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EFFECTS OF EXCHANGE RATE CHANGES ON AGRICULTURAL PRICES UNDER THE FINANCIAL CRISIS IN KOREA

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I. Introduction

The price of the agricultural products declined due to the financial crisis in Korea, then this led to the stagnation of the growth in the agricultural industry. The growth of the agricultural sector has depended on the condition of the domestic demand and supply as well as the change in both inter and intra macro economic condition, i.e., exchange rate and price change in domestic and world markets will greatly affect the domestic agricultural sector.

The current issue is to overcome the financial crisis that occured in 1997. Korea confronted the foreign exchange crisis in November, 1997 and requested a bailout to the International Monetary Fund (IMF) as forced by the national bankruptcy. Since the 1960s, the high level of economic growth has converted to minus economic growth. From a social point of view, it led to negative situations for economic growth such as increase in unemployment, rise in prices, decrease in income, rise in the interest rate, depreciation of exchange rate, and etc.

Due to rising exchange rate, it has also increased the production costs in the agricultural sector. The income and expenditure of farm households became worse due to increase in farming costs caused by rapid currency depreciation, increase in the interest rate and constraint of loans by financial institutes, and decrease in consumption of agricultural products. For this reason, some farm households have

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abandoned engaging in agriculture and agricultural production structure has been changed. Specially, the livestock and horticultural industries have remarkably dwindled due to serious financial crisis.

While analyzing the effect of exchange rate changes on the consumer prices of agricultural products and input prices such as feed mixture for livestock, the effect of exchange rate changes on them shall be assessed, and the possible alternatives for agricultural policy shall be presented. The study concentraters on the effect of exchange rate changes on agriculture in Korea with special focus on consumer prices of wheat flour and edible oil as final goods and input prices of feed mixture for beef, pork and chicken as the intermediate goods. The main objectives of the study are to review the current situation of financial crisis and the level of how much exchange rates pass to domestic price and import prices transmit to domestic price according to the changes in exchange rates and import prices.

Given these objectives, for evaluating the effects of exchange rate changes, which has affected the domestic product and input price, will be examined. The study covers two final commodities which are wheat flour and edible oil, and three inputs which are feed mixtures for beef, pork, and chicken for raising livestock. For evaluating the effect of current financial crisis on the agricultural sector, the law of one price will be applied to analyze the effects of changes of exchange rate and import price on domestic price.

This report consists of four chapters. The second chapter presents situation and impacts related to the issues of current financial crisis in Korea. The third chapter overviews the analytical methodology and investigates the effects of exchange rate changes ensured by the financial crisis. Summary and conclusion are presented in the last chapter.

II. Situation of Financial Crisis in Korea

1. Financial Crisis in Korea

Korean trade policy has its major emphasis on production of the domestic industries, stabilization of prices, improvement of the balance of payments, increase in employment, and efficient usage of

production factors. In Korea, exports have been important in economic growth from the 1960s. To overcome the scarcity for national resources and the constraint of a small domestic market, it was necessary for the Korean government to strongly enhance the balance of payments to achieve continuous economic growth. However, this goal of balancing payments could not be reached because of political as well as social instabilities within the nation.

At the end of the 1980s, due to rapid increases in wages and conflicts between employees and employers, the Korean economy weakened in terms of international competitiveness, and as a result, economic growth deteriorated. This deterioration was linked to deficits of the balance of payments in the 1990s. Also, easing regulations, self-control of money and banking, and liberalizing imports were promoted by the Korean government in the early 1990s. The relationship between total monetary supply and price levels has been weakened due to the progress of financial deregulation and openness.

The main cause of Korean financial crisis was due to the lack of mobility of foreign currency derived from deficit of trade balance. The Korean government officially had asked the IMF funds for support on November 21, 1997, and announced the negotiation result on December 3, 1997. The main contents of mutual agreements with IMF included the minus economic growth rate in 1998, maintenance of deficit of trade balance, structural adjustment in the financial sector, acceleration of capital liberalization, reform of labor market, and etc. Since the content of mutual agreement with the IMF was annouced, exchange rate and interest rate had been increased rapidly.

Table 1 presents balance of payments and exchange rates from 1985 to 1998. Since the beginning of 1990, trade balance has recorded deficit every year except 1993, and especially, it has exceeded 14 billion dollars in 1996. The Korean economic structure could not impede the increasing imports of capital, industrial raw materials, crude oil, and etc. However, the trade balance in 1998 was 41 billion US dollars due to the sharp decrease in imports by devaluation of Korean won.

The Korean won to US dollar increased from a low of 861.3 won in January of 1997 to 1,163.8 won in November of 1997, due to the impact of the Korean currency crisis. After November of 1997 it

rose to 1,415.2 won in December of 1997 and to high of 1,640.1 won in February of 1998. After February of 1998 it has declined to 1,313.8 won in September and 1,207.8 won in December of 1998. For 4 months (from November of 1997 to February of 1998) the Korean currency to US dollar has depreciated by 41%. At present, it is around 1,200 won per US dollar and is relatively stable.

2. Effects of the Crisis on Agricultural Sector

By the beginning of IMF managing system, price index of producer was increased by 3.6% between December 1997 and December 1998, but its index for agricultural products was increased by 15.7%. During this period, the consumer price index was increased by 4.0%. Among them, the prices of food and beverages were increased 7.3%. In other words, producer prices of agricultural products had increased rapidly. During this period, each price index received and paid by farm households was increased 4.6% and terms of trade between price index received and paid by farmers had shown no change.

TABLE 1 Balance of Payments and Exchange Rate

Unit: million US dollars, won/US dollar

Year	Trade Balance			Current Account	Exchange Rate
	Exports	Imports	Balance		
1985	26,633	26,653	-20	-795	890.2
1986	34,128	29,829	4,299	4,709	861.4
1987	46,560	39,031	7,529	10,058	792.3
1988	59,973	48,690	11,283	14,505	684.1
1989	61,832	57,471	4,361	5,360	679.6
1990	63,124	66,109	-2,450	-2,003	716.4
1991	70,541	77,344	-6,803	-8,317	760.8
1992	76,199	77,954	-1,755	-3,943	788.4
1993	82,089	79,771	2,319	990	808.1
1994	94,964	97,824	-2,860	-3,867	788.7
1995	124,632	129,076	-4,444	-8,508	774.7
1996	129,968	144,933	-14,965	-23,005	844.2
1997	138,619	141,798	-3,179	-8,167	1,415.2
1998	131,808	90,643	41,165	40,039	1,207.8

Source: NSO (various issues).

TABLE 2 Main Price Index

1995=100

	Dec.1997	Apr.1998	Dec.1998	Rate of Increase
Producer price index	114.4	122.1	118.5	3.6
Agricultural products	98.7	105.4	114.2	15.7
Manufacturing industrial products	114.9	123.5	118.4	3.0
Consumer price index	113.5	118.4	118.0	4.0
Food and beverages	110.3	117.5	118.4	7.3
Excluding food and beverages	114.9	118.7	117.8	2.5
Price index received by farmers	99.3	100.3	103.9	4.6
Price index paid by farmers	111.9	119.2	117.0	4.6
Terms of trade	88.7	84.1	88.8	-

Source: NACF (various years).

The cost of agricultural products has been increased due to the high price of agricultural raw materials caused by the rapid increase in exchange rate. The feed mixture is an example. Among manufacturing cost of assorted feed, the portion of raw material costs was 77% and the import of raw material of feed mixture, which is mainly corn, was 96%. Therefore, it will increase the price of feed mixture by 74% according to the exchange rate. Along with this rising price of feed, production costs of livestock breeding were increased rapidly.

Due to tight money policy and reduction of real income, the consumption of agricultural products with high income elasticity, such as products of livestock industry, fresh vegetables, and etc., has been decreased. In this regard, the producers, who engage in livestock breeding and horticulture, suffered from soared production cost and reduced demand. Furthermore, a rise in exchange rate elevated to prices of fertilizers and agricultural chemicals which caused an increase in agricultural production cost.

At the beginning of IMF managing system, the budget of agricultural sector was reduced by tight money policy. The budget of agriculture in 1998 was reduced by 9.3% in comparison with the regular schedule. Due to the decline in the budget of agricultural sector, investment and support for agriculture and rural area were reduced and agricultural growth has stagnated. The rural economy has also deteriorated. The rate of agricultural growth in 1998 is estimated

to be -6.2%.

Another problem was high rate of interest by contraction of money. In other words, the industries such as livestock breeding and horticulture used to borrow funds from outside because this type of management usually needs much investment. Under the high rate of interest, the more the borrowing from, outside the more the burden of interest rate. Accordingly, farmers suffered from high interest and high price of raw materials resulted by increased exchange rate, and this resulted in decrease in farm income.

Since the financial crisis, damage in grain sector was less than other agricultural sectors including livestock breeding, horticulture, and etc. The demand for grains was also decreased, but there was only little reduction of income from grains. The reason was that the import volume of raw materials among the managing costs was low. Furthermore, due to high exchange rate, price of imported grain was increased. However, demand for domestically produced grain was increased. The price of processed products from grain, which is mainly composed of imported grain, was remarkably increased by high exchange rate. In 1998, consumption of major processed products from grain, which has shown declining tendency of consumption and production, was decreased.

The reduction of agricultural budget comes under tight money policy and it has affected the agricultural sector. For this reason, agricultural growth has showed down and the rural economy is expected to become stagnant. Domestic recession and reduced demand for agricultural products led to low prices of agricultural products. Consequently the low prices of agricultural products resulted in low investment in the agricultural sector.

III. Effects of exchange rate changes on the Price of Agricultural Products

1. Methodology

The price effects in the import demand can be divided by changes in import price imported from an exporting country and changes in exchange rates. Domestic prices of goods are translated by exchange

rates. Like other prices, exchange rates are subject to change. That is, when a country's currency rises in value relative to those of other countries, exports tend to decrease and imports tend to increase. When a country's currency falls in relative value, exports tend to be increased and imports decreased. When a currency's value rises rising internationally, domestic prices of imported goods tend to decrease and foreign prices of the same goods tend to increase. When a currency's value falls, domestic prices of imported goods tend to increase while international prices tend to decrease.

Such a relationship between exchange rate and price can be explained by the law of one price (LOP). The literature contains several empirical investigations of the LOP. Empirical results generally contradict the LOP theory. Jabara and Schwartz (1987), Ardeni (1989) found that agricultural prices commonly violate the LOP. However, Karbuz and Jumah (1995) used the concept of cointegration to examine long-run relationships between future prices of commodities and the results support the LOP. Sung (1996) also used the multivariate cointegration method to test the LOP. The results indicate that the LOP was valid for 3 out of 5 cases in the Korean beef market. On the other hand, Bredahl, Meyers and Coillins (1980) point to the importance of price transmission elasticity in foreign demand for agricultural products.

The LOP maintains that the domestic price of a commodity will be equal to the foreign price of the same commodity through the exchange rate. The specification of the price equation begins with identity which links the domestic price of a commodity to the import prices:

$$(1) \quad P_d = E \cdot P_m$$

where P_d is the domestic price in importing country, P_m is the import price of the commodity imported from a country, and E is the exchange rate expressed in units of domestic currency per unit of the exporting country's currency. Thus, equation (1) becomes basically a statement of the law of one price. The equation (1) can be rewritten in terms of percentage changes:

$$(2) \quad \frac{dP_d}{P_d} = \frac{dE}{E} + \frac{dP_m}{P_m}$$

The price equation (2) can be also rewritten in terms of percentage changes in import price and exchange rates under the assumption that domestic goods and imported goods are homogeneous:

$$(3) \quad \varepsilon_m = \frac{dP_d}{P_d} \frac{P_m}{dP_m}$$

$$(4) \quad \varepsilon_e = \frac{dP_d}{P_d} \frac{E}{dE}$$

Equation (3) shows the percentage change in domestic price in expressed units of domestic currency to the percentage change in imported price in expressed units of US dollar. It can be defined as price transmission elasticity. Equation (4) indicates the percentage change in domestic price in expressed units of domestic currency to the percentage change in exchange rate in expressed Korean won/US dollar. It can be defined as exchange rate pass-through elasticity. To analyze those effects, the following equation can be applied:

$$(5) \quad \ln P_d = \beta_0 + \beta_1 \ln P_m + \beta_2 \ln E$$

β_1 implies the level of how much import prices transmit to domestic price. β_2 implies the level of how much exchange rates pass to domestic price through international financial markets.

2. Estimation and Results

To analyze the effect of changes in exchange rates and import prices on the domestic prices by the recent financial crisis in Korea, wheat, corn and soybean were selected. These commodities show a continuous increasing tendency because of the shortage of domestic production. The wheat is imported for the purpose of foods, food processing, and feeds, and the total amout of its imports have been increased considerably after the late 1980s. In 1998, 4.3 million tons were imported. The import price of wheat increased from a low of $ 102.77 in 1987 to $ 188.92 in 1989. It rose to the highest import price of $ 225.30 in 1996. After 1996, it has declined to $ 145.29 in 1998.

The corn is imported mainly for the purpose of feeds. The total amount of corn has been increased from 6.2 million tons in 1990 to 8.6 million tons in 1997. After that, it decreased to 7 million tons because of the financial crisis, which impeded the raising of livestock. The highest import price of corn per ton was $ 172.64 in 1996, and then declined to $ 129.76 in 1998.

The soybean, which is imported by three major oil companies and the Agricultural and Fishing Marketing Cooperation, is used for the purpose of processing oil and fats, and feeds. The import of soybean has been increased from 1.1 million tons in 1990 to 1.6 million tons in 1997, and then decreased to 1.3 million tons in 1998. The soybean price declined to $ 281.52 in 1998 from $ 330.47, which was the highest import price, in 1997.

All the data in this study are based on the annual series from 1985 to 1998. The import prices are constructed from quantity and value data obtained from Korea Custom Services. Exchange rate used in this study are published regularly by the Bank of Korea. The data

TABLE 3 Import Quantity and Price of Wheat, Corn and Soybean

Unit: 1,000 ton, $/ton

Year	Quantity			Price		
	Wheat	Corn	Soybean	Wheat	Corn	Soybean
1985	2,996	3,035	885	149.53	130.81	255.37
1986	3,443	3,697	944	127.21	104.95	226.69
1987	4,223	4,792	1,131	102.77	89.32	216.62
1988	4,243	5,236	1,137	126.80	111.73	275.29
1989	2,292	5,528	932	188.92	140.92	320.82
1990	2,239	6,198	1,092	176.42	135.20	264.65
1991	4,524	5,438	912	122.02	125.41	265.35
1992	3,926	6,386	1,231	147.73	128.56	256.70
1993	4,470	6,418	1,113	139.82	114.21	256.96
1994	6,124	5,322	1,299	129.82	119.32	272.52
1995	2,860	8,879	1,435	177.27	131.66	266.20
1996	3,107	8,482	1,467	225.30	172.64	310.16
1997	3,400	8,634	1,628	186.18	158.44	330.47
1998	4,295	6,990	1,261	145.29	129.76	281.52

Source: KSC (various years).

on prices of wheat flour and edible oil are consumer price indices obtained from the *Annual Report on Consumer Price Index* of the National Statistical Office. Price index of feed mixture for cattle, swine, and poultry are obtained from the *Monthly Review* of the National Agricultural Cooperative Federation. The estimated results are presented in the Appendix.

To evaluate the effects of changes in import price and exchange rates on the domestic consumer prices and feed mixture prices as input price, the equation (5) is applied by OLS. The price transmission and exchange rate pass-through elasticities obtained are shown in Table 4.

The exchange rate pass-through and price transmission elasticity for wheat flour are 0.8701 and 0.4962, respectively. The domestic consumer price of wheat flour is more affected by the change in exchange rate than the change in the import price of wheat. The exchange rate pass-through elasticity of edible oil shows that given a 1% increase in the exchange rate, the domestic price of edible oil increases by 0.7832%. The price transmission elasticity of edible oil shows that given a 1% increase in the import price, the domestic consumer price of edible oil increases by 0.1762%. The high figures mean that the domestic consumer price of edible oil are very sencitive to the changes in exchange rate.

The exchange rate pass-through and price transmission elasticities of feed mixture for cattle, swine and poultry are relatively lower. Given a 1% increase in the exchange rate, the domestic feed mixture price paid by farmers increases 0.3709% for cattle, 0.4160%

TABLE 4 Results of Effects of Exchange Rate Changes on Domestic Price

Commodity	Price Transmission Elasticity	Exchange Rate Pass-Through Elasticity
Consumer Price		
Wheat flour	0.4962	0.8701
Edible oil	0.1762	0.7832
Input Price		
Feed mixture for cattle	0.1315	0.3709
Feed mixture for swine	0.1807	0.4160
Feed mixture for poultry	0.2465	0.2849

for swine, and 0.2849% for poultry, respectively. Given a 1 % increase in the import price of corn, the domestic feed price paid by farmers increases 0.1315% for cattle, 0.1807% for swine, and 0.2465% for poultry, respectively.

This result implies that the domestic prices in Korea are more affected by the change in exchange rate than the change in the import prices. Also, the increase in exchange rate are almost fully reflected in the domestic consumer price, but it partially affects the feed mixture prices. The reason seems to be storing period of feed grains which are longer than that of food grains. The result corresponds to the fact that the increasing rate of price index paid by farmers is lower than that of consumer price index for food and beverages for the period from December 1997 to December 1998 in Table 2.

IV. Summary and Conclusion

Important issues needed to be incoportated in the agricultural policies to promote the agricultural growth and to secure food stability resulted by the financial crisis. The rising exchange rate has also increased the production costs in the agricultural sector. The income and expenditure of farm households became worse due to increase in farming costs caused by rapid currency depreciation, increase in the interest rate, and decrease in consumption for agricultural products.

In order to appropriate the effects of the current financial crisis on domestic prices, the price transmission and exchange rate pass-through elasticities were estimated. According to the results, the domestic consumer prices of wheat flour and edible oil are more affected by the change in exchange rate than the change in the import price of wheat. It means that these domestic consumer prices have high sensitivity to the changes in exchange rate and the increase in exchange rate are almost fully reflected in the domestic consumer prices.

Although exchange rate pass-through and price transmission elasticities of feed mixture for cattle, swine and poultry are relatively low, the domestic prices are also more affected by the change in exchange rate than the change in the import prices. On the other hand, the increase in exchange rate only partially affect the feed mixture

prices. The reason for this seems to be the storing period of feed grains which are longer than that of food grains.

The agricultural sector is greatly affected by the changes in macro economic variables such as exchange rate and price in the domestic and world market. Accordingly, it should be considered that the exchange rates also play an important role in the agricultural sector due to the progress of financial openness and trade liberalization.

APPENDIX

Consumer price

Wheat flour : ln *CPWF* = -3.7162 + 0.4962 ln *IPW* + 0.8701 ln *EXR*
(-1.78) (1.42) (3.10)
$R^2 = 0.60$ D.W. = 1.39
where *CPWF* : consumer price index of wheat flour(1995=100)
IPW : import price of wheat in $/ton
EXR : exchange rate in terms of won/$

Edible oil price: ln *CPEO* = -1.7011 + 0.1762 ln *IPS* + 0.7832 ln *EXR*
(-0.89) (0.53) (4.12)
$R^2 = 0.65$ D.W.= 2.17
where *CPEO* : consumer price index of edible oil
IPS : import price of soybean in $/ton

Price of feed mixture

Beef : ln *PIFB* = 1.4744 + 0.1305 ln *IPC* + 0.3709 ln *EXR*
(1.94) (1.03) (3.64)
$R^2 = 0.63$ D.W.= 1.94
where *PIFB* : price index of feed mixture for beef cattle (1995=100)
IPC : import price of corn in $/ton

Pork : ln *PIFP* = 0.9076 + 0.1807 ln *IPC* + 0.4160 ln *EXR*
(1.02) (1.21) (3.48)
$R^2 = 0.62$ D.W.= 2.05
where *PIFP* : price index of feed mixture for swine (1995=100)

Chicken: ln *PIFC* = 1.4622 + 0.2465 ln *IPC* + 0.2849 ln *EXR*
(2.06) (2.07) (2.99)
$R^2 = 0.64$ D.W.= 1.79
where *PIFC* : price index of feed mixture for poultry (1995 =100)

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