). The Food agency collects this price differential. Imported rice is stored for certain periods prior to release in the market or to be used as food aid.

Figure 3.11 Supply and Demand of Wheat, Japan



Source: PS&D, USDA (2003).

In 1999, the Japanese government the Japanese government introduced tariff protection for rice. and reduced the volume of minimum access imports (Table 3.17), in order to curtail the downward pressure of imported rice on domestic rice prices. Within the quota, the MAFF has exclusive right to import rice and tariff level is ineffective. Although rice imports outside of the quota are not subject to the MAFF regulation, this route to rice imports is effectively blocked with a prohibitive tariff level (a specific duty of 351.17 yen per kilogram). Border measures on rice imports effectively keep foreign rice out of the Japanese market and a significant mark-up added to imported rice makes the landed price of imported rice comparable to the price of domestic rice. Thus, price competition between Japan's domestic rice and imported rice is essentially eliminated through this import arrangement.

Table 3.17 Access Levels to the Japanese Rice Market under the WTO Agreement on Agriculture

Year	Initial Access	Revised Access After Tariffication
1995	379.0	370.0
1996	454.8	454.8
1997	530.6	530.6
1998	606.4	606.4
1999	682.2	644.3
2000	758.0	682.2

Source: WTO (1998).

Current negotiations on agricultural trade under the WTO are likely to put pressure on Japan to open it's rice market by altering border measures (i.e. TRQs) and domestic support (producer subsidy). As the Japan reforms its rice policy regime, the rice sector will be forced to improve its competitiveness. Japanese government support to rice producers will decrease and this inevitably will result in reduced prices

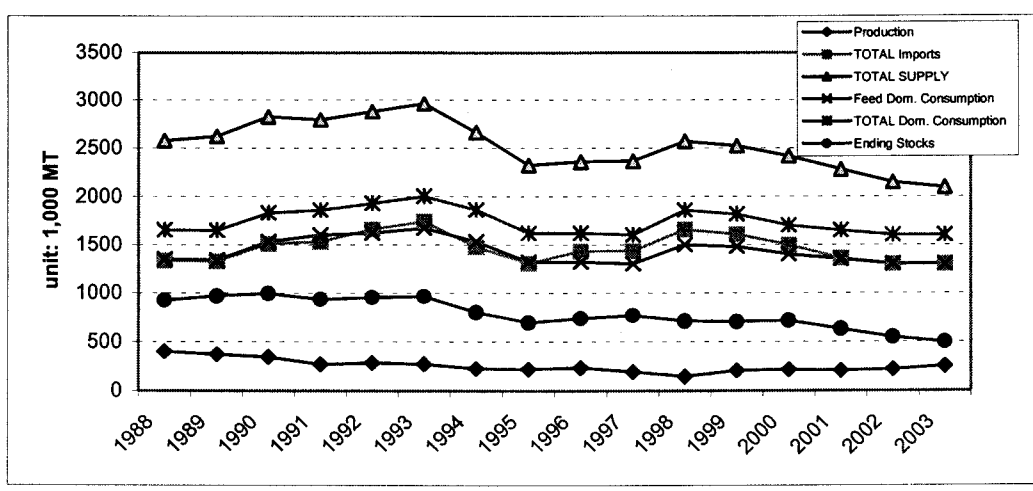
for domestic rice. Consequently, small scale and less efficient rice farmers who do not have competitive operating structure will be forced to exit the market. Further reductions in tariff levels and increases in quota portion of the TRQ will also make the Japanese rice market to become more responsive to international price movements.

Section 6. Grain Sector in Japan

1. Japan's Wheat Production and Consumption

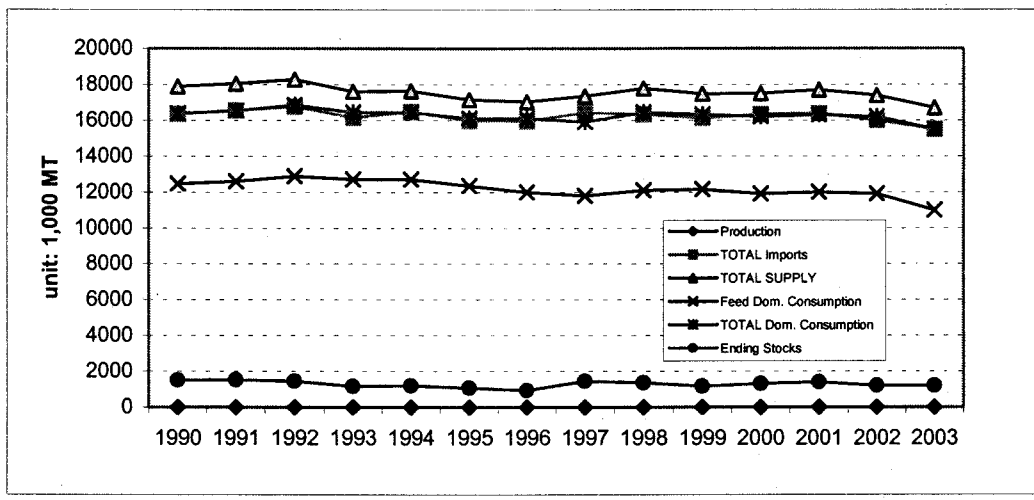
Domestic wheat production supplies 11% of the total domestic wheat consumption in Japan (Figure 3.11). Other crops such as corn and soybeans are mostly supplied through imports and used intensively in livestock production as feed stuffs (Figure 3.13). These feed grains are subject to relatively low border measures. However, for wheat and barley, which are produced domestically and utilized in human consumption, imports are subject to tariffs despite low levels of domestic production.

Figure 3.12 Supply and Demand of Barley, Japan



Source: PS&D, USDA (2003).

Figure 3.13 Supply and Demand of Corn, Japan



Source: PS&D, USDA (2003).

Wheat and barley consumption have been stable since the implementation of the Uruguay Round agreement. Growth in Japanese consumption of wheat took place in the 1970s and 1980s, driven by a rapid economic growth and a high level of urbanization and westernization of the Japanese diet. This was coupled with reduced demand for rice and coarse grains for human consumption. However, demand for wheat and barley leveled off in the 1990s and remain stable.

2. Wheat Marketing and Import System in Japan

Japan Food Agency (JFA) is a government agency, which has an exclusive authority over marketing, pricing and distribution of wheat, barley and rice. This agency was enacted with a mandate to stabilize domestic supply of cereal grains. The JFA managed the marketing of both domestic and imported wheat under "Wheat and Barley

Management Improvement Measures" since 1960s, until "New Wheat and Barley Policies" was introduced in 1998. The JFA used two instruments to regulate the Japanese agricultural sector, border measures and domestic subsides. In terms of border measure, the JFA sets annual import quota for wheat that is used to clear the domestic shortage of wheat.

Based on annual projections of domestic production of wheat, the JFA arranges import agreements with three major wheat exporting countries the U.S., Australia and Canada. The import quota allocation to these three players in the Japanese wheat market has been very stable for past three decades, despite the changes in the preferences of end-users of imported wheat.

The JFA also uses two-tier pricing mechanism in marketing of imported wheat, buying imported wheat at international prices and selling the wheat to end-users (i.e. millers) at substantially higher resale prices. The JFA sells imported wheat to millers at approximately double the CIF import price. This pricing system effectively protects the Japanese wheat producers from intensive price competition from imported wheat, while it imposes considerable costs on Japanese millers and consumers. For example, the Japanese millers paid $ 402 /MT for domestic wheat and paid $ 486 /MT for imported wheat, while the JFA paid $1445 /MT to domestic wheat producers and purchased imported wheat at $ 245 /MT. Thus, the price of domestic wheat is insulated from import competition and international price signals do not reach the Japanese wheat market. Consequently, the demand for wheat in Japan remains quite stable, regardless of the international wheat price fluctuations.

The JFA introduced a reform policy, called "New Wheat and Barley Policies" in 1998 (MAFF, 1998), which were implemented in the 2000-2002 period. The new policies include:

> "(1) establishment of a mechanism for private marketing of domestic wheat; (2) introduction of new measures for stabilizing management of domestic wheat producer with high productivity-the Wheat and Barley Farming Income Stabilization Fund. This fund will assist improving productivity of domestic wheat production. Level of compensation and payment will determine based on production cost; (3) implementation of the Simultaneous Buy and Sell (SBS) for imported wheat and barley for feed use" (MAFF, 1998 p.3-9).

The stated objective of this policy is to improve the competitiveness of domestic wheat producers and to enhance self-sufficiency for food grains in Japan. More importantly, opening the livestock sectors to international competition made it necessary for Japanese livestock producers to have competitive feed costs. Relaxing restrictions on the marketing of wheat and barley for feed use aims to increase price competition among international feed grain suppliers and lower the feed costs of Japanese livestock producers.

The JFA no longer guarantees the unlimited purchase of domestic wheat. Privatization of domestic wheat marketing will inevitably result in direct competition with imported wheat. This competition will be reflected more in quality aspects than in price as the JFA is expected to continue to fix internal prices of both domestic and imported wheat.

Wheat and barley imports for food consumption are subject to tariff-quotas. During the Uruguay Round negotiations, Japan allowed

tariff-quota access of 5.74 MMT of wheat and 1.369 MMT of barley for 2000 are levels which are virtually the same as the access levels in 1995.Japan decreased its within quota tariff on imported wheat from 53,000 yen a tonne in 1995 to 46,500 yen tonne in 2000, while maintaining the over-quota tariff at the same level during this period. This allows the price of imported wheat in Japan to be more than twice the world price. Given the limited changes in the border measures with respect to wheat and barley imports, imports have not increased notably since the implementation of the Uruguay Round.

Table 3.18 Summary of Tariff Rates for Japanese Grains Tariff-Quota'

	Wheat	Barley
Minimum Access		
1995	5.565 MMT	1.326 MMT
2000	5.740 MMT	1.369 MMT
World market price		
1995-96	25000 Yen / MT	17000 Yen / MT
Within quota tariff		
1995	Government markup of 53000 Yen / MT	Government mark up of 34000 Yen / MT
2000	Maximum government Mark up of 46500 Yen/MT	Maximum government Mark up of 29500 Yen/ MT
Beyond quota tariff		
1995	65000 Yen / MT	46000 Yen / MT
2000	55000 Yen / MT	39000 Yen / MT

Source: Young (1994): Country Schedules for the WTO Agreement on Agriculture.

Section 7. Livestock Sector in Japan

1. Japan's Livestock Imports

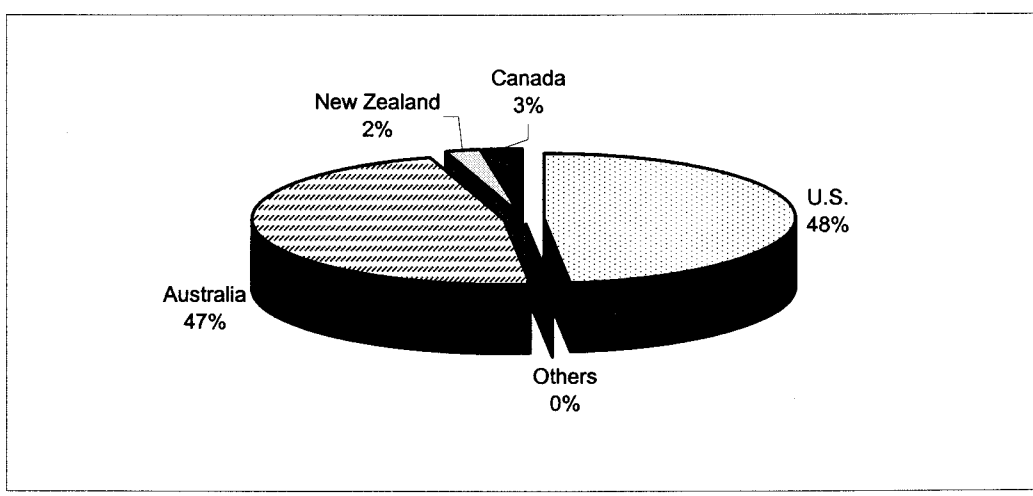
The Japanese beef industry faced significant market reforms in early 1990s, that resulted in trade liberalization and a reduction in tariffs. The liberalization of the Japanese beef market started in 1989, and involved a gradual elimination of import quotas and their replacement with a tariff only regime. The tariffication process in the beef sector in Japan was further liberalized in the Uruguay Round agreement in 1994.

Under the Uruguay Round agreement, Japan agreed to reduce its applied tariff on beef imports. A special safeguard clause allowed Japan to raise the tariff above the bound rate of 50 % if imports exceeded a critical level or if prices fell below a threshold. The tariff equivalent was reduced from 50 % in 1993 to 38.5 % in 2000. During the tariffication process, wholesale prices for beef have declined. This is especially true for lower quality cuts used for meat processing, and this resulted in decreases in the prices of domestic dairy steer beef because of higher quality imports. Also, retail beef prices fell from 76 % above world market prices in 1986-88 to 40% above world prices in 1999 (OECD 2000). Decreases in the price of beef in Japan led to an increase in beef consumption, which was largely supplied through imports. Prices for domestically produced Wagyu beef (higher quality specialized beef from traditional Japanese breeds) have not declined as much, since substitution with imported beef is more limited (ABARE, 2001).

Prior to the liberalization of the beef market, the Livestock Industry Promotion Corporation (LIPC)- a state trading agency had total control

over beef trade. It used imported beef as a buffer to help stabilize market prices (ABARE 2001). As a result, under the state- trading framework a large proportion of the imported beef was marketed in frozen form. Frozen beef was lower priced commodity. With the tariffication of beef imports in 1991, there was a substantial growth in high quality chilled beef imports , which was driven by the Japanese consumer's preference for fresh chilled beef. However, the extent of the impact of the beef market liberalization on consumer demand for imported beef has been constrained as the concentrated retail sector in Japan has managed to absorb the benefits of lower wholesale prices into their margins. Consequently the decline in prices has not been passed on to consumers.

Figure 3.14 Market Share of Major Beef Export Countries in Japan (1999-2000)



Source: MAFF 2001.

Currently there are four major beef suppliers to Japan as it restricts imports of meat products from countries that have FMD or BSE

(Figure 3.14). The U.S. and Australia share large proportion of this market with 97 % of the total beef imports.

While the Japanese government has progressively liberalized its beef sector, its border measures, for the pork sector, have been maintained at a relatively high level. Japan has tariff- only protection for pork. Prior to the Uruguay Round (UR) agreement in 1994, Japan applied a system of variable levies for pork imports. This system was replaced with the gate price system. Under this system, if imported pork enters Japan and is priced at or above the gate price simple tariff is applied. If the price of imported pork is lower than the gate price, the importer must pay the difference between the import value and the gate price as a duty that is applied in addition to the tariff. The main purpose of this border measure is to ensure that competition from imports will not depress internal pork prices below the administratively set stabilization prices. The additional duty is calculated as the difference between the gate price and the "average" value of the invoice on a shipment of pork. This duty calculation causes exporters to strategically mix pork cuts to avoid additional duties. For example, low priced pork bellies are mixed with high priced tenderloins to bring down the average value of the shipment to be equal to the gate price.

Exporters are nonetheless are inclined to ship some high valued pork since lower valued pork would have the same transportation cost. This system skews the cuts or qualities of pork products that are shipped to Japan. Therefore, the gate price system effectively disconnects the linkage between demand in Japan and import supply, creating inefficiencies in the marketing of imported pork in Japan.

Japan also has special safeguard that was agreed under the WTO which can be temporarily applied to increase tariff protection. The special safeguard, that is contained in the UR agreement, allows a country to raise its tariffs if the volume of imports in a given period exceeds 105 % of the average volume recorded in the same period over the previous 3 years, or if the import price falls by more than 10% below the 1986-88 average reference price for the product. Special safeguards were triggered several times in 1995, 1996 and 1997. The border measures that are applied to the Japanese pork sector have inflationary effects on the price of pork in Japan. For example, when the safeguards were in effect Japanese internal prices for pork were 122% above world market prices compared to 73% above world prices in 1986-88 (OECD 2000).

2. Japan's Livestock Production

Japan's livestock production is constrained by relatively high priced imported feedstuffs which have additional transactions costs because of distance, high labor costs, limited land and the costs associated with strict environmental regulations. If free competition is allowed in the Japanese pork sector, the hog farmers in Japan would be faced with considerable market losses because of competitively priced foreign pork suppliers.

The Japanese government provides support to livestock sectors with the maintenance of high internal prices of domestic livestock products and support of producers' incomes. Government support for pork industry is high relative to support levels in other livestock sectors, such as the beef industry, and is comparable support provided to

Japanese grain producers. Since the Uruguay Round agreement, Japan's beef production was leveled off to an average of 543,900 MT between 1994 and 2003. Approximately 57 % of the total beef supply in Japan consists of imported beef, while 38% of the total pork supply consists of imports.

Japan sets a standard stabilization price for pork each year and when the market price falls below this standard price, the government is authorized to take actions to raise the market price. These activities include reduction in supply of pork by government purchase and subsidization of the storage of frozen pork. The Japanese government supports hog farmers primarily through deficiency payments on producer returns, which do not have direct impact on the market price for pork.

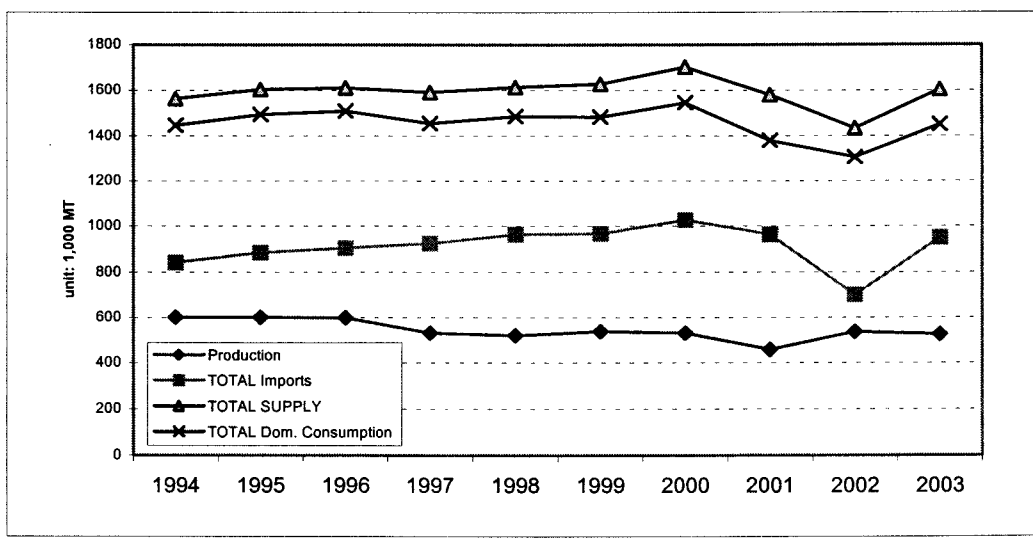
3. Meat Consumption in Japan

The removal of the import quota and tariff reductions have lowered the wholesale price of beef because of increased imports, and as a consequence, consumption of beef in Japan has increased. Japanese total beef consumption has increased 6.5% annually throughout 1990s since beef liberalization in 1991. Until liberalization, import restrictions constrained imports to the lower quality segments of the Japanese market. At the same time, the LIPC allowed imports of frozen beef because they were effective in stock management because of a longer shelf life. Beef market liberalization allowed substantial growth in imports of chilled beef in Japan, allowing an increase in the supply of higher quality imported beef in the Japanese beef market.

Japanese demand for beef is highly differentiated by quality attributes of beef products, creating a wide range of pricing of beef products. Since Japanese consumers prefer highly marbled beef products, beef grading is based on the amount of marbling. Japanese Wagyu beef has a high level of marbling commanding 67 % premium compared to domestic dairy steer beef. Imported beef is considered to be quite lean by Japanese standards, and as a result its price is heavily discounted in the Japanese market.

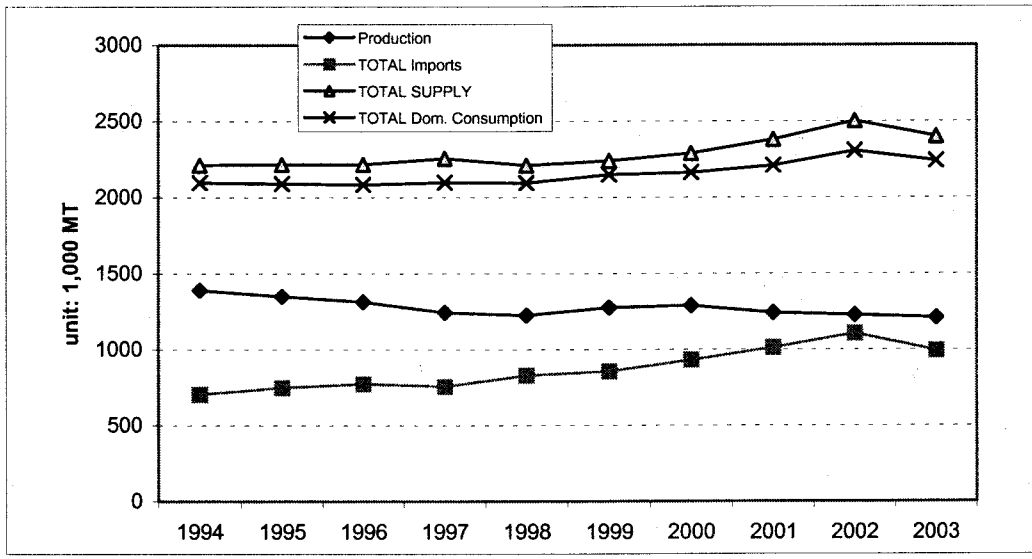
There was a significant decline in consumption and imports of beef in Japan in 2002. This was primarily due to detection of BSE in Japan in 2001 (Figure 3.15). Given that pork and beef are major substitutes, consumption and imports of pork increased in 2002 as Japanese consumers switched away from beef in favor of pork for their protein intake. (Figure 3.16).

Figure 3.15 Supply and Demand for Beef in Japan



Source: MAFF Livestock Production Statistics

Figure 3.16 Supply and Demand of Pork in Japan



Source: MAFF Livestock Production Statistics

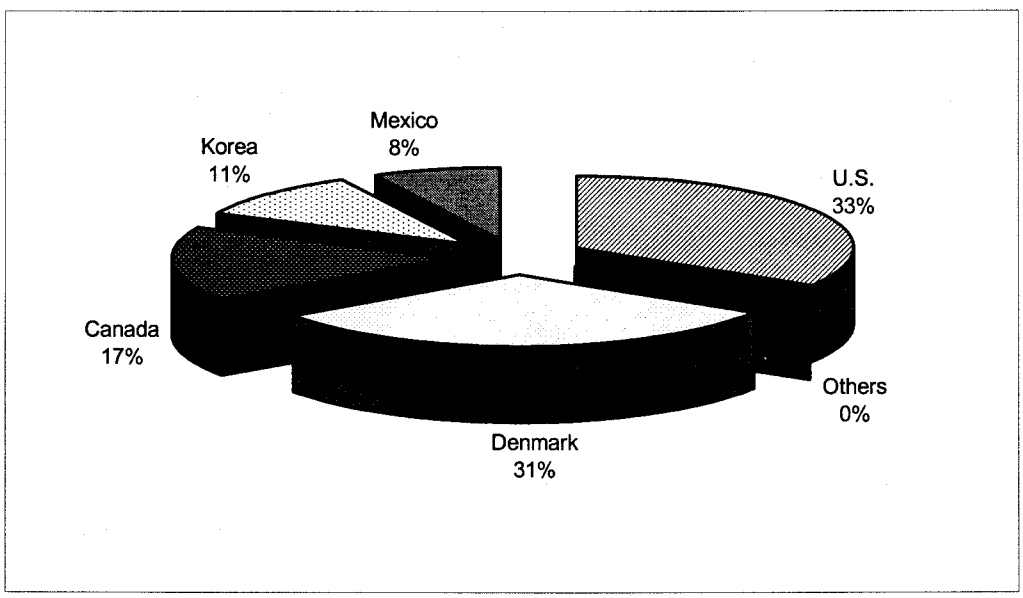
In the pork sector, Japanese consumer preference is clearly reflected in the price differences between domestic and imported pork products. For example, domestic shoulder cuts are sold at about a 12 % premium to imported shoulder cuts; and that domestic loins and legs have sold for about 28 % more than imports over the last 8 years (USDA 2003).

4. Food Safety and Labeling Policies

Japanese consumers and food processors are highly concerned with food safety issues such as E.coli, BSE and FMD. On September 2001, there was an outbreak of BSE in Japan, which was reported to be caused by use of BSE-contaminated feedstuffs on domestic cattle. This resulted in temporary increases of chicken and pork consumption in 2002. The food safety scare due to BSE in Japan was worsened by

discovery of mislabeling, of origin of beef products, by Japanese distributors in 2002. Mislabeling damaged the public confidence in Japan's meat industry and regulatory authorities (i.e. MAFF and MHLW- Ministry of Health, Labor and Welfare). In response to the BSE incident, the wholesale price of beef in Japan has declined as a result of weak demand.

Figure 3.17 Market Share of Major Pork Suppliers in Japan (1999-2000)



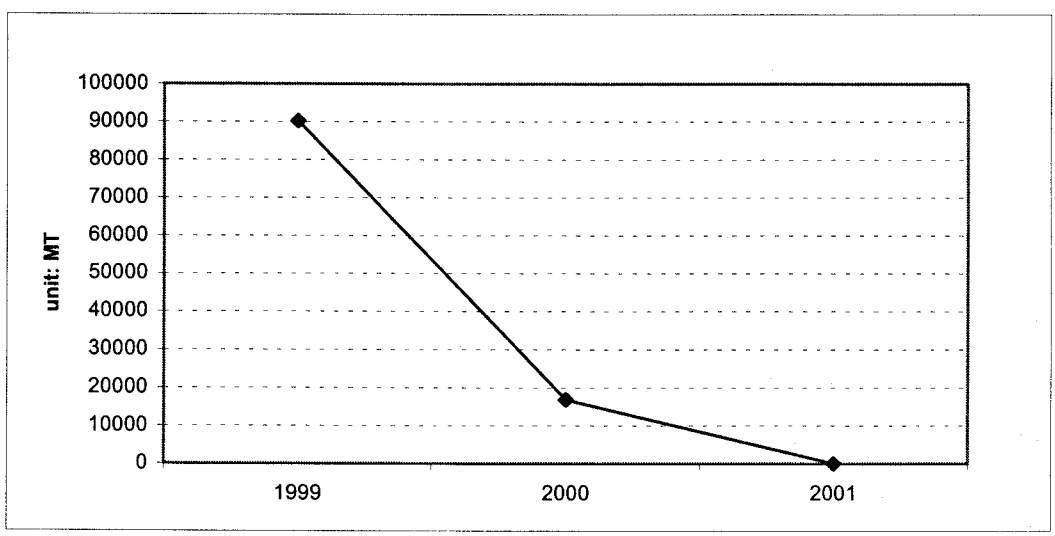
Source: MAFF 2001.

Japan also protects its foot and mouth disease (FMD) free status by prohibiting imports from countries that have FMD. This regulation effectively limits imports from countries in Asia, North America and selected parts of Europe. Denmark and the U.S. are leading pork suppliers in Japan's pork import market, with market shares of 31% and 33% respectively (Figure 3.17). South Korea had 11% of the Japanese imported pork market prior to FMD outbreaks in 2000. Japan

put temporary ban on pork imports from South Korea in 2001 (Figure 3.18). South Korea is planning to resume pork exports to Japan by early 2004.

In response to heightened concerns on food safety by Japanese consumers, Japanese retailers are implementing tracking system (i.e. traceability) which allow consumers to scan meat packages at computer terminals to learn about the history and origin of the product. This may increase transaction costs of meat marketing, which may have inflationary pressures on the price of beef products at wholesale and retail levels. However, whether or not this additional cost will be accepted by consumers will be discovered eventually as premiums on identity preserved (IP) meat products emerge.

Figure 3.18 Korea's Pork Exports to Japan



Source: MAFF 2001.

Section 8. EU Agriculture

Agriculture in the European Union has a number of similarities with Korea, including farmer support goals and rural welfare, farm size, and multifunctionality of agriculture goals. The European Union (EU) supports its agricultural producers through a system of price supports, direct payments to farmers, supply controls, and border controls limiting imports. Until the reform of the Common Agricultural Policy (CAP) in 1992 the largest share of producer support came through a system of intervention purchases where if the market price fell below the intervention price, surplus production was purchased by EU intervention authorities. Excess stocks were disposed of on international markets through a system of export subsidies known as export restitution. The system of intervention purchases and export restitution applies to cereals, beef, dairy products, sugar and fruits and vegetables.

With the 1992 reform of the CAP, intervention prices were reduced and compensation was provided to farmers in the form of direct payments. The direct payments were tied to historic criteria such as past yields and new supply control measures were required. For the cereal, oilseed and protein crop sectors these supply controls were land set-asides. For beef and sheep production the controls were in the form of maximum stocking densities and compensation was provided with headage payments.

Table 3.19 describes intervention prices for cereals, beef and dairy for the periods prior to 1992, prior to 2000, and the current prices. Table 3.19 also describes how the direct compensatory payments have changed over time.

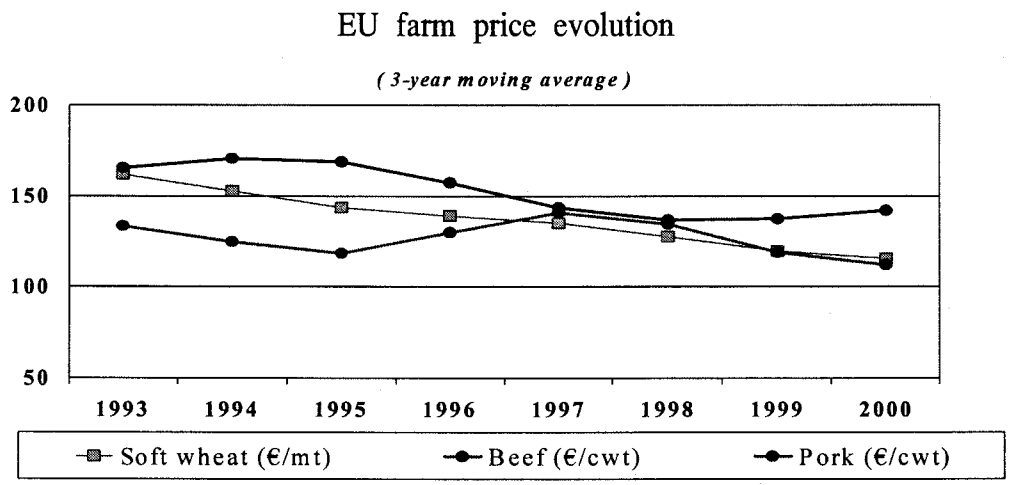
Table 3.19 EU Intervention Prices and Direct Payments Euro/metric tonne

	Intervention Prices			Compensatory Payments		
	Cereals	Beef	Butter*	Cereals	Beef **	Dairy*
pre-1992	155/mt	3197/mt	3444/mt	NA	NA	NA
1999	119/mt	2780/mt	3282/mt	54/mt	145 /animal	
2002	101/mt	2220/mt	2799/mt*	63/mt	200/animal	17/mt milk*

* dairy reform after 2005 so the prices shown and subsidies are after 2005
** suckler cow premium

A second round of CAP reform took place in 2000 where intervention prices were further reduced, but the direct payments only compensated farmers for half of the reduction in the support prices. Figure 3.19 illustrates the how EU farm prices have fallen in the period since the first reform of the CAP in 1992. For instance, cereals intervention prices were reduced by 1/3 in first set of reforms starting in 1992 and reduced by a further 15% as result of the 1992 reforms.

Figure 3.19 EU Farm Price Evolution



Source: EU Commission "The mid term review of the CAP - Issues and options"
http://europa.eu.int/comm/agriculture/mtr/archive/index_en.htm

Further reforms are being contemplated in anticipation of the enlargement of the EU with new members from eastern Europe. On 22 January 2003, the EU Commission adopted a package of proposals to reform the CAP(EU Commission 2003). The reform would continue the process of reducing intervention prices. But the system of compensation would change from one that is at least partially tied to the production of specific commodities to a whole farm payment that is independent from production. There would be cross-compliance conditions attached to these payments that relate to regulations for food safety, animal welfare, health and occupational safety standards, a requirement to keep farmland in good condition, and environmental stewardship. As well there would be a reduction in payments for larger farms and the savings would be redirected to rural development and financing further reforms.

At this time it is unclear if the EU will proceed with further reforms and they are currently engaged in a contentious internal debate about CAP reform. Nonetheless there is a general trend to redirect spending to rural development, and issues like animal welfare, food safety and food quality. This change in where financial support is directed to is consistent with the EU's view on multifunctionality. The Europeans "look to agriculture to ensure safe and high quality goods, protect the environment, save finite resources, preserve rural landscapes and contribute to the socio-economic development of rural areas including the generation of employment opportunities." (EU Commission 1999a)

The idea of multifunctionality is that agriculture produces un-priced spillover benefits that occur in addition to the provision of food and fiber. These benefits range from environmental benefits, rural employment

and development, to food security. The belief is that agriculture is integral to the rural community, that it shapes the landscape, and that the sector is necessary to feed the nation. The economic arguments are that the spill over benefits are not just positive externalities but have a public good aspect as well. Public goods are non-rival (consumption by some does not reduce the availability for others) and non-excludable (no one can be excluded from consuming the good). The policy implication of public goods, and positive externalities, is that the market fails to provide an adequate amount of the good. Therefore government intervention is called for. The Europeans argue that there is territorial dimension so they are looking not just to preserve the rural landscapes but also prevent the de-population of remote areas.

The final argument with respect to multifunctionality is that the spillover effects are joint products with agricultural production. Some proponents of multifunctionality propose that since coupled production subsidies induce more agriculture output, they are the appropriate instruments to induce other multifunctional spill-over benefits.

The European view on multifunctionality differs somewhat from the Japanese and Korean view in that the Europeans are seeking interventions where the support should be targeted specially at the spillover benefits. The phrase non-trade concerns is frequently used as a synonym for multifunctionality. "The EU's proposal says non-trade concerns should be targeted (e.g. environmental protection should be handled through environmental protection programmes), transparent and cause minimal trade distortion." (WTO). It is unclear if the EU would support coupled production subsidies to promote multifunctionality when the Commission is proposing to convert their direct producer payments to decoupled

support and advocate that multifunctionality payments are to be targeted. The EU Commission argues, "Ensuring the fulfillment of the multifunctional role of agriculture requires policies encompassing agriculture as a whole."

- Of particular importance for enhancing the multifunctional role of farming are investment aids, less favoured areas (LFA) schemes and the LEADER programme. Investment aids, including those to the agro-food chain, permit structural adjustment and adaptation to higher standards, whether for environment, quality or safety purposes. LFA compensatory allowances for natural handicaps aim at the continuation of farming where, notwithstanding these more difficult natural conditions, rural settlements are part of the European cultural heritage. This is the case in particular in hilly and mountainous areas, Nordic zones, small islands but also in zones, under strict criteria, where traditional farming plays a predominant role. The LEADER programme, promoting the bottom-up approach, notably encourages on and off farming activities, thanks to local and often co-operative initiatives, like diversification, promotion of regional quality products, local processing and direct marketing, and/or alternative farm schemes for countryside conservation, that strengthen social cohesion and help to preserve rural viability.(EU Commission 1999b)

Section 9. US Crop Farm Policy

U.S. agricultural exports for many commodities are relatively large, and the U.S. price is sometimes considered as an approximation of world price. While U.S. policy and intervention for meat is limited, U.S. policy regarding grains is significant and can affect world grain prices.

The U.S. writes new farm legislation at regular intervals every three to seven years. These pieces of legislation have become commonly known as Farm Bills. The first farm bill was passed in 1933. Until 1973 farm bills provided a wide variety of techniques to support farmers including price supports, production controls, two priced systems and other methods of providing assistance. The 1973 farm bill introduced systematic direct commodity price supports. Between 1973 and 1996 the farm bills were of the same general set of policy instruments: loan rates, target prices and deficiency payments. The 1996 farm bill which is sometimes described as "Freedom to Farm" marked a fundamental change in the way that commodity support is provided.

The 1973 act continued the loan rate provisions that were established earlier. The loan rate effectively established a floor price for crops. From a practical sense, the loan rate is the price per unit (pound, bushel, bale, or hundredweight) at which the Commodity Credit Corporation (CCC) provided commodity-secured loans to farmers for a specified period of time. If the market price was less than the loan rate then crops what were offered as collateral for the loan were ceded to the CCC. In effect the CCC maintained the floor price by purchasing the excess product, at the loan rate, adding to government stocks. The 1973 farm bill introduced the target price (for wheat, feed grains, cotton, and rice) that was based on a national average estimate of the cost of production. The target price was supported with a deficiency payment that was the difference between the target price and the greater of the loan rate or the market price on the eligible quantity of the product in question. The eligible quantity was not the total amount of commodity that would be provided at the target price. The eligible

quantity was established with a program base area for each crop. To access loan rates, target prices and deficiency payments, farmers had to agree to take a percentage of their land out of production with acreage set-aside programs. The 1985 farm act is best know for lowering the loan rate and for the introduction of the export enhancement program.

The 1996 FAIR act retained the loan rate but got rid of target prices and deficiency payments. Producers were no longer required to maintain base areas for program crops and to have mandatory land set-asides(the conservation reserve program of environmental set-asides was maintained). Money that had historically been paid through deficiency payments continued to be paid to producers, but in a method that did not vary with market conditions. Production flexibility contract payments (PFC) converted the same amount of money that was historically paid in deficiency payments into a direct payment. Farmers could not affect the size of this payment because it was based on a historic area multiplied by a historic yield times a fixed dollar amount. This type of payment is similar to a lump sum transfer because the recipient cannot affect the size of the payout by changing his actions. Therefore these payments were described as decoupled payments and reported as green box measures in the US domestic support notification to the WTO. The way the loan rate was implemented was changed as well. The CCC no longer purchased excess stocks to maintain the market price above the loan rate, but rather a loan deficiency payment was made which was equal to the difference between the loan rate and the lower market price times all of the production of the crop in question.

The 2002 Farm Bill continued on with some aspects of the 1996 FAIR act. The PFC payments were continued and are now called annual fixed direct payments. The direct payment for an individual crop would be calculated as:

- DP_{crop} = Payment $rate_{crop}$ Payment yield $_{crop}$ [Base acres $_{crop}$ · 0.85]

The 2002 Farm Bill also re-introduced target prices for program crops, including are wheat, corn, grain sorghum, barley, oats, rice, upland cotton, soybeans, minor oilseeds, and peanuts. Target prices are used with the new counter-cyclical payments(CCPs) program. The payment amount is equal to the product of the payment rate, the payment acres, and the payment yield. For example the payment for an individual crop is determined as:

- Payment $rate_{crop}$ = $(\text{Target price})_{crop}$ $(\text{Direct payment rate})_{crop}$ $\text{Max}(\text{commodity price, loan rate})_{crop}$
- CCP_{crop} = $[(\text{Base acres})_{crop}$ x 0.85] $(\text{Payment yield})_{crop}$ $(\text{Payment rate})_{crop}$

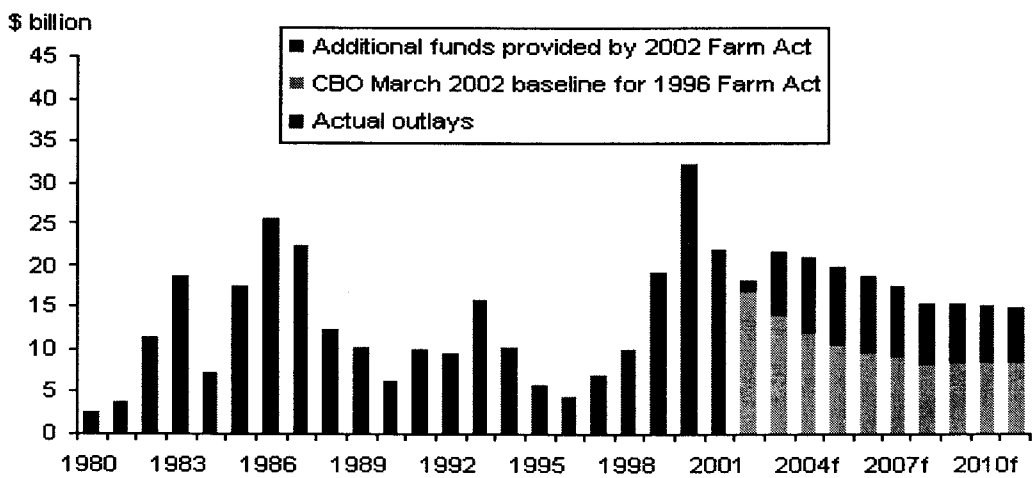
Farmers are given almost complete flexibility in deciding which crops to plant, however land must be kept in agricultural uses and they must comply with certain conservation and wetland provisions. There are upper limits on amount of counter-cyclical payments and direct payments that each producer can receive. Since there virtually nothing that a producer can do to affect the size of payout -in DP and CCP payments- by changing his level of output, he is assumed to react to market signal and not to program payments. Therefore these programs are considered by some to be at least partially decoupled. There is great deal of the debate concerning the degree of decoupling with the

current US programs and not all commentators believe that the effects of these programs are neutral. However, the degree of program induced production predicted by even the most cynical is not large nor are the effects on world crop prices.

Figure 3.20 shows that although the overall US government outlays have varied over time, the general level of support has not dramatically increased. While there have been significant changes in how the US provides farm support over the three decades and the degree to which programs are tied to production has changed, it is unlikely that international grains markets would have evolved much differently if the pre-1996 legislation had applied over the last eight years.

Figure 3.20 Commodity Credit Corporation Net Outlays

Commodity Credit Corporation (CCC) net outlays *



* The Commodity Credit Corporation (CCC) is a Federally owned and operated corporation within the U.S. Department of Agriculture created to stabilize, support, and protect farm income and prices through loans, purchases, payments, and other operations. All money transactions for agricultural price and income support and related programs are handled through the CCC.
Source: *CCC Budget* and *Congressional Budget Office/March 2002 forecasts.*

Chapter 4. Results and Analysis

Price transmission results for Korea are examined in this chapter. The bulk of the econometric results in this study are monthly from 1996-2002, in order to present most current results and changes in various markets. However, some caution should be used in interpreting results as two commodities can often differ by form, such as by variety, grade, standard, level of processing, or level of value added. The linkage between domestic and international markets can be described by the elasticity of price transmission and price ratios. The price transmission elasticity is a measure of the co-movement of two prices and shows, for example, the extent to which changes in world prices are transmitted back to import prices or within-country prices (Nather and Weaver, 1999). One of the objectives in this study is to compare international prices with Korean import and domestic prices, and examine price transmission levels and price ratios, and their implications regarding liberalization for then the Korean agriculture. This is a timely topic, as the Korean government is preparing the domestic agricultural sector to have a smooth transition to more market-oriented structure, which is expected to proceed accordingly with the WTO negotiation.

Another objective is to examine farm to retail prices, in order to examine the rate of price increases between farm and retail levels. Additionally, macro prices will also be examined to assess their relationship with agricultural prices. The impact of exchange rates on

import prices will be examined to assess the magnitude of import price changes resulting from a change in the exchange rate. The relationship of the consumer price index with farm and retail prices will also be examined, to assess the relationship of farm and retail prices with inflation.

Section 1. Properties of Data

Results in the three stationarity tables (Tables 4.1- 4.3) below indicate that most prices analyzed in the study are not stationary, and this is expected. Agricultural price data, like most time series economic data is often expected to display considerable variability and non-stationarity. On the demand side, prices are influenced by factors such as changes in income, population, prices of substitutes, inflation, and consumer habits. On the supply side, prices are influenced by variables such as technology, input prices, government policies, price of substitutes, and weather. Imports also play a role for many agricultural prices, with import prices largely influenced by world prices, exchange rates, and possible tariffs. Upward price trends brought on by inflation are most likely one of the main causes of the non-stationarity. When the data trend was removed by using price changes rather than price levels were examined, many of the variables became stationary, indicating that much of the non-stationarity was likely due to trends. Tests of the data found only limited evidence of generalized conditional heteroskedasticity, therefore OLS models were used rather than GARCH (generalized autoregressive conditional heteroskedasticity) models.

Table 4.1 Stationarity Statistics for Korean Monthly Prices in $US, 1996-2002

Market Level	Commodity	Currency	ADF Test Statistic
Farm Level			
	Corn	$US	-2.07
	Soybean	$US	-1.66
	Barley	$US	-2.12
	Rice	$US	-2.10
	Beef	$US	-1.44
	Pork	$US	-2.24
	Chicken	$US	-3.78*
Wholesale Level			
	Soybean	$US	-3.99*
	Barley	$US	-2.43
	Rice	$US	-2.09
	Beef	$US	-2.21
	Pork	$US	-2.21
	Chicken	$US	-1.59
Import Level			
	Corn	$US	-1.49
	Soybean	$US	-1.12
	Wheat	$US	-1.92
	Beef	$US	-2.56
	Chicken	$US	-2.13
Retail Level			
	Rice	$US	-2.10
	Beef	$US	-0.70
	Pork	$US	-1.79

a/ ADF is augmented Dickey Fuller Statistic, null hypothesis is non-stationarity. Asterisk indicates reject null hypothesis at 10% level of confidence. All variables are in logarithms.

Table 4.2 Stationarity Statistics for Korean Monthly Prices in Won, 1996-2002

Market Level	Commodity	Currency	ADF Test Statistic
Farm Level			
	Corn	Won	-0.96
	Soybean	Won	-1.15
	Barley	Won	-0.69
	Rice	Won	-1.60
	Beef	Won	-0.03
	Pork	Won	-2.22
	Chicken	Won	-4.00*
Wholesale Level			
	Soybean	Won	-1.89
	Barley	Won	-1.82
	Rice	Won	-1.47
	Beef	Won	-1.10
	Pork	Won	-2.28
	Chicken	Won	-2.58*
Import Level			
	Corn	Won	-2.11
	Soybean	Won	-1.95
	Wheat	Won	-2.17
	Beef	Won	-2.71
	Pork	Won	-0.90
	Chicken	Won	-2.02
Retail Level			
	Rice	Won	-1.60
	Beef	Won	-0.36
	Pork	Won	-0.77

a/ ADF is augmented Dickey Fuller Statistic, null hypothesis is non-stationarity. Asterisk indicates reject null hypothesis at 10% level of confidence. All variables are in logarithm.

Table 4.3 Stationarity Statistics for United States Monthly Prices in $US, 1996-2002

Market Level	Commodity	Currency	ADF Test Statistic
Farm Level			
	Corn	$US	-4.00*
	Soybean	$US	-1.56
	Wheat	$US	-2.14
	Barley	$US	-2.00
	Rice	$US	0.30
	Beef	$US	-2.49
	Pork	$US	-1.70
	Chicken	$US	-1.01
Retail Level			
	Rice	$US	-1.01
	Beef	$US	-0.10
	Pork	$US	-3.04*
	Chicken	$US	-2.77*
Korea Consumer Price Index (CPI)			-1.29
Exchange rate			-2.08

a/ ADF is augmented Dickey Fuller Statistic, null hypothesis is non-stationarity. Asterisk indicates reject null hypothesis at 10% level of confidence. All variables are in logarithms.

Cointegration statistics for a number of price relationships are shown in the two cointegration tables (Tables 4.4 and 4.5).Nearly all price relationships shown in the tables are found to have no cointegration, and this was expected for a number of reasons. Cointegration implies that two prices series must move very closely together. Cointegration between prices or markets would most likely be expected to be found within countries where markets differ only across space and by a short

distance, rather than markets which differ in form. For example, farm price for corn in Iowa and Illinois would likely be cointegrated because these products have the same form and are only a short distance apart. Markets which are unlikely to be cointegrated would be, for example, linkages between Korean farm and Korean retail prices, or farm prices between countries such as U.S. and Korea. Markets which differ by form e.g. corn vs. wheat would be unlikely to be cointegrated.

Table 4.4 Cointegration Equation Statistics For Monthly Prices, 1996-2002

	Commodity	ADF
Import US$ &	Corn	-2.13
Korea Farm US$	Soybean	-1.72
	Beef	-1.47
	Pork	-2.51
	Chicken	-4.11*
Import US$ &	Soybean	-3.96*
Korea Wholesale US$	Beef	-2.02
	Pork	-2.37
	Chicken	-1.94
Import US$ &	Corn	-1.91
U.S. Farm US$	Soybean	-3.03
	Wheat	-1.69
	Beef	-2.55
	Pork	-1.58
	Chicken	-1.34
Import, Won &	Corn	-1.98
Exchange rate	Soybean	-1.48
	Wheat	-1.74
	Beef	-3.67*
	Pork	-0.92
	Chicken	-1.68
Korea Farm, Won &	Corn	-2.34
Korea CPI	Soybean	-3.00
	Barley	-2.41
	Rice	-1.37
	Beef	-1.55
	Pork	-2.24
	Chicken	-4.03*
U.S. Retail US$ &	Rice	-2.38
U.S. Farm US$	Beef	-1.15
	Pork	-3.01

Table 4.5 Cointegration Equation Statistics For Monthly Prices, 1996-2002

	Commodity	ADF
Korea Retail, Won & Korea Farm, Won	Rice	-2.80
	Beef	-1.74
	Pork	-0.54
Korea Retail US$ & U.S. Retail US$	Rice	-2.09
	Beef	-1.48
Korea Retail, Won & Korea CPI	Rice	-2.60
	Beef	-0.99
	Pork	-2.19

Section 2. Comparison of US Farm versus Korean Import Prices

Korean grain import prices in the Table 4.6 below show relatively high price transmission from U.S. farm grain market prices, indicating relatively efficient markets for grain imports. As well, import grain prices appear to have converged to closer U.S. levels after allowing for transfer and other costs, indicating liberalization of the market. Findings of efficiency in the import grain markets are important because Korea imports a large amount of feed corn and soybeans for the livestock industry, as well as wheat for human consumption. However, meat import markets were found to have reasonably low price transmission from the U.S.

Price movements of US farm prices and Korean import prices are compared to examine the price linkage between US producer level and Korean import level. The price differential between the U.S. farm level and the Korean import level reveals efficiency in the spatial price relationships. Under an efficient market, spatial price relationships are primarily determined by transportation costs between regions. The closer price movement between the U.S. farm (world price) and the Korean import prices implies the higher the market integration between the U.S. farm sector and the Korean import markets.

The price transmission elasticity between U.S. farm price and Korean import price is measured by the Beta coefficient in Table 4.6 below. Beta represents an elasticity measure since both the independent and dependent variables are in logarithms. If two markets are fully integrated, then Beta should equal one, and if there is no transmission between the markets, then Beta would equal zero. The coefficient of .74 in the table below implies that when U.S. farm corn price increases by one percent, Korean import price for corn is expected to increase by .74 percent on average. The R^2 statistic of .76 indicates that 76 percent of the corn import price variation is explained by the variation in U.S. corn farm price. A higher R^2 value indicates a stronger price transmission relationship between the two variables. The T-value of 16.13 indicates that the Beta coefficient is statistically different from zero at the 5 percent level. Therefore, this represents a statistically significant relationship between U.S. farm corn price and Korean corn import price. For large sample sizes such as in this study, a T-value of approximately 2.0 or greater represents statistical significance at the 5 percent level.

All coefficients in the table are above a level of one, along with a fairly good statistical fit, as measured by relatively high R^2 values. Increased liberalization of the Korean grain market over time and relatively few restrictions on Korean grain imports allow a fairly high price transmission elasticity and efficient market between the U.S. farm grain market and the Korean grain import market.

Korean beef import price appears to have fairly limited price transmission from the U.S. beef farm price as the Beta has only a .04 value. The R^2 value is almost zero, indicating basically no relationship between the two markets. This is poor transmission is likely partly due to the remaining trade restrictions on beef, which disconnect the beef import price from the U.S. farm price. Secondly, the U.S. beef farm price is for live animals, whereas the import beef price is at the process stage in a different form that represents a higher value, and another disconnection between the two prices. Pork import price transmission showed a higher relationship than beef because Korean pork is competitive on the world market and therefore tied more closely to a world or U.S. price. However, chicken showed a relative weak relationship between U.S. farm price and Korean import price, with only a .11 R^2 value. Overall, price transmission results indicate considerably less liberalization effects in the meat sector than the grain sector.

Table 4.6 Monthly Price Transmission Elasticity from U.S. Farm Price to Korean Import Price, 1996-2002, Prices in $US a/

	Constant	β^a	R^2
Corn	1.54 (7.61)	0.74 (16.13)	0.76
Soybean	1.15 (6.14)	0.82 (23.41)	0.87
Wheat	2.20 (13.67)	0.62 (18.50)	0.81
Beef	1.04 (16.93)	0.04 (0.24)	0.0007
Pork	0.85 (27.36)	0.69 (5.92)	0.30
Chicken	0.36 (5.81)	0.82 (3.25)	0.11

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses.

Causality and time lag results are presented in the Tables 4.7 and 4.8 below. Overall, these indicate fairly efficient pricing, based on the two month lag time found for price information to fully flow from U.S. farm level grain markets to Korean import grain markets Table 4.8). The primary relationship of interest in the causality analysis is the lead-lag time between U.S. farm price and Korean import price for corn, wheat, and soybeans, all of which are quite heavily imported into Korea. Livestock prices are not analyzed regarding lag times, because these prices would be expected to have a considerably long lag time, given that the price transmission elasticity was low for livestock.

While the rest of this study uses price levels, data for causality and time lag results in this section uses first differences of logarithims of

price (percentage change in price). This is because causality and time lag analysis is primarily interested in price changes and short-term analysis of price linkages, rather than long-term price movements. Both Fishers Kappa and Bartlett's Kolmogorov-Smirnov tests failed to reject the null hypothesis of white noise in all six equations as shown in Table 4.7 below, indicating that all statistically important information has been captured by the model and only while noise remains in the residuals.

Table 4.7 White Noise Tests of the Residuals from Causality Equations, 1996-2002

Commodity	[a]Barrlettss K-S Statistic	[a]Fishers Kappa
US Corn Farm→ Korea Corn Import	.0754	2.96
Korea Corn Import→ US Corn Farm	.0859	3.74
US Soybean Farm→ Korea Soybean Import	.0952	3.03
Korea Soybean Import→ US Soybean Farm	.1766	4.08
US Wheat Farm→ Korea Wheat Import	.0910	4.85
Korea Wheat Import→ US Wheat Farm	.1901	4.03

a Tests failed to reject the null hypothesis of white noise residuals at the ten percent level of significance in all 6 equations.

The causality F statistics, equation F statistics, and R^2 values are shown in the table below. All of the six equations show significant F statistics at the five percent level, indicating significant explanatory power for the equations. The R^2 values are all below .32, however, this is not unexpected. Equations with monthly price changes would not be expected to have nearly as high R^2 values, as for example, undifferenced annual data (price levels).

All three grains were found to have a two month lag between the U.S. farm price and the Korean import price, according to the AIC statistic for identification of the causality equations (Table 4.8). For example, U.S. farm corn price is found to lead or "cause" Korean corn import price by two months. This was expected to find that U.S. farm markets lead Korean import markets for grain. It would indicate that the price is determined primarily in the U.S. market, and then the price information is transmitted to Korea. This shows that the price is determined primarily on the exporter side or supply side. The importer side, or demand side in Korea, has less influence on initially determining the price compared to the supply side in the U.S. This could be partially because there may be more significant supply shifts in the market than demand shifts. However, it is more likely that the U.S. being a large country in the world grain market, that it has more influence on price than a smaller country such as Korea.

The lag time between markets can provide an estimate of relative pricing efficiency between two markets. A shorter lag time indicates higher price efficiency between markets. The results below showing that prices take about two months to be transmitted from U.S. farm level to Korean import level for grains seems reasonably efficient. It is interesting that the price transmission if found to be the same, two months, for each commodity, and indicates that each commodity has a similar pricing efficiency level. This is within range of results of Boyd and Brorsen (1986), for example, who found that international price transmission between the U.S. and Europe typically takes between about three and nine weeks. One reason for the lag time and longer information flow and price transmission between markets may be shipping and transportation time. Since Korea is considerably further

than Europe from the U.S., the two month price transmission time appears reasonable to transport grain from the farm to the end user in Korea. Some pricing rigidities may also account for the two month lag in prices. For example, merchants in the Korean import market may be reluctant to change their prices until they are certain that the shift in supply or demand is justified. Overall, the grain import market pricing appears to be reasonably efficient.

Table 4.8 Monthly Price Causality Lead-Lag Relationships and Equation Results for Corn, Soybeans and Wheat, 1991-96

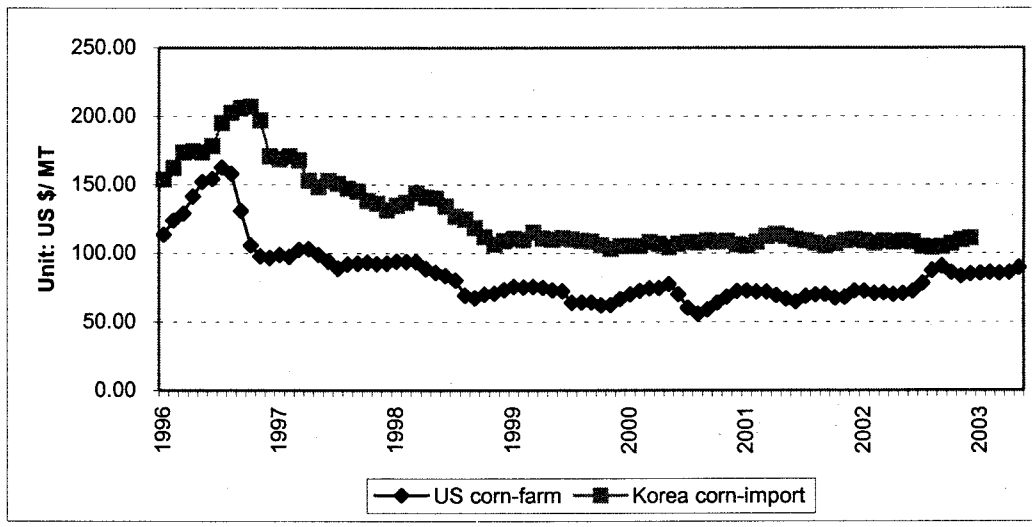
Commodity	Causality Wald F-Statistic	Equation F-statistic	R^2
US Corn Farm→ 2[a] Korea Corn Import	8.81*	7.86*	.29
Korea Corn Import→ 2[a] US Corn Farm	.08	9.35*	.32
US Soybean Farm → 2[a] Korea Soybean Import	5.93*	3.44*	.15
Korea Soybean Import → 2[a] US Soybean Farm	.46	2.73*	.13
US Wheat Farm→ 2[a] Korea Wheat Import	8.67*	9.87*	.34
Korea Wheat Import→ 2[a] US Wheat Farm	1.16	3.25*	.15

* Indicates significance at 5 percent level.

a For example, US corn farm price leads or causes Korean corn import price by 2 months, as evidenced by the significant causality Wald F-statistic

Graphically, the data can be examined from the figures below. The Korean government relaxed border measures for several commodities trading under the Uruguay Round agreement in 1994 and the impacts of market liberalization are revealed in this price comparison. Figure 4.1, 4.2 and 4.3 report price comparison U.S. farm and Korean import prices for corn, soybean and wheat and Figures 4.4, 4.5 and 4.6 report price comparison for beef, pork and chicken sectors.

Figure 4.1 Corn: US Farm vs. Korea Import Prices



Overall, prices of U.S. farm level and Korean import level were more correlated in grain sectors than in meat sectors. The import price in Korea and the U.S. farm price in the corn sector were highly connected and the difference between these two price levels may imply transaction costs of trading corn from the U.S. to Korea, including transportation and import costs.

The U.S. farm price and Korean import price of wheat had a relatively close price movement, which may be primarily due to the wheat trade liberalization that took place in 1990 in South Korea. Imports of soybeans and corn continue to grow with decreasing domestic production and with the increased demand for animal feed.

Figure 4.2 Soybean: US Farm vs. Korea Import Prices

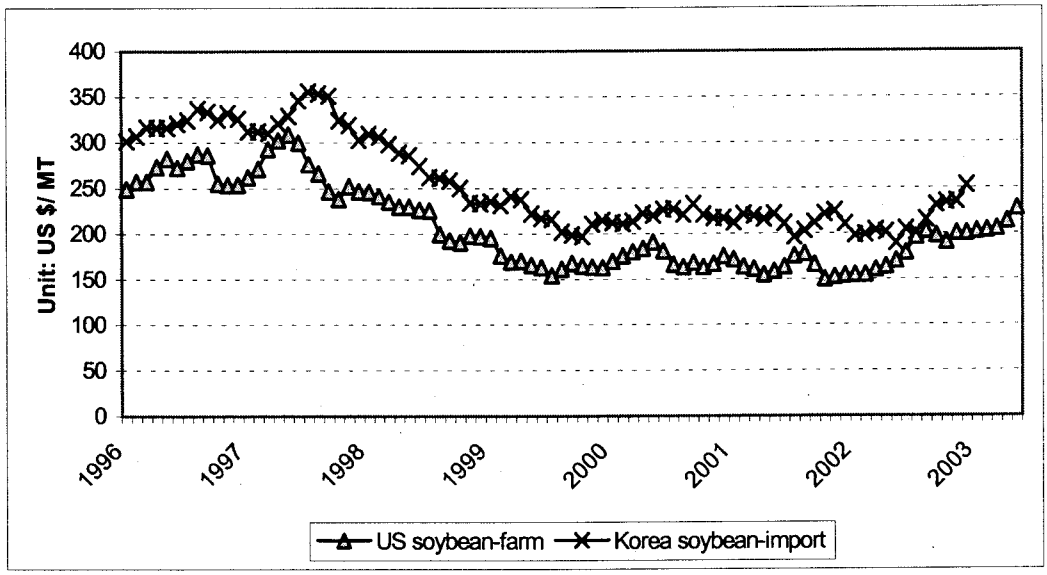
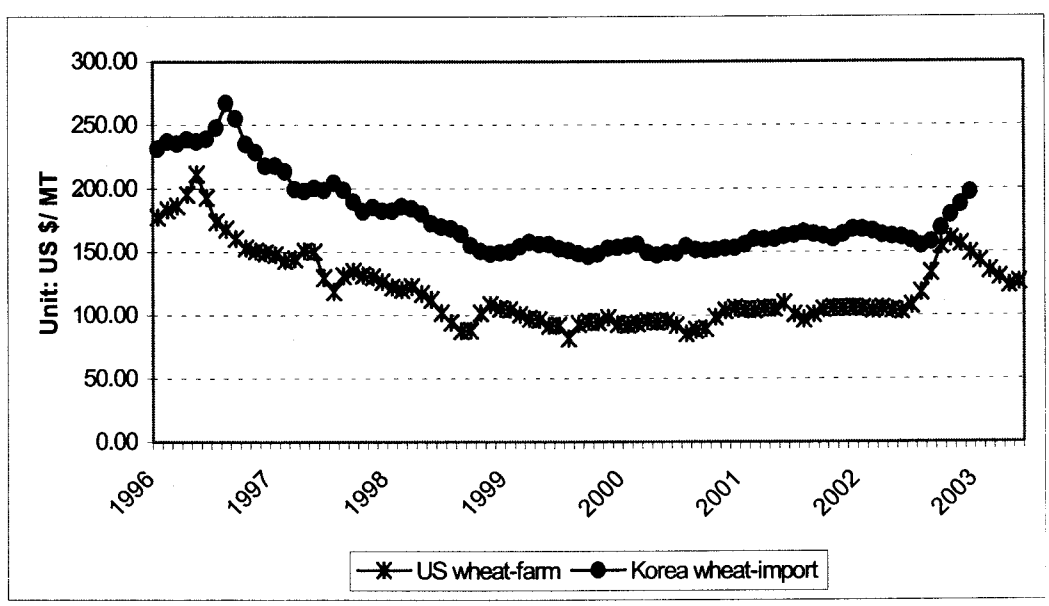


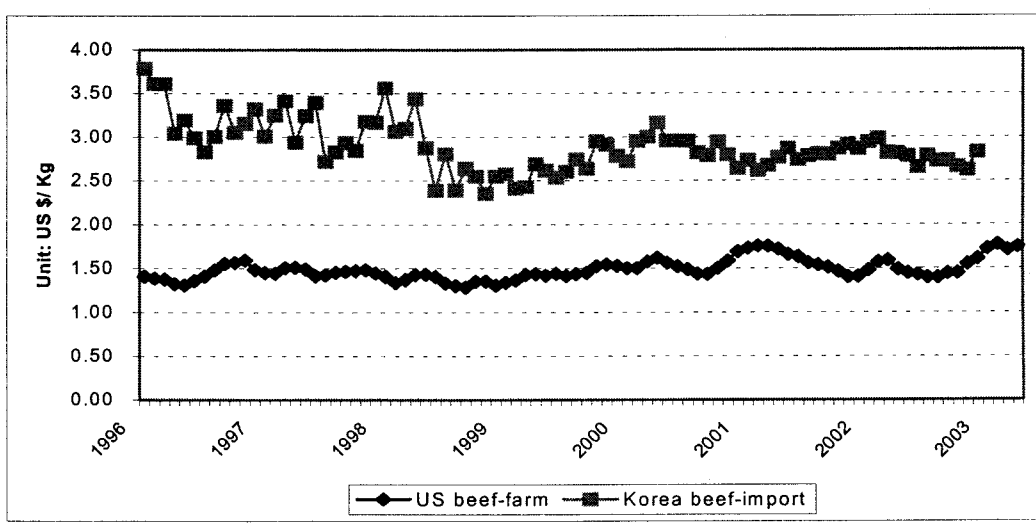
Figure 4.3 Wheat: US Farm vs. Korea Import Prices



The livestock industries in South Korea are heavily dependent on imported feed grains and the Korean government allows the livestock producers to have competitive input costs by eliminating border measures on imported feed grains. Consequently, the import prices of corn and soybeans stay at much lower level compared to the farm prices. Reduction in the border restrictions for grain translates into a closer price movement between the U.S. farm price and the Korean import price of grains.

Some caution has to be paid in comparing U.S. price and Korean import price of meat sectors. The U.S. farm prices are the price of live animal, while the Korean import prices are the price of processed meat products. Thus, the price gap between the Korean meat import price and U.S. farm prices is fairly wide as the processing costs of U.S. meat products are not included in the U.S. price level, so the prices differ by form as well by space.

Figure 4.4 Beef: US Farm vs. Korea Import Prices



The price gap between the Korean import price and the U.S. farm price for both pork and chicken sectors narrowed substantially since 1998. The complete market liberalization of pork and poultry imports in 1997 contributed to this narrowing price gap. The tariff rate for frozen pork was 33.4% in 1997 and scheduled to be reduced to 25 % by 2004, which is reflected in the price movement of the Korean import price. In contrast, the import price of beef in Korea does not appear to move closely with the U.S. farm price despite the market liberalization in 2000.

Figure 4.5 Pork: US Farm vs. Korea Import Prices

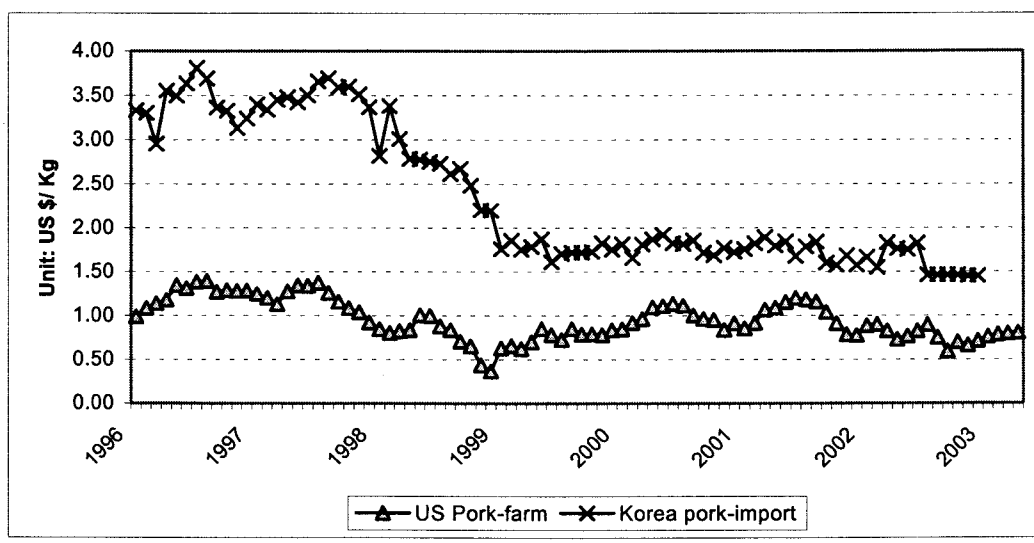
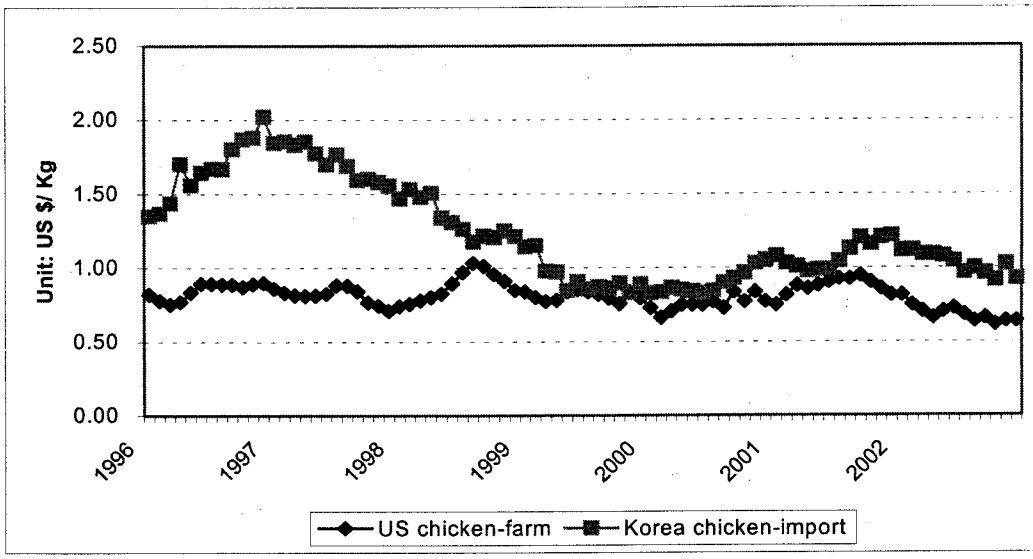


Figure 4.6 Chicken: US Farm vs. Korea Import Prices



Overall, comparison of the U.S. farm prices and the Korean import prices indicated that there were several factors affecting the price movement of Korean import prices of selected commodities that were different from the price movement of the U.S. farm prices. First, the financial crisis in 1997 had a significant impact on the import price of all commodities in Korea. The import prices (in US $ term) declined significantly in 1998 due to devaluation of Korean won against U.S. dollar and gradually recovered through 1999 and 2000. Another important factor that influenced the price movements was extensive market liberalization scheme in various commodity sectors in South Korea. Under the Uruguay Round agreement, the Korean government reduced border measures in most of the import-dependant sectors. The Korean import prices in most commodity sectors had closer price movements to the U.S. farm prices since mid-1990s, with market liberalization process.

Grain imports have been priced from a high of around $50/MT above U.S. farm prices, to a low of about $10/MT above U.S. farm prices. In more recent years, the price difference between the two markets appears to be narrowing slightly. On the meat side, import prices dropped substantially for beef, chicken, and pork in relation to U.S. farm prices. This likely reflects the lagged effects of increased liberalization in the Korean market, combined with lower income following the financial crisis, resulting in moderated demand for meat imports.

For example, the Korean pork import price to U.S. farm price ratio dropped from about 3.5/1.5 = 2.3 in 1997/98 to about 1.7/.9 = 1.9 in 2000. For beef, the ratio dropped from about 3.3/1.5 = 2.2 to 2.7/1.5 = 1.8, while chicken dropped from about 1.7/.8 = 2.1 to about .9/.7 = 1.3 level. These results indicate that considerable liberalization has began to take effect for the Korean meat market by the year 2000.

However, there are some counteractive factors that decelerate the market integration between the U.S. farm level and the Korean import level. For example, some commodity end-users and buyer groups (e.g. millers and grain processors) in Korea have sizeable purchasing power, partially gained through market privatization and consolidation. This may have price distorting effect in the Korean import markets. Also, comparing prices of products with different nature (i.e. live-animal vs. processed meat products) may factor into less price linkage in the meat sectors, as rigidities in value added process create additional price diversion.

Section 3. Comparison of Korean Import and Farm & Wholesale Prices

Results in Table 4.9 below show that price transmission for grains from import price to Korean farm price is fairly low. For example, Beta is .09 for soybeans, compared with a Beta of .82 from U.S. farm price to import price, as indicated in the earlier table. This is expected as grain markets in Korea for wheat, corn, and soybeans are relative open and reflect world price, whereas Korean farm level grain markets are not as closely linked to world price. Therefore, the U.S. price, e.g. world price connection to import price is greater than the import price connection to Korean domestic price.

However, Korean beef import prices showed a relatively close connection to Korean farm prices, with a Beta of .97 and an R^2 with a .60 value. Therefore, Korean beef import price appears to be linked more closely to Korean farm beef price than U.S. farm beef price, e.g. world price. This likely reflects that the Korean beef market still faces some barriers to imports. In contrast, import chicken and pork markets in Korea appear slightly more closely linked to U.S. farm price e.g. world price than Korean farm price.

The financial crisis from October 1997 through January 1999 appears to have a major impact on Korean farm prices. Price transmission results from Korean import price to Korean farm price in Table 4.9 below show a statistically significant T-value for the binary variable in each equation representing the financial crisis. Beef showed the largest impact from the financial crisis, as the binary variable for beef for the

financial crisis had a large coefficient of -.51 for the financial crisis, indicating a large drop in Korean domestic beef prices during this time when measured in U.S. dollars. The drop in Korean beef price in U.S. dollar terms can be linked to the drop in the exchange rate as well as the drop in demand for beef in Korea, given the lower income and credit during the financial crisis. This is expected that beef imports would be most impacted compared to other commodities, because beef would be most sensitive to changes in income compared to other meats, as beef has a high income elasticity.

Table 4.9 Monthly Price Transmission Elasticity from Import Price to Korean Farm Price, 1996-2002, Prices in $US a/

	Constant	β^a	D1	R^2
Corn	4.30 (19.57)	0.39 (8.51)	-0.27 (-11.68)	0.71
Soybean	7.14 (16.50)	0.09 (1.11)	-0.39 (-10.26)	0.57
Beef	0.64 (2.78)	0.97 (4.51)	-0.51 (-9.52)	0.60
Pork	0.15 (3.30)	0.45 (8.04)	-0.34 (-7.31)	0.53
Chicken	0.03 (0.83)	0.39 (3.90)	-0.18 (-2.62)	0.18

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

The Table 4.10 shows price transmission results from Korean import price to Korean wholesale price. The most important result is that once again the financial crisis shows a large impact on Korean prices, in this case wholesale prices. In the case of all commodities, the binary

variable for the financial crisis has a T-value greater than 2.0 and so is statistically significant. Beef once again shows a large -.46 coefficient on the financial crisis binary variable, indicating the beef wholesale price as measured in U.S. dollars was substantially impacted by the financial crisis. As well, the wholesale soybean price was impacted substantially by the financial crisis as well, as indicated by the large negative sign on the binary variable with a -.52 coefficient.

Table 4.10 Monthly Price Transmission Elasticity from Import Price to Korean Wholesale Price, 1996-2002, Prices in $US, 1996-2002 a/

	Constant	β^a	D1	R^2
Soybean	6.30	0.29	-0.52	0.46
	(8.83)	(2.24)	(-8.35)	
Beef	1.33	0.55	-0.46	0.52
	(5.81)	(2.57)	(-8.66)	
Pork	0.57	0.41	-0.36	0.51
	(12.10)	(7.13)	(-7.75)	
Chicken	0.66	0.53	-0.24	0.34
	(23.08)	(5.88)	(-4.03)	

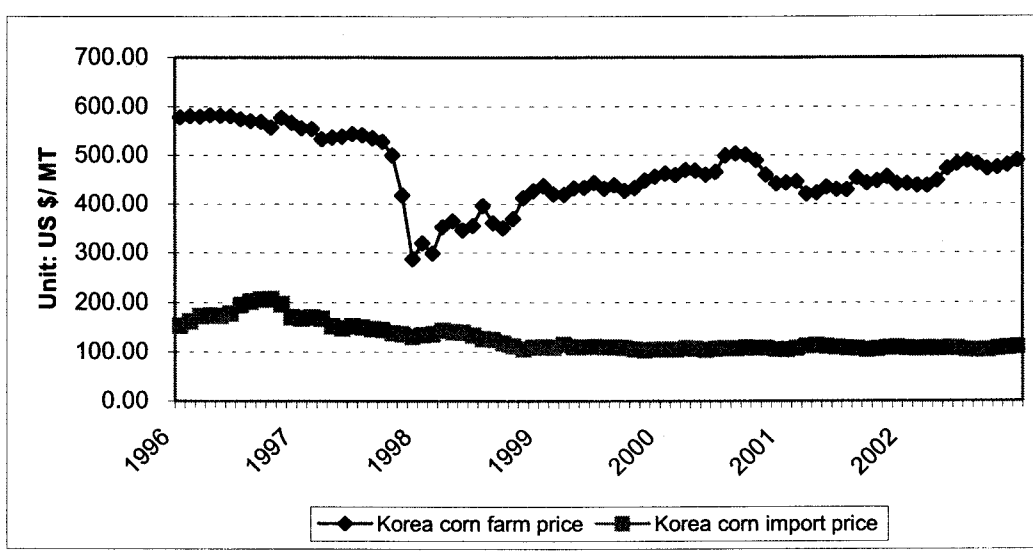
a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

Examining the figures below, the price of agricultural commodities show higher fluctuations relative to non-agricultural products as the result of a complex mixture of changes associated with seasonal, cyclical, trend and irregular factors. Prices of storable commodities (i.e. grains) have a seasonal pattern of change, while prices of perishable commodities (i.e. meat and vegetables) exhibit cyclical behavior. Price cycles for agricultural commodities vary in length and amplitude of fluctuations.

Price movements of Korean farm and import prices are compared for each commodity selected for analysis in this study. Figures 4.7, 4.8 and 4.9 present a comparison of Korean import and Korean farm prices of grain commodities such as corn, soybean and wheat, while Figure 4.10, 4.11 and 4.12 present price comparisons of Korean import and Korean wholesale for three major meat commodities.

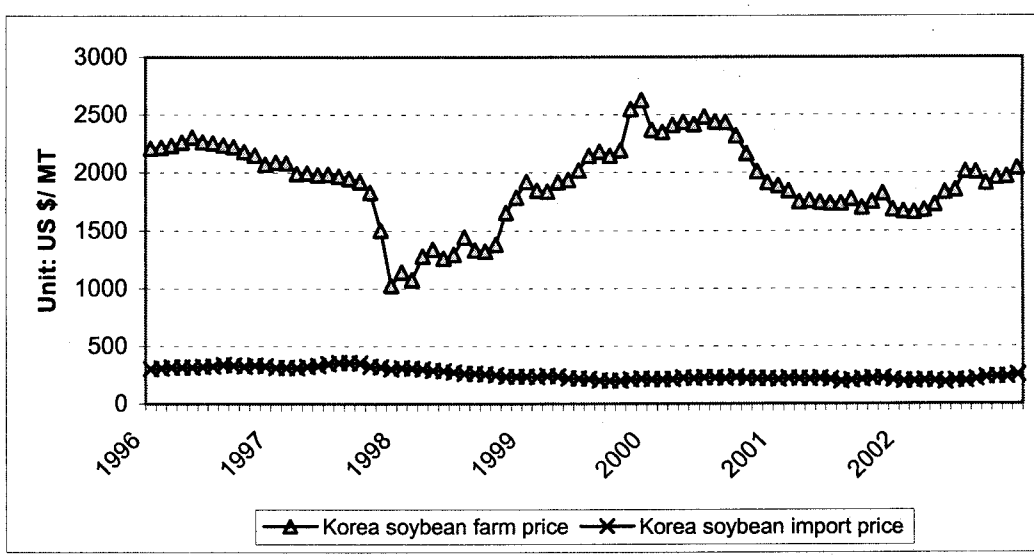
Overall, there were limited connections between Korean farm and Korean import prices and domestic prices for the meat and grain sectors in South Korea. Import prices of corn, soybean and wheat remained relatively stable since 1996, while import prices of pork, chicken and beef showed more variance in the price movement. While the import prices of grain remained at relatively low and even level, farm prices of grain soybean and corn had more fluctuation. Thus, there were limited connection between import and farm prices of corn and soybean.

Figure 4.7 Corn: Korea Farm vs. Korea Import Prices



The Korean farm price of soybeans is at considerably higher level compared to corn (Figure 4.7 & 4.8), and this may be due to the importance of soybean in making to for human consumption. Imports of barley, corn, and soybeans for feed grains were liberalized in 1995 and allowed for end-users, while imports of these grains for human consumption are subject to tariff rate quota. The import quantity restriction and differential tariff rate imposed on barley, soybeans for food led to a higher farm price level than feed grains.

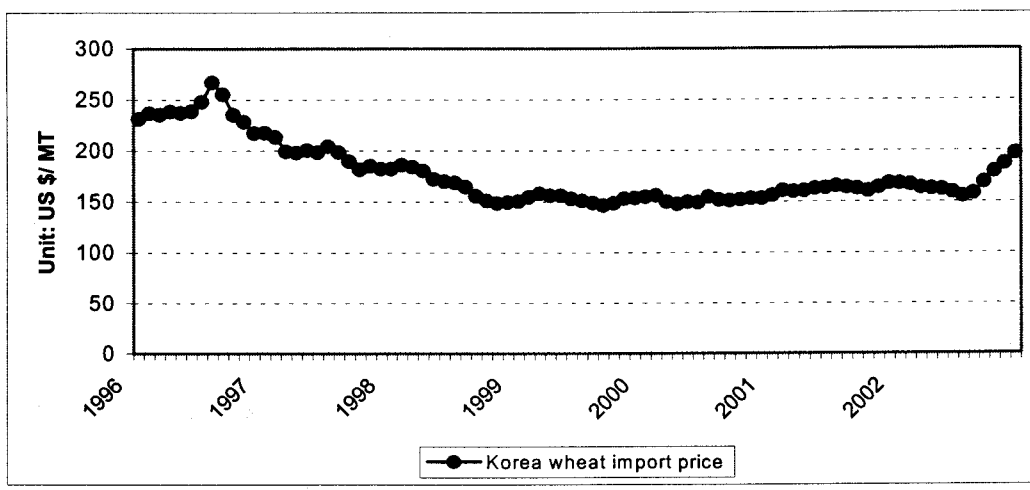
Figure 4.8 Soybean: Korea Farm vs. Korea Import Prices



The Korean government has price supports for soybean to ensure stable supply of domestic soybeans for human consumption, and loosens its control on supply of imported soybeans which are mostly used in producing feedstuffs(75 % of import volume). For soybeans, the Price Differential Compensation Program (PDCP) has been implemented since 1989. The government purchases soybeans at its guaranteed price from farmers and resells to soybean processors.

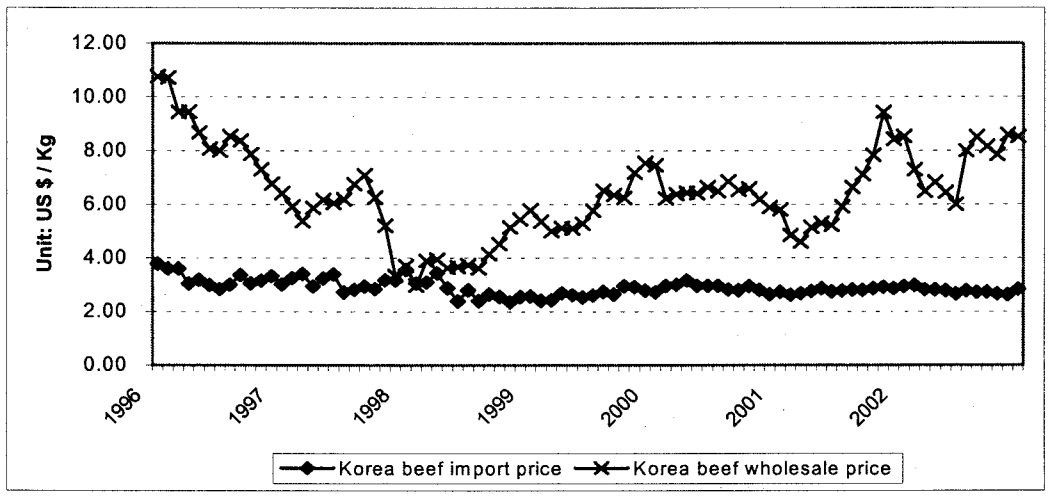
Also, the tariff rates for soybean and corn were 5% and 3%, respectively. The MAF's current rice policy that encourages planting of alternative crops to reduce rice production may also have effects on the farm price of corn, soybean and barley. As the Korean rice farmers switch away from rice to alternative crop production with financial support from the MAF, supply of these crops is likely to increase in long term.

Figure 4.9 Korea Wheat Import Prices



There was more variation in the price movements in the meat sectors (Figure 4.10, 4.11 & 4.12). For meat sectors, the import prices were compared with the wholesale prices since farm price of meat sector are the prices of live-animal, while import price of meat includes costs that incur due to processing of meat.

Figure 4.10 Beef: Korea Import vs. Korea Wholesale Prices



The import price of beef remained within a range between US$ 2.00/kg and US $ 4.00/kg, while the wholesale price of beef in Korea showed a high variance in price movement (Figure 4.10). The import price and the wholesale price of beef converged in 1998, which is due to a significant decrease in the price of the Korean wholesale price. This is viewed to be a consequence of the 1997 financial crisis. Rapid devaluation of the Korean won during the financial crisis in 1997 made the import price of feed grains very high, which led the cattle producers in Korea to release their herds into market. During this period, Korean consumption of beef declined significantly low as consumers' disposable income decreased and consumers substituted beef with alternative meat. Shocks from both supply and demand sides led to significant fall in the wholesale price of beef. However, the wholesale price of beef recovered rapidly as the Korean economy regained its strength.

Figure 4.11 Pork: Korea Import vs. Korea Wholesale Prices

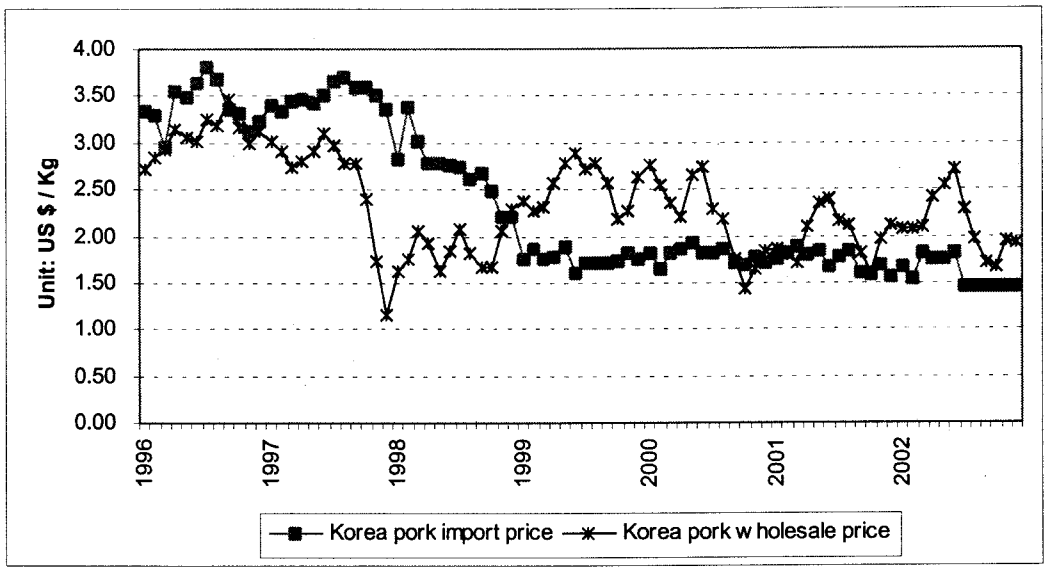
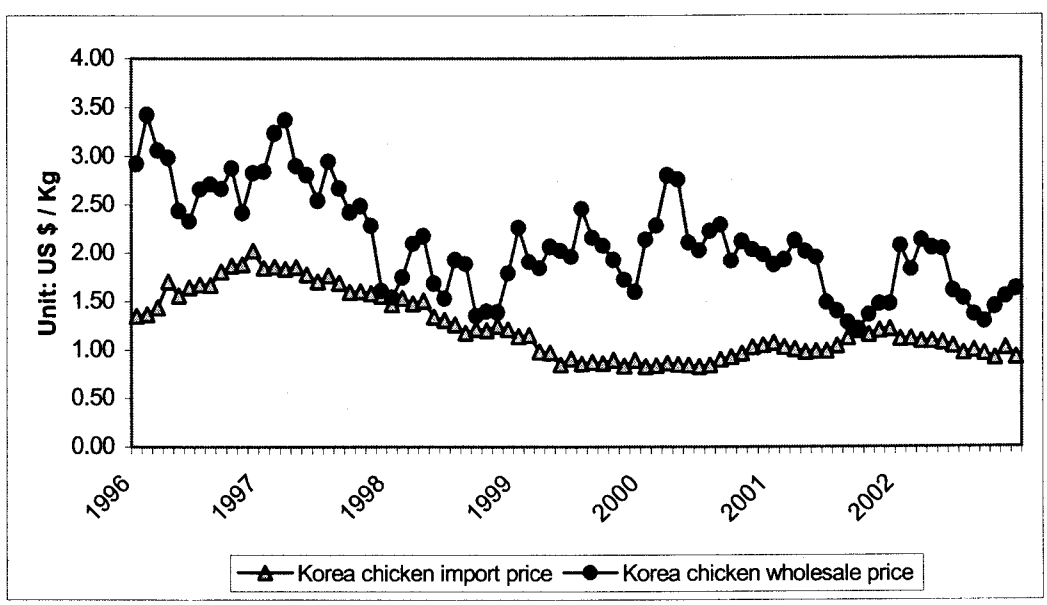


Figure 4.12 Chicken: Korea Farm vs. Korea Import Prices



The pork sector showed a closer price gap between the import level and the Korean wholesale price level compared to other meat sectors (Figure 4.11). For past two decades, the size of Korean hog farm has significantly increased, which resulted in improved efficiency and competitiveness in the Korean pork sector.

Wholesale price of chicken in Korea (Figure 4.12) showed more fluctuations than those of other meat sectors. This is primarily due to relatively short production cycle of poultry sector, ineffective marketing structure and low production adjustment capability of the Korean poultry industry (KREI 2000, p146).

Section 4. Comparison of Macroeconomic Variables and Korean Prices

The farm price of a commodity is influenced by changes in microeconomic factors that originate within the agricultural sector, but it is also influenced by macroeconomic variables, including monetary, fiscal and trade policies (Tomek & Robinson 1990, p 179). Therefore, it is important that agricultural market and price analysis should be viewed in national and international scope to examine macroeconomic forces that externally impact the agricultural sector.

The currency exchange rate is of particular importance given its impact on import prices during the financial crisis. The currency exchange rate has a significant impact on commodity prices as it becomes embedded in the import price of commodities through trading process. The prices of commodities that are heavily dependent on imports are especially sensitive to changes in the exchange rate that is

the price of one currency relative to another. Exchange rate pass through hypothesis suggests that the import price of commodity has a high positive correlation with exchange rate, if the market in a given country and is sufficiently small to not substantially influence world price, and if the market is efficient. In other words, as the Korean won devalues, the import price of commodity increases in Korean won value, since more Korean currency must be paid to purchase the imported commodities. If markets are fully integrated and efficient, and the country is small and is only an importer of the commodity, then the exchange rate pass through coefficient could have a Beta value of near one. In other words, if the exchange rate pass through coefficient is equal to one, then if the Korean Won/USD rate increases, (meaning the Won devalues) by 1%, then corn imports valued in Won would increase by 1% as well.

Table 4.11 results below show the exchange rate pass through (price transmission) coefficient for 1996-2002 for various commodities. Beef shows the highest exchange rate pass through coefficient, with a relatively high value of .75, and a relatively high R^2 at the .73 level. Since beef retailers have not found it overly difficult to pass on price increases to consumers (as later analysis shows), it appears that beef retailers would be able to pass on exchange rate changes in the form of higher or lower prices to the customer, thus allowing a relatively high exchange rate pass through for beef. Pork and chicken show basically no relationship regarding exchange rate pass through with very low R^2 values near zero, possibly because there are more limited imports of chicken and pork. Corn and soybeans also show relatively low exchange rate pass through of .21 and .38, and low R^2 values of .08 and .18, indicating very limited relationship to the exchange rate.

Table 4.11 Monthly Price Transmission Elasticity from Exchange rate (Won/$US) to Import Price (Won), 1996-2002 a/

	Constant	β^a	R^2
Corn	3.48	0.21	0.08
	(6.16)	(2.59)	
Soybean	3.00	0.38	0.18
	(4.87)	(4.30)	
Wheat	2.67	.37	0.30
	(6.07)	(5.93)	
Beef	2.79	0.75	0.73
	(7.89)	(14.96)	
Pork	7.85	-0.26	0.000
	(7.25)	(-0.02)	
Chicken	5.37	0.26	0.05
	(5.86)	(2.00)	

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses.

However, the Table 4.12 for exchange rate pass through for the 1997-98 financial crisis (data October 1997- January 1999) shows very high exchange rate pass through coefficients. All coefficients are above one, are statistically significant, and most have relatively high R^2 values. This indicates that the exchange rate has a very large impact on import prices during the financial crisis. When the exchange rate devalues by one percent, imports increase in price by more than one percent. This may be due to merchants anticipating the exchange rate, and then over reacting due to the crisis and adjusting import prices by amounts larger than the actual exchange rate changes. The excessive exchange rate pass through illustrates the extent of excessive import price volatility brought on by the financial crisis, and disruption to the import market.

Table 4.12 Monthly Price Transmission Elasticity from Exchange rate (Won/$US) to Import Price (Won), 1997-1998 a/

	Constant	β^a	R^2
Corn	-3.30 (6.09)	1.17 (6.09)	0.73
Soybean	-2.35 (-1.53)	1.15 (5.35)	0.67
Wheat	-3.06 (-2.62)	1.18 (7.25)	0.79
Beef	-1.18 (-0.68)	1.31 (5.42)	0.68
Pork	-0.81 (-0.31)	1.25 (3.47)	0.46
Chicken	-0.58 (-0.35)	1.12 (4.93)	0.63

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. Data covers the financial crisis from October 1997 through January 1999

CPI measures the change in the cost of a market basket of consumer goods relative to the cost in some base period. Results in Table 4.13 show price transmission elasticity from Korean consumer price index (CPI) to Korean farm meat and farm grain prices. The grain prices consisting of corn, soybeans, and barley have kept up with inflation over the period, with coefficients of 1.08, 1.56, and 1.25, and reasonable R^2 values. However, rice did not keep up with inflation, as evidenced by a coefficient of .81. Beef , pork, and chicken prices showed relatively low correlation with inflation, and appear to be changing at less than inflation except for beef, with a 1.39 coefficient.

The three grain prices kept up with inflation because of the policy of

government support for these commodities. The rice coefficient is lower than other grains, as rice prices began to drop around 2001. Overall, these results indicate sufficient farmer welfare for the grain sector on the price side as grain prices have kept up with inflation, except for rice. Both pork and chicken show very low coefficients on of .04 and .21 and low R^2 values, indicating these meat prices did not keep up with inflation. This may be because these commodities have been liberalized considerably, and are no longer supported like the grain sector. Therefore, meat prices of chicken and pork have adjusted more downward toward world price levels.

The Table 4.13 results also show transmission from consumer price index to retail prices for rice, beef, and pork. Results show that beef and pork have fairly high price transmission from the CPI, with coefficients of 2.15 and 3.25, respectively. This indicates that retailers have been able to pass on price increases to consumers at rates greater than the inflation rate. However, the rice coefficient is .82, indicating that retail rice price increases have been lower than the inflation rate.

Table 4.13 Monthly Price Transmission Elasticity from Korean Consumer Price Index(1983=100) to Korean Farm & Retail Price (Won), 1996-2002 a/

	Constant	β^a	R^2
a) Price Transmission Elasticity from Korean Consumer Price Index (1983=100) to Korean Farm Price			
Corn	0.44 (1.93)	1.08 (25.37)	0.89
Soybean	-0.74 (-0.73)	1.56 (8.35)	0.46
Barley	-0.16 (-0.53)	1.25 (21.67)	0.85
Rice	3.17 (9.81)	0.81 (13.43)	0.69
Beef	1.09 (0.63)	1.39 (4.31)	0.18
Pork	7.28 (6.66)	0.04 (0.18)	0.0004
Chicken	5.94 (3.30)	0.21 (0.64)	0.0049
b) Price Transmission Elasticity from Korean Consumer Price Index (1983=100) to Retail Korean Price			
Rice	3.27 (14.09)	0.82 (18.91)	0.81
Beef	-1.82 (-1.09)	2.15 (6.93)	0.37
Pork	-8.68 (-10.12)	3.25 (20.40)	0.84

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses

Examining the exchange rate figures below, the Korean Won exchange rate (won/USD) variable is compared with Korean import prices to assess possible impacts. Figures 4.13 and 4.14 present comparison of exchange rate with Korean meat and grain import prices. Figures 4.13 and 4.14 show a clear indication of the significant impact of the financial crisis on the commodity import prices. Between 1998 and 1999, the Korean won devalued and the exchange rate had a sharp increase, which raised commodity import prices. Since beef was more import-dependent compared to pork and poultry sectors, the beef import price appears to increase more than pork and chicken import prices.

The grain import prices did not show as high an increase in the price level as meat import prices during the financial crisis. This is due to availability of credit from exporting countries for Korean grain buyers in importing grains during the financial crisis. The Korean millers have access to GSM-102 (a credit guarantee) that is provided by the U.S. government. The GSM-102 allows mills to repay their debt with a lower amount of Korean currency (Won) at the end of a credit term. Thus, the Korean millers who purchase imported grains directly could minimize the negative impact of the financial crisis by using this credit guarantee. The grain import prices were not as severely affected as the meat import prices in 1998.

Figure 4.13 Exchange Rate vs. Korean Meat Import Prices

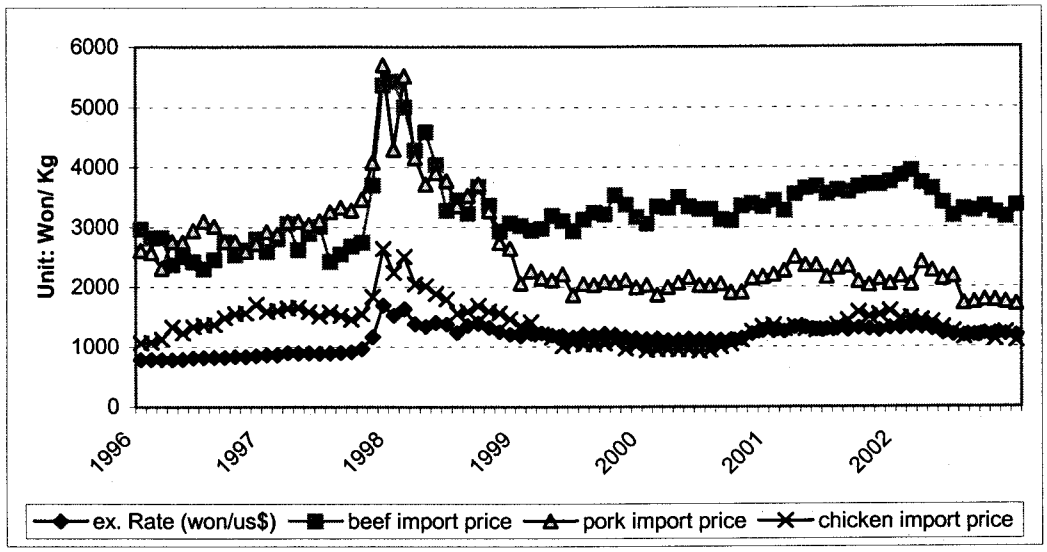
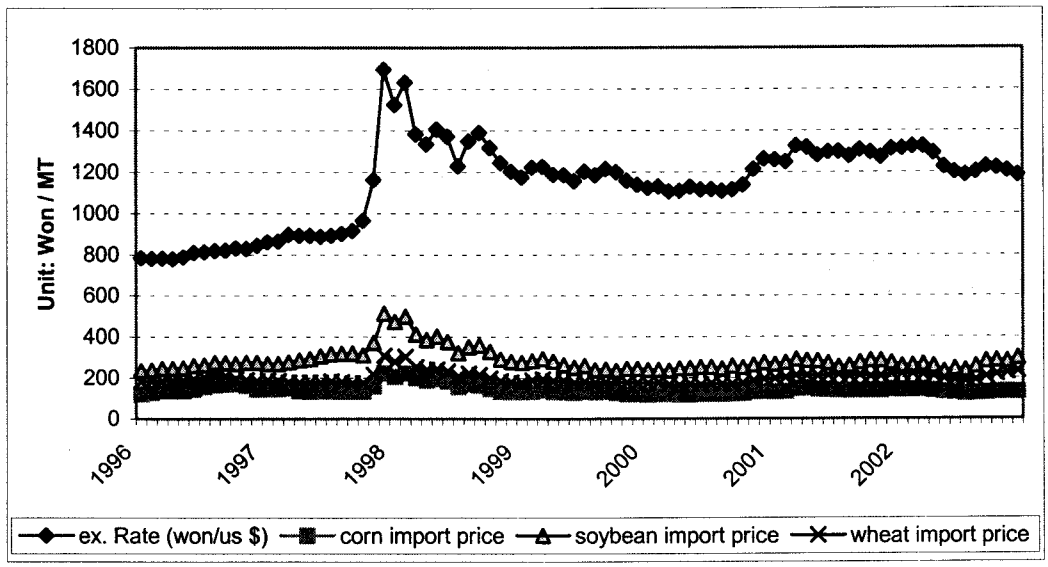


Figure 4.14 Exchange Rate vs. Korean Grain Import Prices



Examining Figures 4.15 and 4.16 shows a comparison of Consumer Price Index (CPI) and Korean meat and grain farm prices. Comparison of the CPI and commodity farm prices allows an evaluation of the value of each commodity relative to other goods that are included in a market basket.

Figure 4.15 CPI(1983=100) vs. Korea Meat Farm Prices

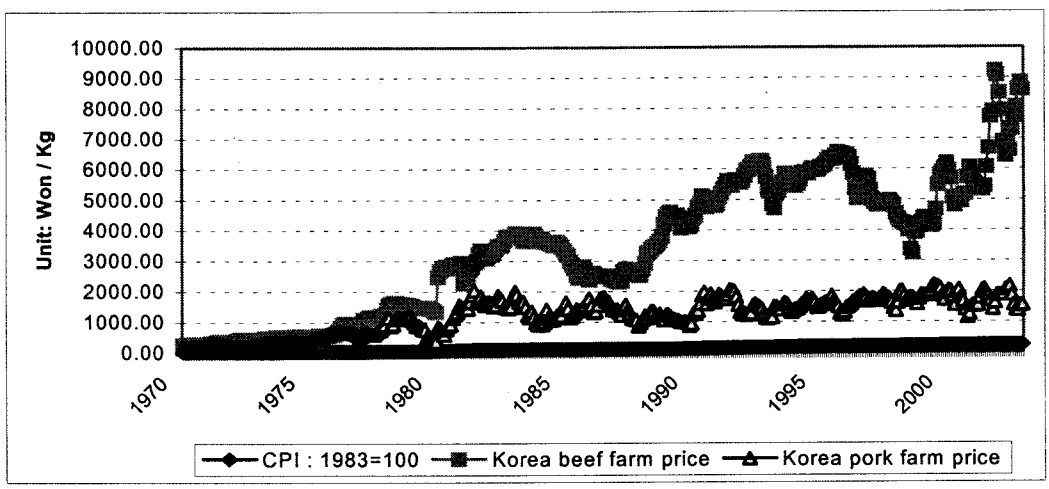


Figure 4.16 CPI (1983=100) vs. Korea Corn & Soybean Farm Prices

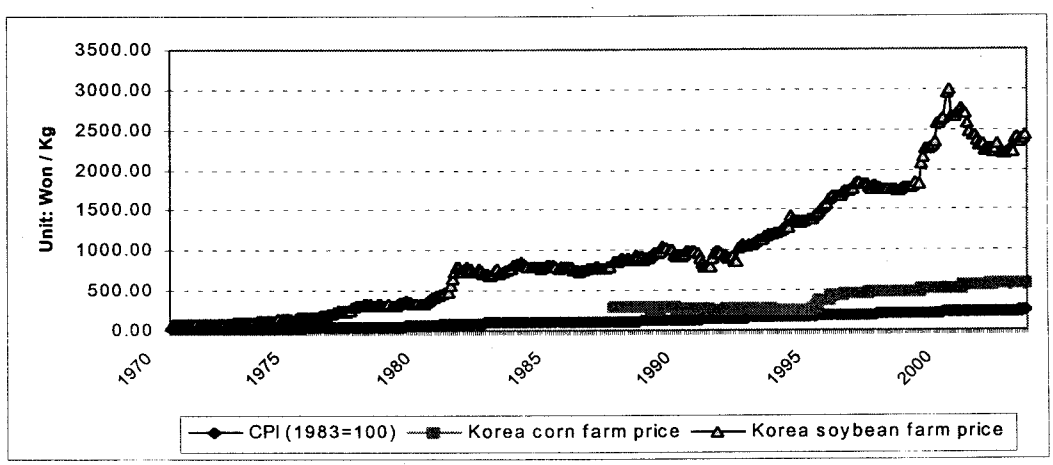
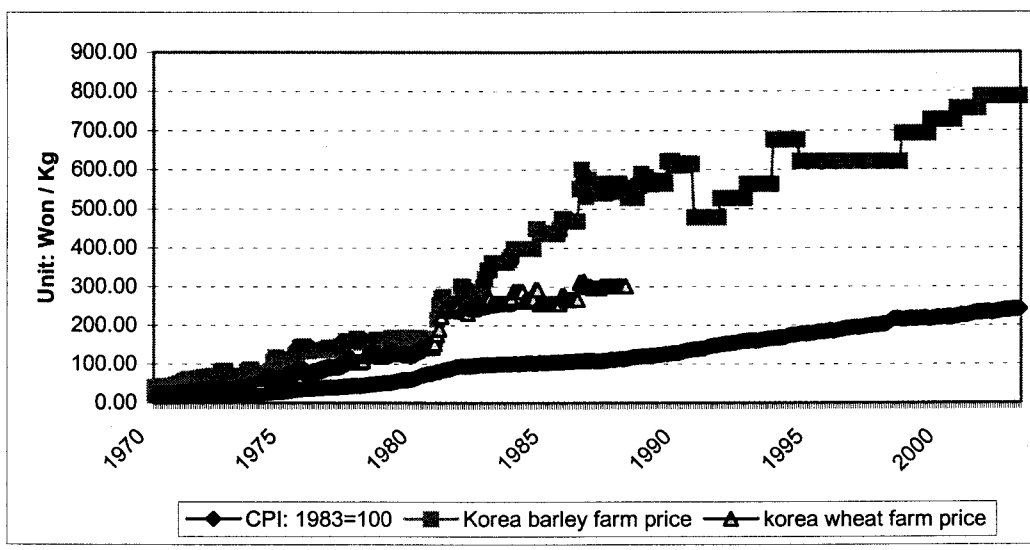


Figure 4.15 shows that the farm prices of beef and pork increase at different rate. The relative value of beef to other general goods is much higher than that of pork. Figure 4.16 and 4.17 are comparisons of the CPI versus grain farm prices. Figure 4.16 shows that the farm price of soybean increases at much higher rate than that of corn price. This may be primarily due to large proportion of soybean used as human consumption (i.e. tofu), adding demand-pull inflationary pressure on the farm price of soybean.

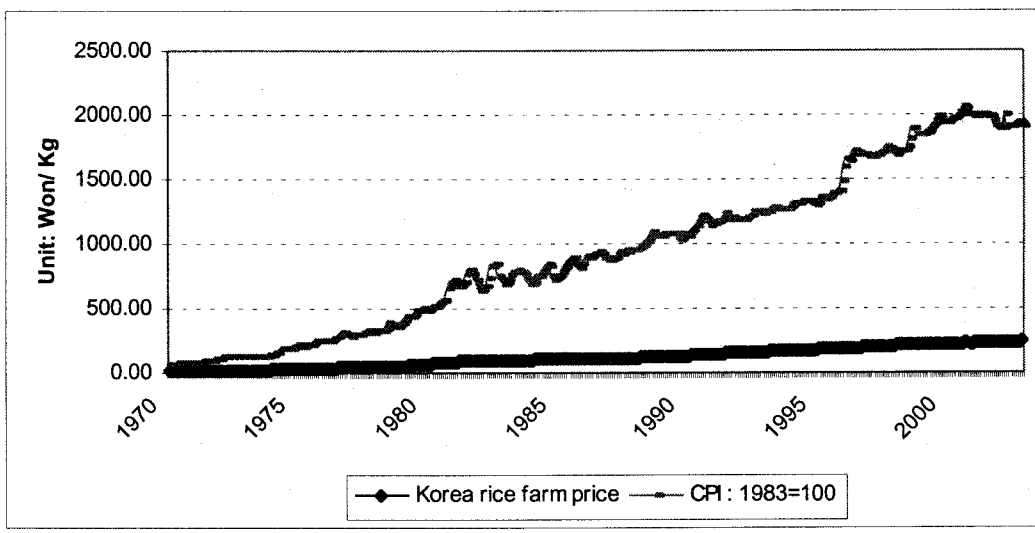
Figure 4.17 CPI (1983=100) vs. Korea Barley & Wheat Farm Prices



The rice farm prices in Korean increased consistently from 500 won/kg in 1980 to 2000 won/kg in 2002 (Figure 4.18). This price movement was induced by the Korean government's agricultural policy objective to achieve a high self-sufficiency in rice supply. The Korean government continues to purchase approximately 20 % of the domestic rice production at a guaranteed price in order to support the Korean

rice farmers. The government purchases continued to rise for past decade at a rate faster than the CPI. This suggests that the relative value of rice to other goods in a market basket has increased substantially for past few decades (Figure 4.18), though rice price has decreased in more recent years.

Figure 4.18 CPI (1983=100) vs. Korea Rice Farm Prices



Since 1970,, the farm price of beef increased at a high rate relative to the retail price other commodities. This implies that the relative high value of beef would likely to result in higher return for the beef producers than producers of other commodities. However, this does not automatically translate into an indicator of well being or of relative income changes among producers of different commodities.

Section 5. Comparison of U.S. Farm and Korean Farm Prices

In this section, farm prices of U.S. commodities and Korean commodities are compared in order to assess the competitiveness of each commodity market in Korea relative to the international market (i.e. the U.S. agriculture). Price ratios results are presented rather than price transmission elasticities, as there is limited price transmission between U.S. farm prices and Korean farm prices, especially for grains. This is because government support of Korean farm prices attempts to place prices well above world levels with objectives to provide farmer welfare consistent with urban welfare and also provide sufficient food security.

Figures 4.19, 4.20, 4.21, 4.22 and 4.23 show comparisons of U.S. farm price and Korean farm price in the grain sectors, while Figure 4.24, 4.25 and 4.26 show comparisons of farm prices in the meat sectors. Overall, the U.S. farm prices in both grain and meat sectors are relatively stable for the period between 1970 and 2002.

In the Korean agricultural market, farm prices of commodity sectors that are import dependent had a sharp price fall (in $US) relative to the international price during the period of 1997 to 1999 due to the financial crisis. These commodity sectors include beef, rice, soybeans, barley, corn and wheat. In general the farm price of commodities in Korea increased gradually for past three decades, except chicken and pork. The increasing farm price in Korea can be attributed to government price support programs on several grain commodity

sectors. Price of commodities such as pork and poultry have not been supported directly, although support programs on feed grains have influenced the prices of these commodities.

In Korea, the principal objective of government intervention in pricing farm products has been to enhance farm incomes and to achieve self-sufficiency in staple food products (i.e. rice) and to conserve foreign exchange by decreasing dependence on imports. In addition, the Korean government aims to sustain rural communities by providing supports to agricultural producers and to stabilize domestic agricultural prices with the combined management of price and supply. These primary mandates in agricultural policies are reflected in substantially higher prices of commodities price in Korea relative to the international prices.

Figure 4.19 Rice: Korea Farm vs. US Farm Prices

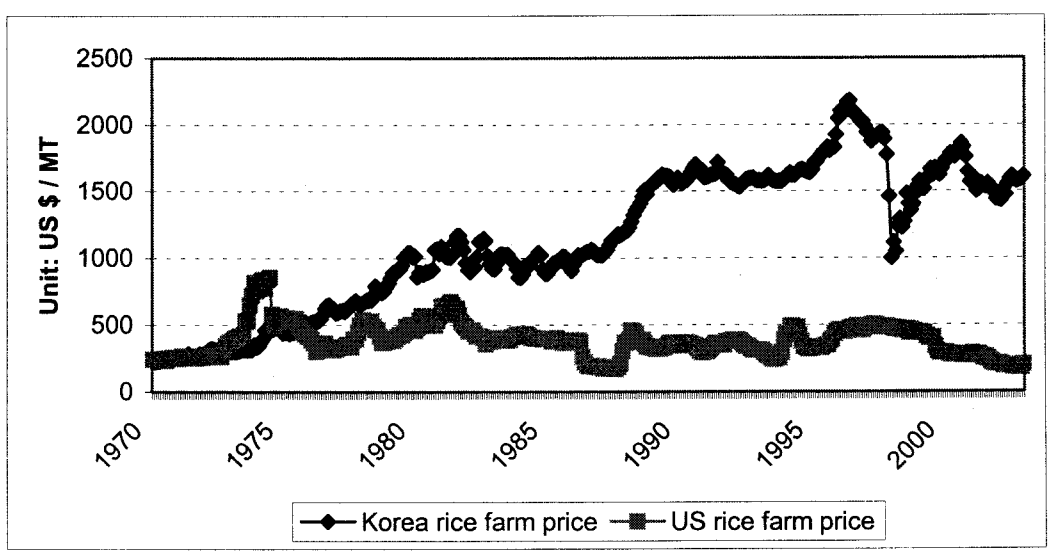


Figure 4.20 Wheat: Korea Farm vs. US Farm Prices

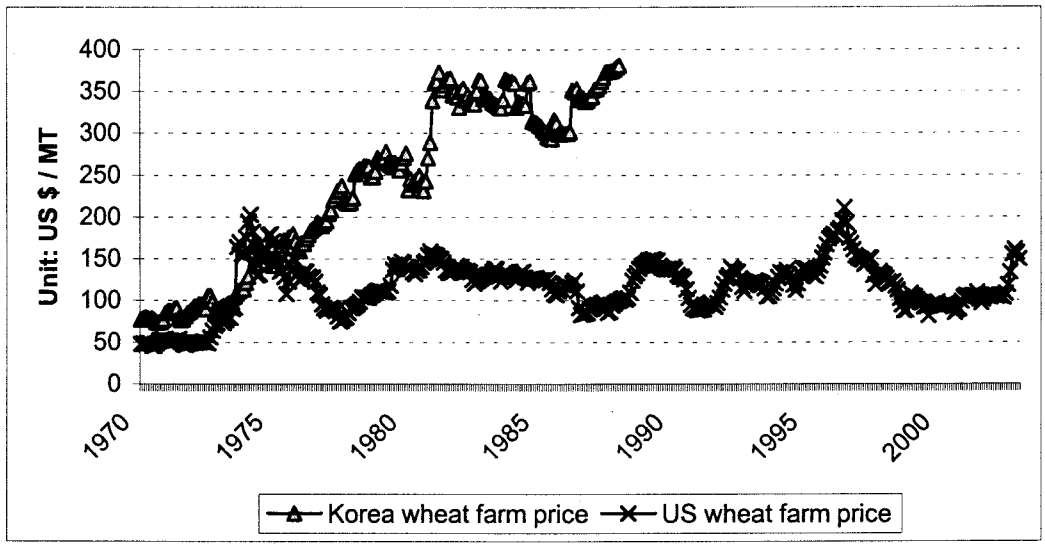


Figure 4.21 Soybean : Korea Farm vs. US Farm Prices

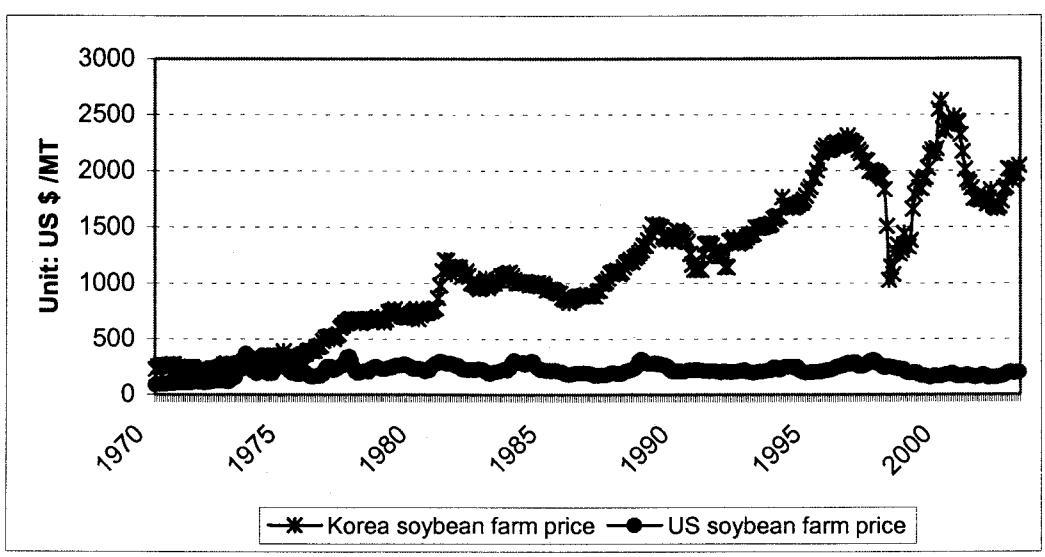


Figure 4.22 Barley: Korea Farm vs. US Farm Prices

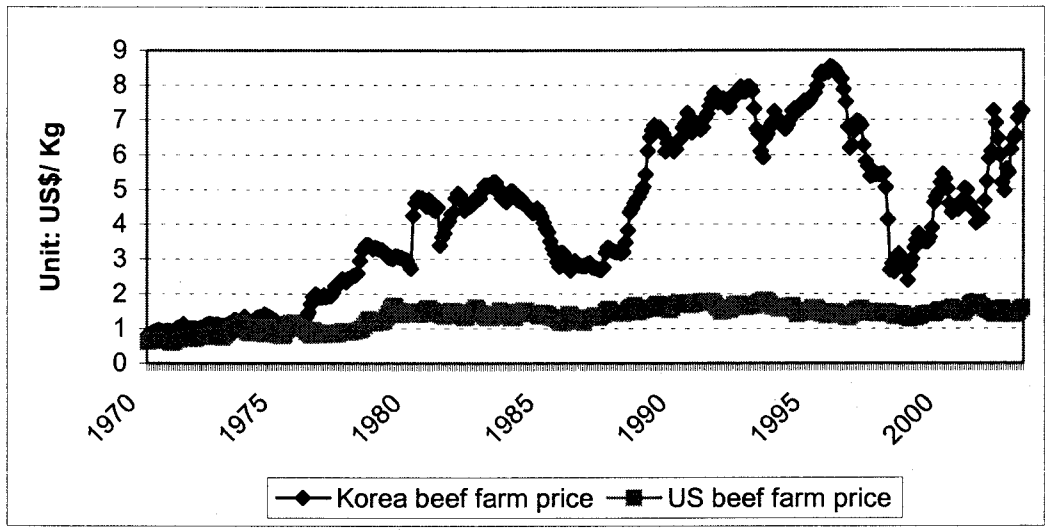
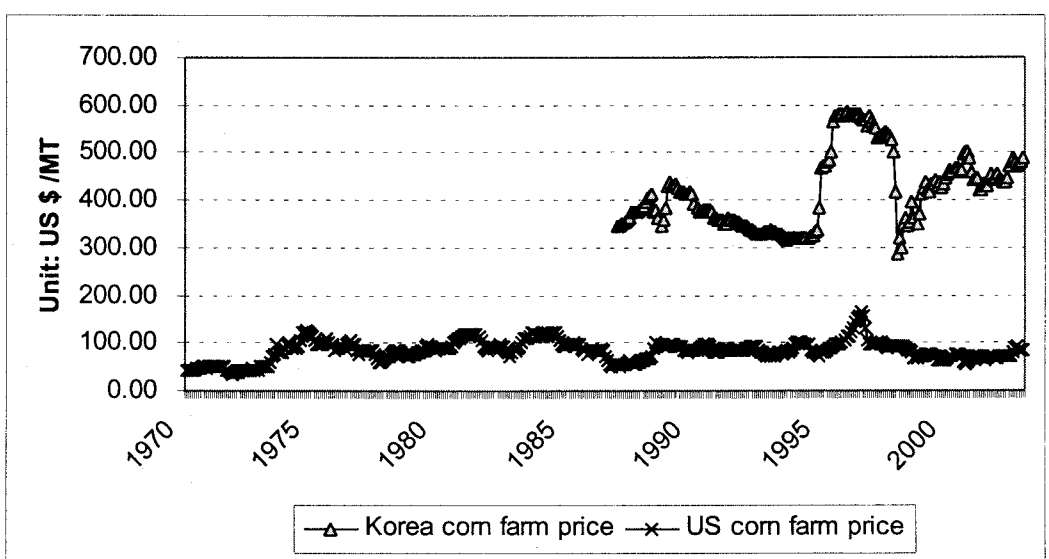
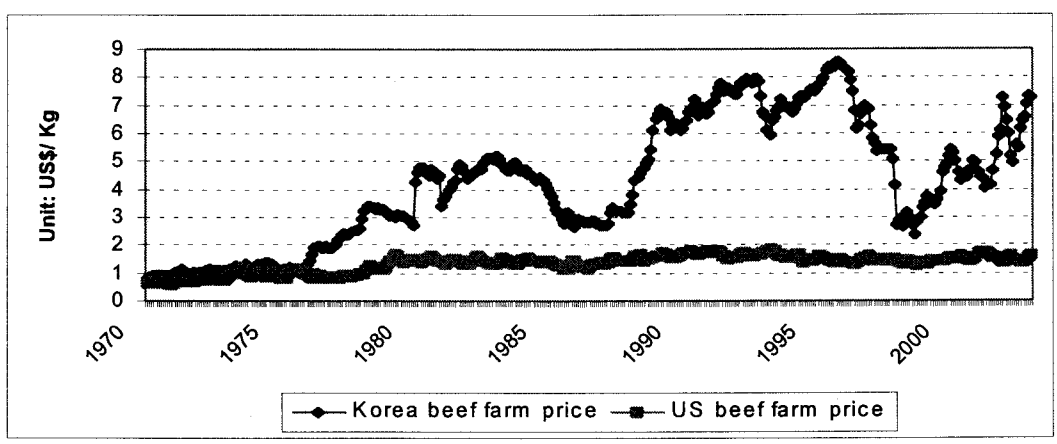


Figure 4.23 Corn: Korea Farm vs. US Farm Prices



The farm price gap between the U.S. and Korea for the grain and beef sectors has widen gradually for past three decades. A number of farm commodity prices in Korea are three to five times higher than that of the U.S. However, the agricultural policy reform "A Comprehensive Plan on the Rice Industry"that was introduced in 2002 is expected to have wide ranging implications on various grain sectors in Korea by reallocating resources from the rice to other alternative crop sectors. The rice reduction program that is coupled with an alternative crop enhancement program may eventually stabilize the farm price of rice and of other crops.

Figure 4.24 Beef: Korea Farm vs. US Farm Prices



Pork and poultry sectors show large price fluctuations between 1996 and 2002 (Figure 4.25 and 4.26). However, the Korean farm price of pork and chicken has a narrower gap with that of U.S. prices, as the pork market quotas were liberalized in 1997 and increase in pork import led to a decline in the pork farm price in Korea. This may result in reduced profitability of hog industry, causing decreased hog production, while it benefits consumers with lower retail price.

Figure 4.25 Pork: Korea Farm vs. US Farm Prices

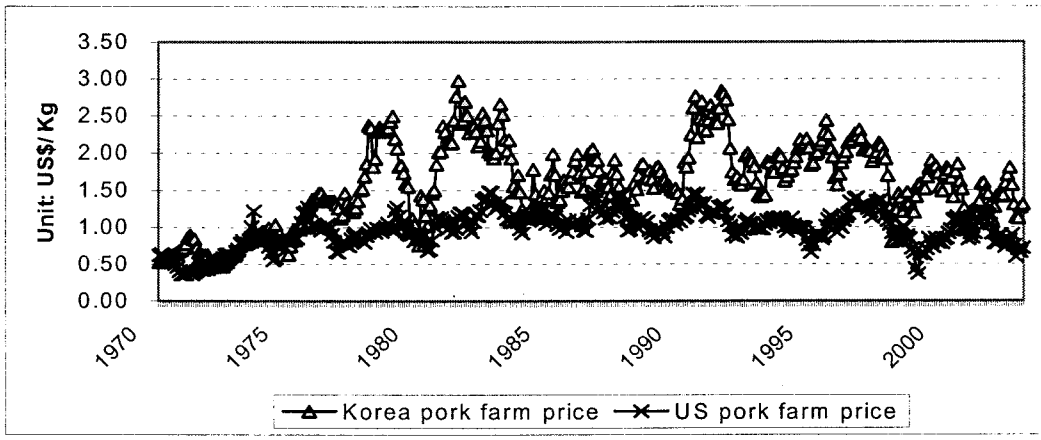


Figure 4.26 Chicken: Korea Farm vs. US Farm Prices

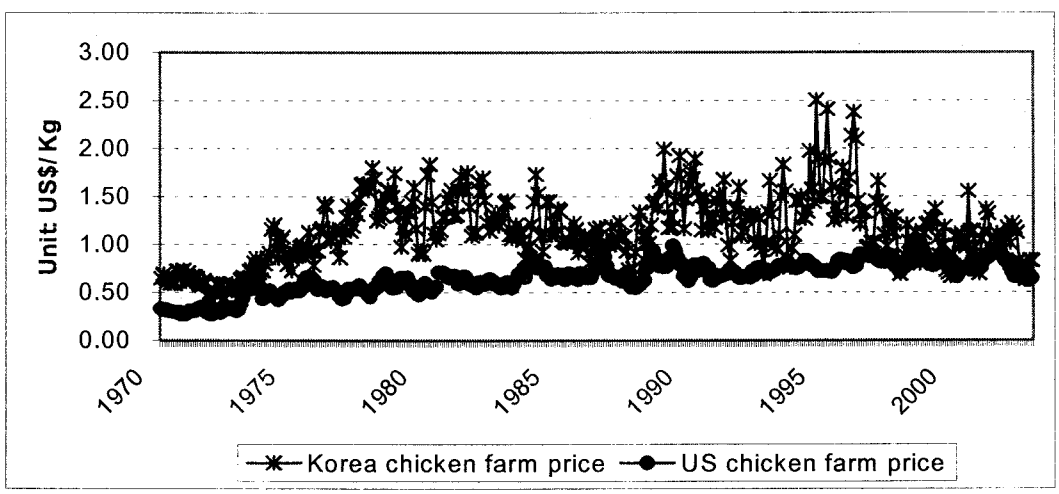


Table 4.14 below shows a comparison of farm price ratios for Korea/U.S. and Korea/Japan. Results show that Korean farm prices for corn, soybeans, and barley were about 2-3 times those of U.S. levels in 1970, though rice prices were about the same as U.S. rice prices. But by 2000, Korean farm corn, barley, and rice prices were about 5-7

times the level of U.S. prices, and soybeans were 14 times the level of U.S. prices. Therefore, lower priced imports have been allowed into the country in order to provide a more reasonable cost of feed for livestock producers. Less grain is being produced in Korea due to the high cost, except for rice, the staple commodity. Overall, these relatively high farm grain prices indicate that Korean policy has been prepared to support farmer welfare by providing prices well above world levels, in order to keep the Korean farmer income within reach of urban citizens.

Korean farm beef and pork prices were about even with U.S. prices in 1970 according to the Table 4.14, except for chicken that was about twice the level of U.S. chicken prices. However, by 2000, Korean farm beef prices were 3.5 times U.S. levels, and Korean pork prices were about twice U.S. levels, and chicken prices were about 1.5 times U.S. levels. This indicates that only Korean pork and chicken would have the opportunity to be competitive on the work market.

Part b) of Table 4.14 indicates that Korea and Japan have had roughly the same farm price levels for grain in 1970, though Korean farmers received considerable less than Japanese farmers, with a farm price ratio of only the .68 level. By 2000, Korean rice prices were 78 percent of Japanese levels, while barley farm prices were only 53 percent of Japanese levels. However, Korean soybean prices were about the same level as Japanese soybean prices. Overall, results indicate that Korea and Japan have similar farm price policies, especially for rice, with main objectives being sufficient farmer welfare and food security.

Table 4.14 Farm Price Ratio Comparison for Korea, U.S., and Japan a/

a) Korea Farm Price / U.S. Farm Price	1970	2000
Corn	3.80	6.58
Soybean	2.59	14.00
Barley	3.25	6.92
Rice	0.92	5.92
Beef	1.32	3.53
Pork	0.85	2.12
Chicken	1.94	1.48
b) Korea Farm Price / Japan Farm Price	1970	2000
Soybean	0.96	1.16
Barley	0.89	0.53
Rice	0.62 (1977)	0.78 (1999)

a/ Korea and U.S. farm prices are data for January, 1970 and 2000. Japan farm prices are annual data.

Section 6. Comparison of Retail and Farm Prices in the U.S. and Korea

The relationship between farm and retail prices, also known as the farm-retail price spread or marketing margin, provides insights into marketing efficiency and consumer and farmer welfare. Overall, important results are that Korean beef and pork retailing appears to have undergone structural change following the financial crisis, with considerably higher retail prices that may be linked to higher

concentration of firms at the retail level. Results in the Table 4.15, part a), are first presented for price transmission from U.S. farm price to U.S. retail price. Results show limited price transmission from farm to retail for U.S. food commodities. Rice shows a farm to retail transmission coefficient of only .17, though with a good statistical fit and high R^2 .84 value. This indicates that as farm rice prices change in the U.S. over the period by 1 percent, only .17 percent of the price is passed on to the retail level. This likely indicates that much of the value of rice at the farm level is quite small in the U.S., and that considerably more value is added beyond the farm level, in processing, packaging, distribution, and retailing. The beef coefficient is higher at .66, indicating that when farm price changes by 1 percent, that .66 percent of the price change is passed on to the retail level. This may indicate that a relatively large share of the value of U.S. beef is derived from the farm value.

Korean farm price to Korean retail price transmission results are shown, part b), in the Table 4.15 below. Korean rice shows a very high price transmission farm level to retail level, with a .89 coefficient and a high .92 R^2 value. This may be because a goal of Korean agricultural policy is to ensure that farm price increases for rice are consistent with retail price increases, in order to ensure that rice farmer welfare is linked to urban welfare. Beef retail price also appears to be linked to farm price up until the end of the financial crisis, with a high .86 coefficient value. However, a period of structural change appears for the beef and pork retail markets, following the financial crisis. Structural change in the beef market is significant, as evidenced by the statistically significant binary variable representing the period following the financial crisis, February 1999 through December 2002. During this

time following the financial crisis, Korean retail beef prices increased considerably relative to farm beef prices. This possible structural change in beef retailing may have been linked to imperfect competition in the beef retailing industry.

While Korean pork price transmission from farm to retail is relatively weak, significant structural change appears to have occurred in the pork retail market as well the beef market, as indicated by the significant binary variable for the period following the financial crisis. Pork retail prices for Korea have increased considerably relative to farm pork prices, after the financial crisis. Again, it appears that a structural change has taken place in the pork retail market following the financial crisis, resulting in higher retail pork prices.

Table 4.15 Monthly Price Transmission Elasticity from Farm Price to Retail Price, 1996-2002 a/

	Constant	β^a	R^2	D2
a) Price Transmission Elasticity from U.S. Farm Price to U.S. Retail Price, Prices in $US				
Rice	-0.87 (-18.05)	0.17 (20.89)	0.84	
Beef	1.63 (39.71)	0.66 (6.26)	0.32	
Pork	1.70 (264.8)	-0.01 (-0.45)	0.0025	
b) Price Transmission Elasticity from Korean Farm Price to Korean Retail Price, Prices in Won				
Rice	0.96 (4.42)	0.89 (30.83)	0.92	
Beef	2.34 (3.91)	0.86 (12.17)	0.75	0.07 (2.09)
Pork	8.23 (12.41)	0.04 (0.50)	0.83	0.46 (19.7)

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D2 represents a binary variable for structural change in the meat market following the financial crisis, for the period February 1999 through December 2002.

Figures 4.27 to 4.32 reports price spread between retail and farm price levels, for both Korea and the U.S. Vertical price transmission among various levels of the food market has become an important issue since increasing concentration has been occurring both in the food processing industry and in the distribution sector. This concentration may modify the competitive positions of different economic agents

participating in the market and may alter the price transmission processes (Serra and Goodwin 2002).

Many previous studies on farm to retail price relationship over the last two decades have shown that asymmetric price transmissions are quite common. The studies of Kinnucan and Forker (1987), Hahn (1990), Aguiar (1990), Bernard and Willet (1996), and Aguiar and Connor (1997) found that price increases are more rapid and fully transmitted than price decreases. Ward (1982), Punyawadee, Boyd and Faminow (1991) have found contrasting outcomes price decreases were transmitted more rapidly. Price asymmetry may be due in part to market power of merchandisers (Ward, 1982).

Some of other features of price relationship in food chains are; (1) changes in farm (wholesale) prices are not fully or more than fully transmitted in consumer prices; (2) changes in consumer prices are not related to short run changes in farm prices and follow medium and long run changes in farm prices with a lag; and (3) downstream changes in consumer prices show a longer time lag than upstream changes do (Bunte and Peerlings, 2003). Farmers and consumers are disadvantaged by these asymmetries if they are due to the exploitation of market power by processing industries or retail organizations (McCorriston et al. 1998).

Figure 4.27 Rice: US Retail vs. US Farm Prices

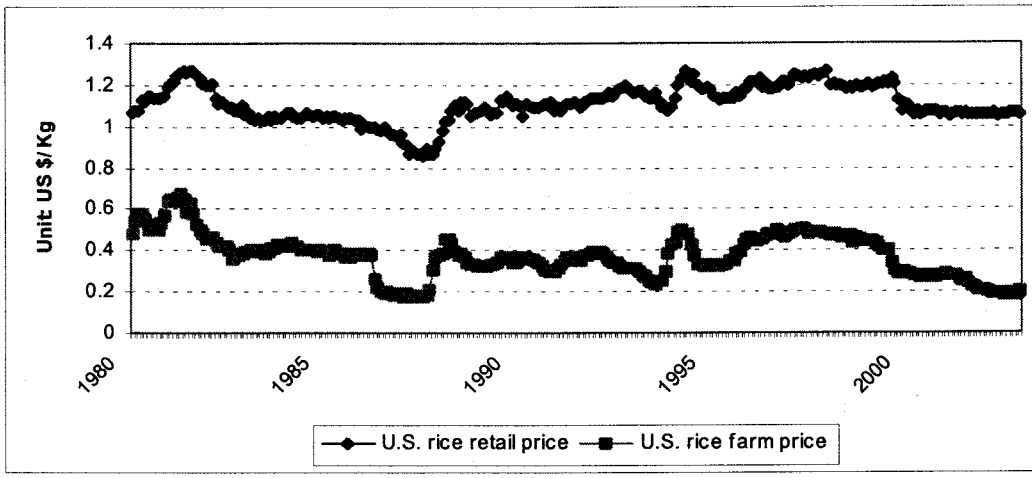
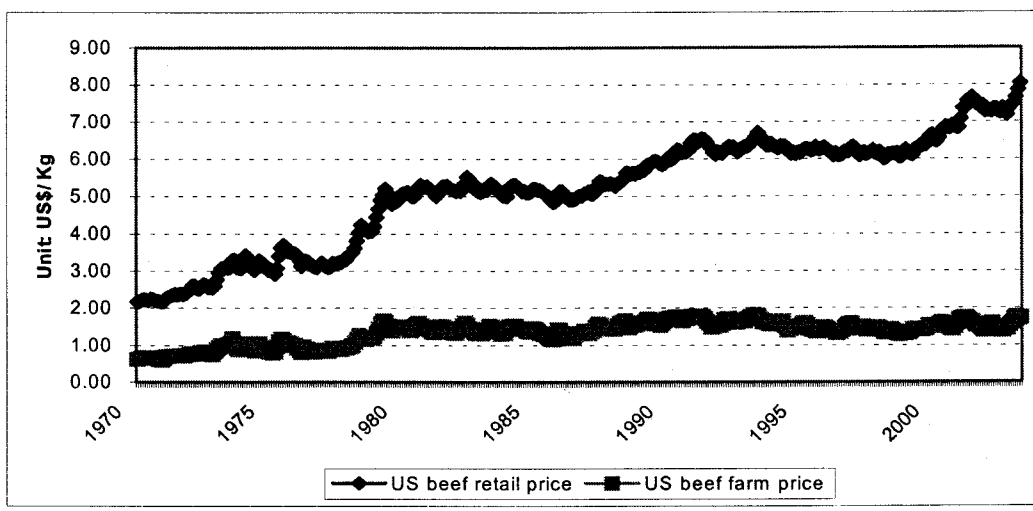


Figure 4.28 Beef: US Retail vs. US Farm Prices

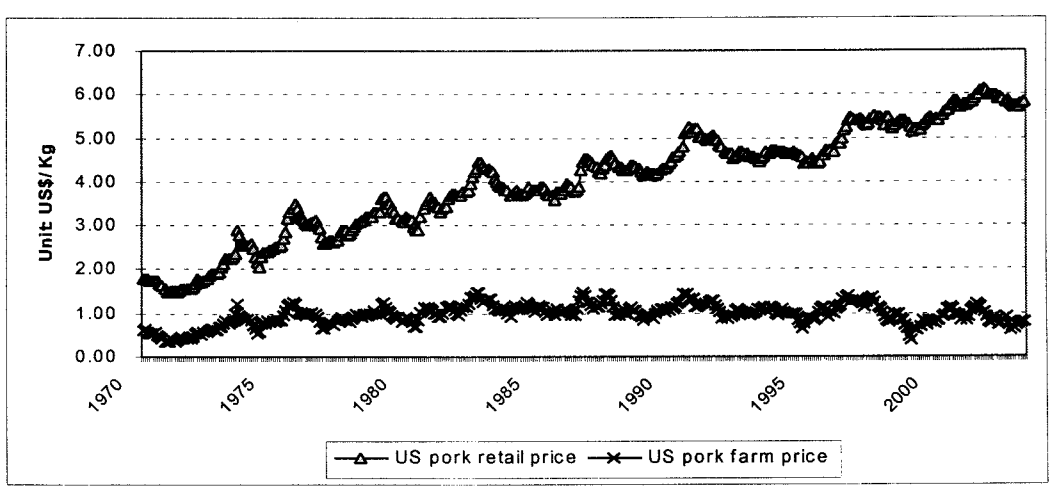


Farm level price of the U.S. pork and beef sectors remain low, which brings financial stress to beef and pork producers, while the retail price of beef and pork continued to rise throughout the last three decades (Figure 4.27 and 4.28) . This is viewed to be due in part to industry

concentration, consolidation and vertical integration, which endows wholesalers, retailers and processors substantial market power.

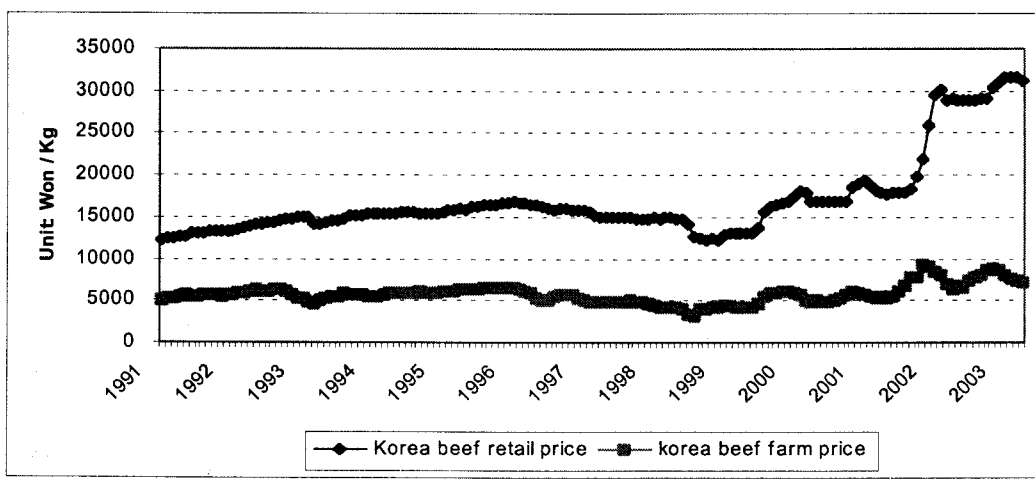
Over the past two decades, the U.S. livestock processing industry has seen increased market concentration. The majority of hogs are now grown and marketed under contract to large packers (i.e. vertical integration) and terminal auction markets have greatly diminished in their importance (Harper and Goodwin, 1999). This change was accompanied by decrease in the number of producers, with significant increases in the scale of operations. Firms may choose to vertically integrate to reduce the risk of supply uncertainty and to increase the efficiency of the firm by reducing costs in the production process. However, a high level of market concentration may have work as a barrier to market entry and increase the likelihood of noncompetitive pricing. The increasing price spread between the retail and farm level prices in the beef and pork sectors in the U.S. indicates that buyers (processors) and retailers in the U.S. are likely to have the ability to influence their and selling prices under imperfectly competitive markets.

Figure 4.29 Pork: US Retail vs. US Farm Prices



Since 1995, the Korean beef industry has experienced significant structural changes and consolidation at different levels of beef supply chain. For example, number of cattle producers in Korea has decreased from 620,000 producers in 1990 to 290,000 producers in 2000. A number of Hanwoo producers are exiting the industry in anticipation to heightened competition from imported beef in 2000, which may lower the supply of Hanwoo beef products. Consequently, the retail price of Hanwoo increased, which lead to decreased consumption of domestic Hanwoo beef and increased consumption of imported beef in 2001 (Figure 4.29).

Figure 4.30 Beef: Korea Retail vs.Korea Farm Prices

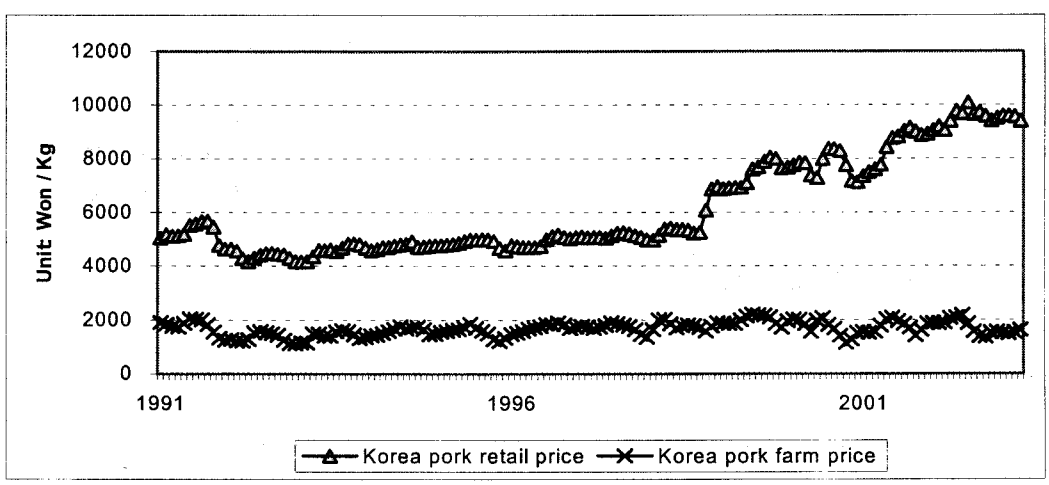


As the beef market quotas liberalized in 2000, several major trading companies and wholesale buyers in Korea entered the beef import business, directly purchasing beef from packers in foreign countries. Many of these major trading companies have vertical integration in the food supply chain, having ownership of retail chain, beef trading and processing subsidiaries. Vertical integration, in principle, reduces

marketing costs. However the integrated firms may not always pass on such cost savings to consumers as lower retail prices or to producers as higher farm prices unless driven to do so by competition (Tomek & Robinson 1990, p 125).

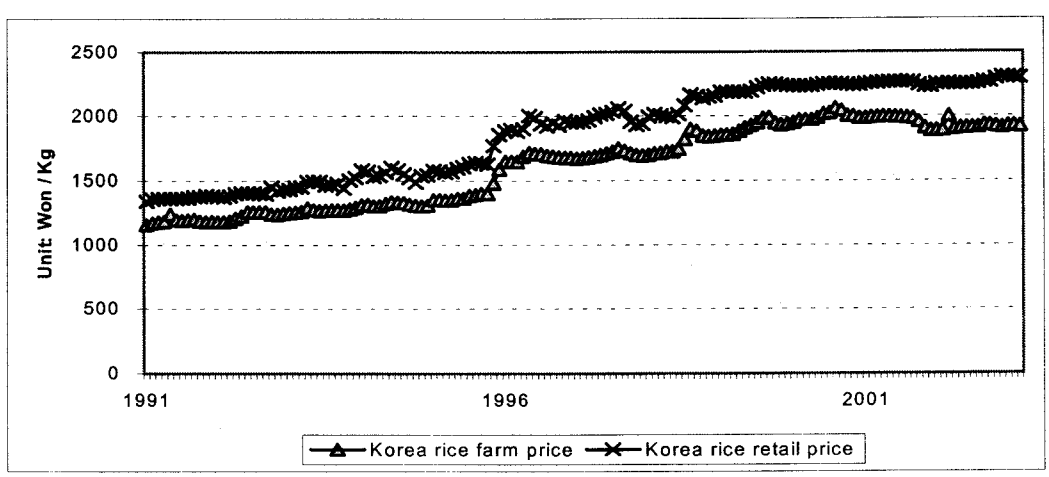
In contrast, smaller wholesale buyers and import trading companies that entered meat import market in 2000 as the beef import quota dismantled, were bankrupted due to lack of capital to cope with severe demand and supply shocks that resulted in price fluctuation of beef market. Thus, the Korean beef market is experiencing extensive market consolidation and changes in the framework of beef marketing. Major retailers with market power may raise the price of domestic Hanwoo in respond to increasing preference of Korean consumers for domestic meat products. The farm price of beef and pork remained stable between 1996 and 2002, however, the retail price of beef and pork has increased significantly in 2001 (Figure 4.29 and 4.30).

Figure 4.31 Pork: Korea Retail vs. Korea Farm Prices



In contrast to the meat sectors, the rice sector in Korea consistently exhibits a stable price spread between the retail and farm prices, which is due to extensive government involvement in rice marketing. There are three main routes that domestically grown rice can be distributed in Korea. The Korean government purchases rice directly from farmers, which consists of 17 % of the total rice production, and the rice processing complexes (RPCs) purchase most of non-government purchased rice. There are approximately 300 RPCs in major rice production areas in Korea, in which extensive rice processing takes place, including purchasing, drying, storing and selling rice. The last group of rice distributors is agricultural cooperatives and private rice handling companies that own and manage their own RPCs. The Korean government sets stable standardized rice prices throughout the supply chain, thus the marketing margin in rice sector is transparent and stable (Figure 4.31). Due to this orderly marketing structure of rice sector, retailers and wholesalers are not allowed to raise the retail and wholesale price of rice, while rice producers receive a significant share of the consumer's dollar for rice.

Figure 4.32 Rice: Korea Retail vs. Korea Farm Prices



Section 7. Comparison of Korea Retail Prices vs. U.S. Retail Prices

Price transmission results from U.S. retail prices to Korean retail prices are shown in Table 4.16. There appears to be a reasonable amount of price transmission from U.S. retail prices to Korean retail prices. Price transmission coefficients for rice, beef, and pork were 1.24, .48, and .95. Inflation has likely provided some common linkage for the retail prices between both countries. However, an important result appears to be the effect of the financial crisis. The binary variable representing the Korean financial crisis is statistically significant in all cases for rice, pork, and beef. When analyzed in U.S. dollars, Korea food prices faced a large price drop relative to U.S. levels during the financial crisis. Effects of retail prices for beef a[[ear greatest for beef during the crisis, as it is a relatively expensive food, and also has a fairly high share of consumption that is imported.

Price levels can be compared at the retail level for Korea and the U.S. in Figures 4.33, 4.36. Retail prices are higher for Korea for beef and rice. However, while pork price appears higher, it is still within range to be competitive with the U.S. price. Chicken retail price appears competitive with the U.S. price during the entire period. The financial crisis of 1997/1998 can be observed when most of the Korean retail prices shown fell briefly to levels near U.S. price levels. Beef retail price has appeared to increase relative to U.S. retail levels since the crisis, as well as in relation to Korean farm price levels, import price levels, and U.S. farm price levels. One explanation for these increases may be increasing concentration in the beef retailing industry and possible imperfect competition.

Table 4.16 Monthly Price Transmission Elasticity from U.S Retail Price to Korean Retail Price, 1996-2002 a/

	Constant	β^a	R^2	D1
Rice	0.53 (20.40)	1.24 (6.61)	0.60	-0.33 (-10.6)
Beef	1.92 (3.00)	0.48 (1.43)	0.44	-.43 (-6.39)
Pork	0.24 (0.56)	0.95 (3.75)	0.68	-0.41 (-11.1)

a/ β is the price transmission elasticity, since the model is in log-log form. T-values are in parentheses. D1 represents a binary variable for the financial crisis from October 1997 through January 1999.

Retail food price levels for selected rice, beef, pork, and chicken be compared for Korea and the U.S. in Figures 4.33-4.36. Retail prices are higher for Korea for beef and rice. However, while pork price appears higher, it is likely still within range to be competitive with the U.S. price. Chicken retail price appears competitive with the U.S. price during the entire period. The financial crisis of 1997/1998 can be observed when most of the Korean retail prices shown fell briefly to levels near U.S. price levels. Beef retail price has appeared to increase relative to U.S. retail levels since the crisis, as well as in relation to Korean farm price levels, import price levels, and U.S. farm price levels. One explanation for these increases may be increasing concentration in the beef retailing industry and possible imperfect competition.

Figure 4.33 Rice: Korea Retail vs. U.S. Retail Prices

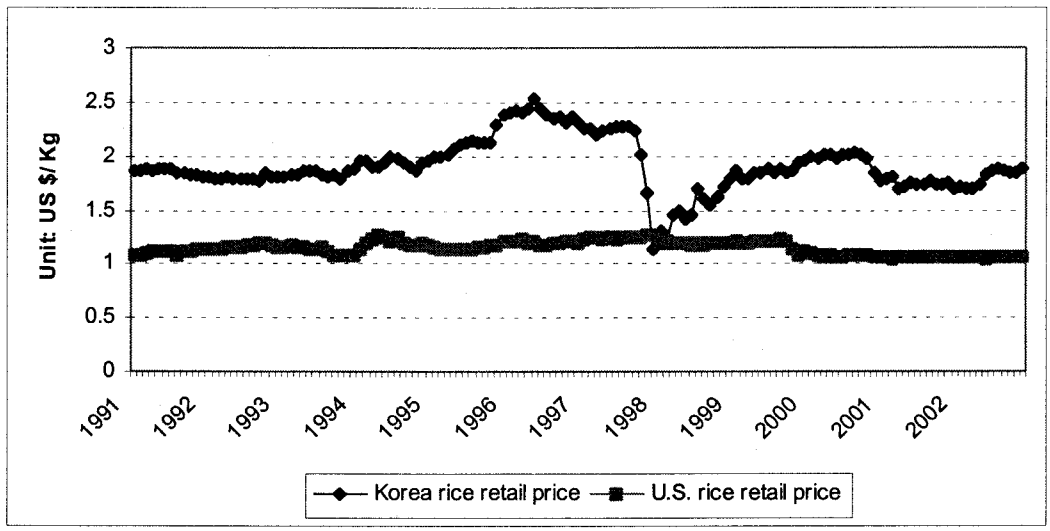


Figure 4.34 Beef: Korea Retail vs. US Retail Prices

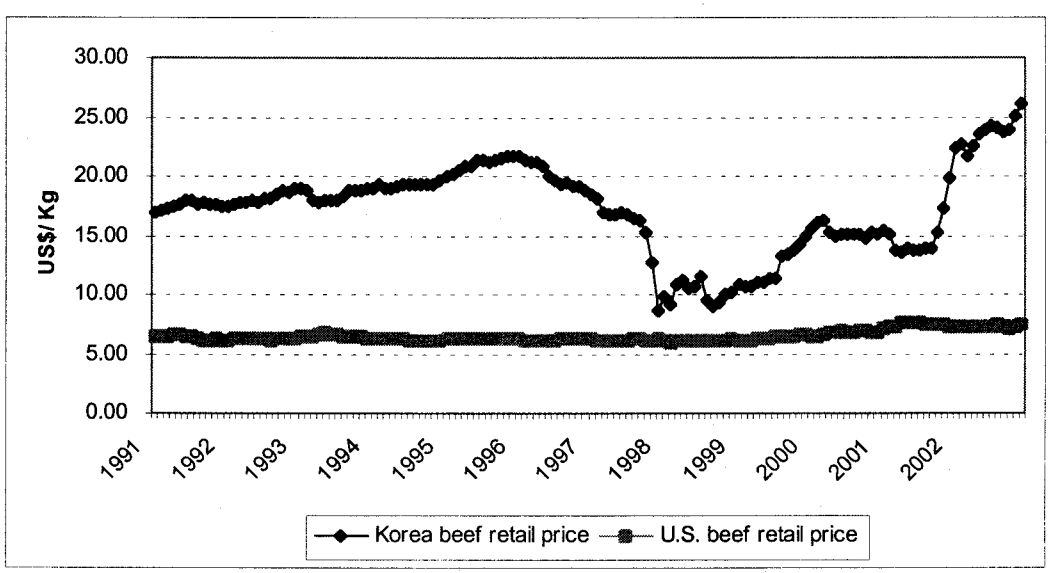


Figure 4.35 Pork:Korea Retail vs. US Retail Prices

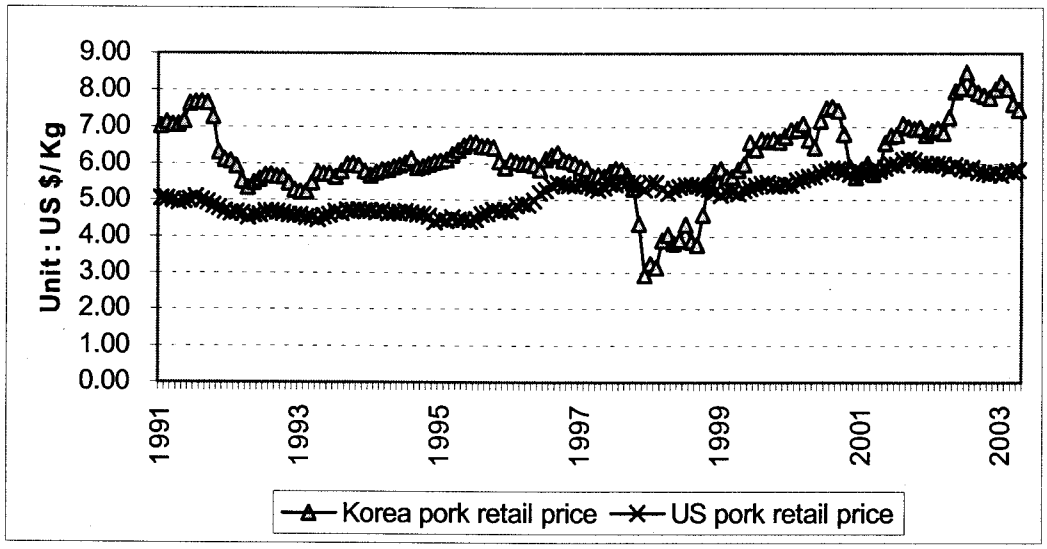
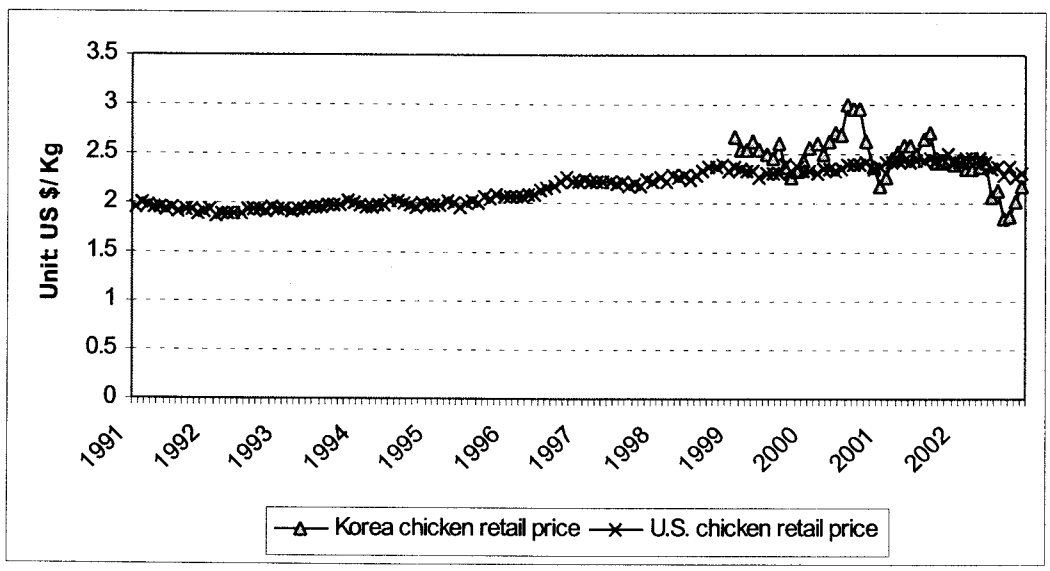


Figure 4.36 Chicken: Korea Retail vs. U.S. Retail Prices



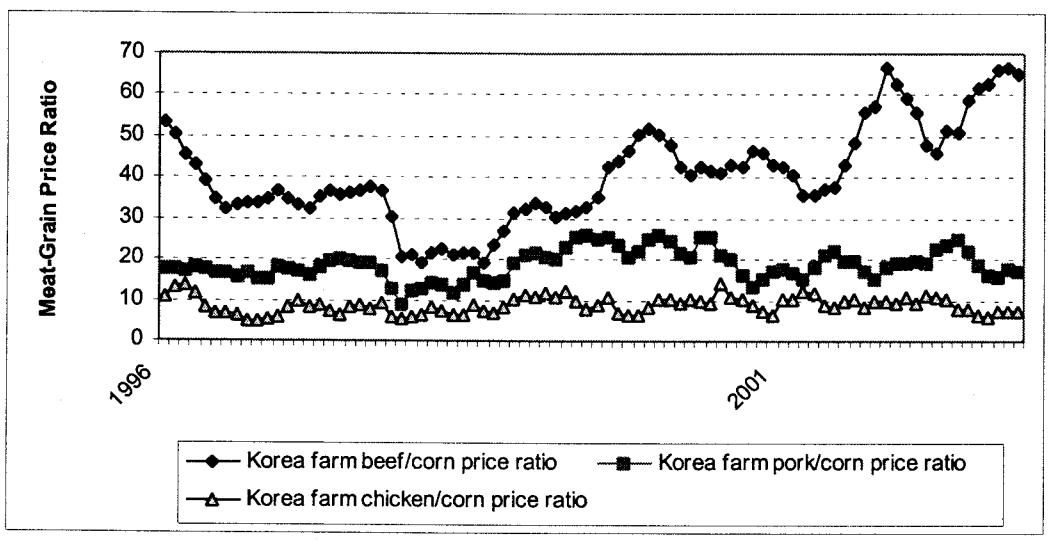
Section 8. Comparison of Korea & U.S. Output/Input Price Ratios

Output/input price ratios, also known as product-factor ratios, are often used to analyze the relationships between output prices and input prices in agriculture. These ratios are shown for Korean meat including beef, corn, and chicken in the figure below. For example, Korea output/input price ratio for meat, such as beef, is beef farm price/kg for divided by import corn price/kg. A high output/input ratio is often associated with higher profitability in livestock, and increased livestock numbers. For beef, the ratio was as high as 50 to 60 according to the figure, but during the financial crisis, it dropped to around 20, creating a very unprofitable situation for Korean beef producers. The high variability in the output/input ratio illustrates that livestock production has been relatively risky and cyclical due to the variation in both output prices and input prices. Beef , with a ratio range of about 20 to 60, appears to have a about twice as high an output/input ratio compared to pork, which ranges from about 10 to 25. The ratio for chicken is considerably lower than pork, at around the 5 to 12 range.

The financial crisis of October 1997 through January 1999 placed a large stress on livestock profitability in Korea, especially for beef. During the later months in 1997 the output/input ratio for beef dropped from about 40 to 20 in a period of about two months. The crisis caused corn import price to increase substantially in value due to devaluation of the Won. At the same time beef price dropped due to less demand from the consumer from lower income and credit during the crisis. The beef market was especially impacted because beef is a relatively

expensive and highly income elastic food. Some beef producers were forced to stop raising livestock as they were unable to afford feed, fuel, heat, and other imported inputs. Pork output input rations also dropped significantly during the financial crisis, as pork production is dependent on imported feed, and pork consumption is also fairly responsive to changes in income. As well, chicken output input ratios appear to have been significantly impacted by the financial crisis.

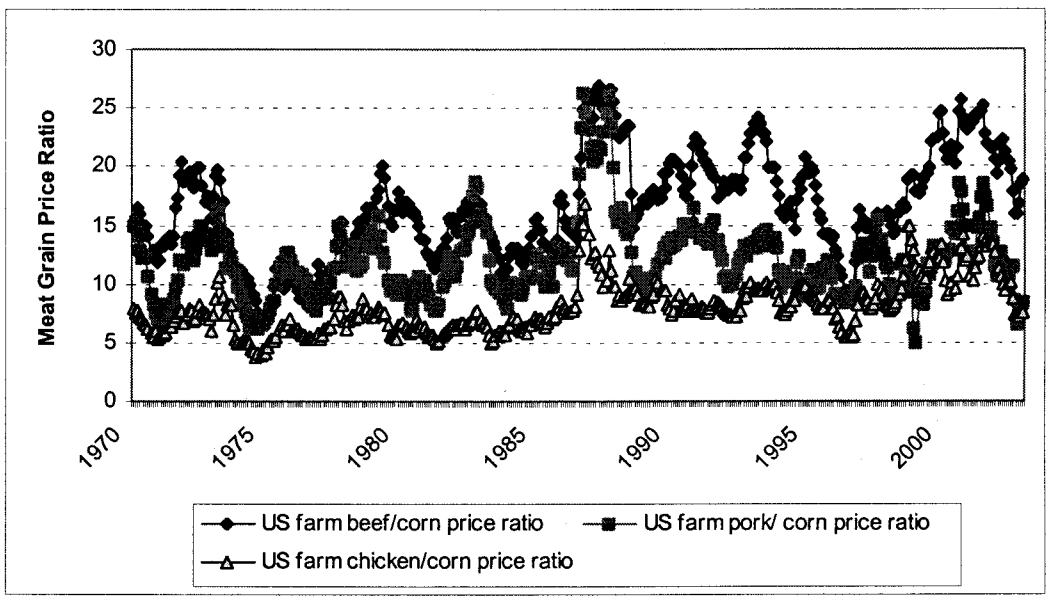
Figure 4.37 Output/Input Price Ratio: Korea Beef, Pork, and Chicken vs. Import Corn Prices



For comparison, U.S. output/input ratios are given for livestock. For example, U.S. output/input price ratio for meat, such as beef, is beef farm price/kg for divided by farm corn price/kg. Overall, beef output/ input ratios are higher for Korea than the U.S, especially beef. However, pork and chicken output/input ratios are much closer to U.S. levels. Since corn prices paid by Korean and U.S. producers are somewhat similar, it would appear that the higher beef prices received by the

Korean producer are the main factor causing the higher beef ouput/ input ration for Korea compared to the U.S.

Figure 4.38 Output/Input Price Ratio: US Beef, Pork, and Chicken vs. US Corn Prices



Overall, it would appear that the Korean beef producer has received favorable output input price ratios, however, increased imports from liberalization may drop beef prices and put downward pressure on the beef output/input ratio. Therefore, beef producers may need to enhance their competitive position in beef production in order to cope with lower output/input price ratios.

References

ABARE (2001). Agricultural Trade Policies in Japan: The Need for Reform. ABARE, Research Report 01.5, edited by Tim Bull and Ivan Roberts.

Aguiar, D.R.D. and Santana, J.A. "Asymmetry in Farm to Retail Price Transmission: Evidence from Brazil." Agribusiness 18 (1), (2002): 37-48.

Akaike, H. Canonical Correlations Analysis of Time series and the Use of An Information Criterion. In R.Mehra and D.G. Lainiotis (eds.) Advances and Case Studies in System Identification. Academic Press, New York, 1976.

Arnade, C and S. Osborne, S. "Measurement and Testing for Neutrality of Foreign Price and CPI Transmission in Russia". Paper presented at the AAEA annual meeting in Chicago, Illinois (2001).

Ardeni, P.G. "Does the Law of One Price Really Hold for Commodity Prices.?" American Journal of Agricultural Economics 71 (1989): 661-669.

Asche. F. Bremnes, H., and C.R. Wessells. "Product Aggregation, Market Integration, and Relationships Between Prices: An Application to World Salmon Markets." American Journal of Agricultural Economics. 81 (1999): 610-622.

Baulch. B. "Transfer Costs, Spatial Arbitrage, and Testing for Market Integration." American Journal of Agricultural Economics. 79 (1997): 477-487.

Bettendorf, L. and Verboven, F. "Incomplete Transmission of Coffee Bean Prices: Evidence from the Netherlands." European Review

of Agricultural Economics, 27 (1), (2000):1-16.

Bernard, J.C. and L.S. Willett. "Asymmetric Price Relationships in the U.S. Broiler Industry." Journal of Agricultural and Applied Economics, 28 (2) December (1996) : 279-289.

Blyn, G. "Price Series Correlation as a Measure of Market Integration." Indian Journal of Agricultural Economics. 28 (1973): 56-59.

Boyd, M.S. and B.W. Brorsen. "Dynamic Relationship of Weekly Prices in the U.S. Beef and Pork Marketing Channels." Canadian Journal of Agricultural Economics 33 (1985): 331-442.

Boyd, M.S. and B.W. Brorsen. "Price Asymmetry in the U.S. Pork Marketing Channel." North Central Journal of Agricultural Economics 10, January (1988): 103-110.

Boyd, M.S. and R. Christie. "The Economic Integration of Central European Countries into World Agricultural Economies: The Case of Poland and USA Integration." International Association of Agricultural Economists, August, 2000, Berlin Germany.

Boyd, M.S. and B.W. Brorsen. "Dynamic Price Relationships for US and EC Corn Gluten Feed and Related Markets." European Review of Agricultural Economics, 13 (1986):199-215.

Bredahl, M.E., Meyers, W.H. and Collins, K.J. "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity". Amer. J. Agr. Econ. 61, February (1979): 58-63.

Brooker, J.R., Eastwood, D.B., B.T. Carver, and M.D.Gray. "Fresh Vegetable Price Linkage Between Grower/Shippers, Wholesalers and Retailers". Journal of Food Distribution Research, February (1997): 55-61.

Bunte, F. and J. Peerlings. "Asymmetric Price Transmission Due to Market Power in the Case of Supply Shocks." Agribusiness, Vol.

19 (2003): 19-28.

Coleman, W. "Money and Output: A Test or Reverse Causation." American Economic Review. 86 (1996): 90-111.

Colman, D. "Imperfect Price Transmission Policy and Prices." European Review of Agricultural Economics 12 (1985):171-186.

Copeland, M.and T. Copeland. "Leads, Lags, and Trading in Global Markets" Financial Analysts Journal. 54 (1998):70-80.

Engle. R. F. and C.W. Granger "Cointegration and Error Correction: Represention, Estimation, and Testing." Econometrica. 50 (1987): 251-276.

European Commission, 1999a, "Contribution of the European Community on the Multifunctional Character of Agriculture" http://europa.eu.int/comm/agriculture/external/wto/document/ip2_en.pdf

European Commission, 1999b, "Safeguarding the multifunctional role of EU agriculture." http://europa.eu.int/comm/agriculture/external/wto/document/ip3_en.pdf

EU Directorate General for Trade, 2001. "The non-trade impacts of Trade Policy Asking Questions, seeking sustainable Development." http://europa.eu.int/comm/trade/issues/global/sia/docs/csc_idp.pdf

European Commission, 2003, "A Long-Term Policy Perspective For Sustainable Agriculture" http://europa.eu.int/comm/agriculture/mtr/memo_en.pdf

Faminow, M.D. and B.L. Benson. "Integration of Spatial Markets." American Journal of Agricultural Economics. 72 (1990):49-62.

Frances, P. "Volatility Transmission and Patterns in Bund Futures" The Journal of Financial Research. 20 (1997): 459-482.

Frino, A., T. Walter and A. West. "The Lead-Lag Relationship Between

Equities and Stock Index Futures Markets Around Information Releases" The Journal of Futures Markets. 20 (2000): 467-487.

Gardner B. and K. Brooks. "Food Prices and Market Integration in Russia:1992-93." American Journal of Agricultural Economics. 76 (1994):641:646.

Goodwin, B. and T.C. Schroeder. "Cointegration Tests and Spatial Price Linkages in Regional Cattle Markets." American Journal of Agricultural Economics. 73 (1991):454-464.

Goodwin, B. "Multivariate Cointegration Tests and the Law of One Price in International Wheat Markets." Review of Agricultural Economics 14(1992):117-124.

Goodwin, B.K. and M.T. Holt. "Asymmetric Adjustment and Price Transmission in the U.S. Beef Sector". Amer. J. Agr. Econ. (Principal paper) 81 (1999): 630-37.

Goodwin, B.K. and D. Harper. "Price Transmission, Threshold Behavior, and Asymmetric Adjustment in the U.S. Pork Sector". Journal of Agricultural and Applied Economics 32, December (2000).

Goodwin, B.K. and N. Piggott. "Spatial Market Integration in the Presence of Threshold Effects". Amer. J. Agr. Econ. May (2001).

Goodwin, B.K., T. Grennes, Lee Graig. "Mechanical Refrigeration and the Integration of Perishable Commodity Markets." Explorations in Economics History. (2002).

Granger, C.W. " Investigating Causal Relationships by Econometric Models and Cross-specrtal Methods." Econometrica 37 (1969): 424-438.

Gravelines, R.S. and M.S.Boyd. "A Note on Asymmetry in Commodity Futures Markets." Canadian Journal of Agricultural Economics 47 (1991): 321-329.

Hahn, W. F. "Price Transmission Asymmetry in Pork and Beef Markets". The Journal of Agricultural Economic Research 42 (1990): 21- 30.

Harper, D.C. and Goodwin, B.K. "Price Transmission, Threshold Behavior, and Asymmetric Adjustment in the U.S. Pork Sector". Paper presented at the 1999 AAEA Meeting in Nashville, Tennessee. (1999).

Johnson, D.G. "Food Security and World Trade Prospects". Amer. J. Agr. Econ.80, December (1998): 941-47.

Kinnucan, H.W. and O.D. Forker. "Asymmetry in Farm-Retail Price Transmission for Major Dairy Products." Amer. J. Agr. Econ. 69 (1987): 285-292.

Kwiecinski, A. and W. Quaisser. "Agricultural Prices and Subsidies in the Transformation Process of the Polish Economy." Economic Systems. 17 (1993):125-154.

Lele, U.J. "Market Integration: A Study of Sorghum Prices in Western India." Journal of Farm Economics. 49 (1967):139-147.

Loy, J.P. and R.E. Weaver. "Inflation and Relative Price Volatility in Russian Food Markets." European Review of Agricultural Economics, (1998).

MAFF . Basic Facts about Japanese Agriculture, Japan's Agricultural Review, Vol. 28, Tokyo, March, 1999.

Miller, D.J. and Hayenga, M.L. "Price Cycles and Asymmetric Price Transmission in the U.S. Pork Market". Amer. J. Agr. Econ. 83 (2001): 551-562.

Moledina, A.A. and T.L. Roe. "Exploring the Transmission of International and Domestic Economic Shocks to U.S. Agriculture". Paper presented at the AAEA annual meeting in Tampa, FL. (2000).

Mundlak, Y. and Larson D.F. "On the Transmission of World

Agriculture Prices". World Bank Econ. Rev. 6, September (1992): 399-422.

Natcher, W.C. and R.D. Weaver. "The Transmission of Price Volatility in the Beef Markets: A Multivariate Approach", Selected Paper for 1999 AAEA Annual Meeting, Nashville, Tennessee.

OECD (2000). Agricultural Policies in OECD Countries: Monitoring and Evaluation: 2000, Paris.

Palaskas, T.B. and B.Harris-White. Testing Market Integration: New Approaches with Case Material form the West Bengal Food Economy." Journal of Development Studies.30 (1993):1-57.

Palaskas, T.B. "Statistical Analysis of Price Transmission in the European Union." Journal of Agricultural Economics.46:(1995)61-69.

Palaskas, T.B. and P. Varangis. "Primary Commodities and Macro-economic Variables: A long-run Relationship." World Bank Working Paper, WPS-314, Washington, DC,1989.

Punyawadee, V., M.S. Boyd, and M.D. Faminow. "Testing for Asymmetric Pricing in the Alberta Pork Market." Canadian Journal of Agricultural Economics, 39 (1991):493-501.

Ravillion, M. "Testing Market Integration." American Journal of Agricultural Economics 68 (1986):102-109.

Schroeder, T.C. "Price Linkage Between Wholesale and Retail Pork Cuts". Agribusiness 4 (4), (1988): 359-369.

Reed, A.J. and Clark, J.S. "The Transmission of Trends in Retail Food and Farm Prices." Amer. J. Agr. Econ.80 (5), (1998): 1139-1143.

Stephan von Cramon-Taubadel, Jens-Peter Loy and J. Meyer. " The Impact of Data Aggregation on the Measurement of Vertical Price Transmission: Evidence from German Food Prices". Paper selected for the AAEA annual meeting, Montreal, Canada (2003).

Stephan von Cramon-Taubade. "Estimating Asymmetric Price Transmission

with the Error Correction Representation: An Application to the German Pork Market". European Review of Agricultural Economics 25 (1998): 1-18.

Tomek G.W. and K.L. Robinson (1990). Agricultural Product Prices, 3rd edition, Cornell University Press.

USDA . Pork Polices in Japan. ERS USDA LDP-M-105-01, by Kakuyu Obara, John Dyck and Jim Stout, 2003a.

USDA . Rice Polices in Japan. ERS USDA RCS-0303-01, by Hisao Fukuda, John Dyck, and Jim Stout, 2003b.

USDA ERS "European Union: Issues and Analysis" Briefing Room http://www.ers.usda.gov/Briefing/EuropeanUnion/policy.htm

WTO. "AGRICULTURE NEGOTIATIONS: BACKGROUNDER Phase 1: 'Non-trade' Concerns: Agriculture Can Serve Many Purposes." 2003 http://www.wto.org/english/tratop_e/agric_e/negs_bkgrnd11_nontrade_e.htm

Young. B. Uruguay Round Outcomes: Agriculture, Agriculture Branch, Trade Negotiations and Organization, Department of Foreign Affairs and Trade, Canberra, 1994.