On Testing PPP and the Stability of EMP: The Korean Experience, 1980-1987**

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CONTENTS

Ⅰ. Introduction

This paper examines the external imbalance of Korea under a managed floating exchange rate over the period 1980-87, applying the exchange market pressure model. The basic theoretical proposition is that any excess supply of money can be relieved by an exchange rate depreciation, a loss in foreign reserves, or by some combination of these two under a managed floating exchange rate system.

Since the Korean economy can be regarded as a small, open economy and its exchange rate system was changed to managed floating from the previous adjustable pegged type, it seems that the exchange market pressure model is now applicable. One interesting aspect characterizing the Korean economy is that its balance of payments situation has changed to surplus after long periods of deficits. Although Kim(1985) has already applied this model to the Korean economy, the data period was too short and monthly data were used. With more observations it is possible to use quarterly data in applying the exchange market pressure model to Korean economy. In addition, the drastic turn to a balance of payments surplus since late 1985 provides a good test on the stability of the estimated coefficients of the exchange market pressure model in Korea using 1980s data.

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The paper is organized into three sections. Section 2 briefly states the essential elements of the exchange market pressure model. Section 3 reports the empirical results for testing purchasing power parity relationship(which is one of the main building blocks in establishing the exchange market pressure model) concerning Korea over the period 1980-87. Section 4 shows the estimation results for the exchange market pressure model in case of Korea and tests the stability of the estimated coefficients. Section 5 summarizes the main conclusions of the paper.

II. The Exchange Market Pressure Model

The monetary approach to the balance of payments and the exchange rate concentrate on the role of the supply and demand for money. As an application of the monetary approach, the exchange market pressure model explains how these pressures operate under a managed floating exchange rate system where the exchange rate or the foreign exchange reserve may change as a result of excesssupply of(demand for) money.

The building blocks for the monetary approach are (1) a stable money demand function which depends upon domestic prices and real income, (2) the money supply process, consisting of a change in foreign reserves via the balance of payments and a change in domestic credit, (3) purchasing power parity stating that domestic prices reflect foreign prices via the exchange rate and, finally, (4) the monetary equilibrium condition. Consepuently, the model can be expressed in terms of the following equations :

$$(1)\ M=L \qquad (2)\ M=A(R+D)$$

$$(3)\ L=KPY \qquad (4)\ P=SP^*$$

where M is the money supply, L is the demand for money, A is the money multiplier, R is the international reserve component of the money base, D is the domestic credit component of the money base, K is the fraction of income that firms and households wish to hold in the form of money balances, P is domestic prices, Y is real income, S is domestic currency price of foreign exchange and P* is foreign prices.

Based on the above equations, the exchange maket pressure equation cna be derived in the following way. Substitute eq. (4) into (3) and, substitute eq. (2) and (3) into eq. (1), then taking logarithms and differentiating eq. (1) gives us the following :

$$(5)\ r+e= -d+p^*+y-a$$

Eq. (5) shows the percentage changes in the relevant variables(except a which represents the percentage rate of appreciation of domestic currency) and the left hand side of eq. (5) denotes the pressure imposed on the exchange market. These are consistent with previous research on the same topic; such as Girton and Roper(1977), Connolly and Silveira(1979), Modeste(1981), Kim(1985).[1]

First, increases in the rate of grawth in domestic credit or the money multiplier result in a proportional depreciation of domestic currency and an outflow of foreign reserves. Second, an increase in the foreign inflation rate results in a proportional appreciation of domestic currency and an inflow of foreign reserves. Third, an increase in real income results in a proportional appreciation of domestic currency and an inflow of foreign reserves.

III. Checking the PPP Relationship

Purchasing power parity(PPP) dealing with the relationship between exchange rate and price level has been applied to many models analyzing problems in international finance. As shown in the previous section, PPP is also used in the derivation of our exchange market pressure model. In this section, we briefly examine the validity of PPP in case of Korea.[2] Using quarterly data running from 1980: I till 1987: IV, we rely on the following equation to check the relative PPP.

$$(6)\quad e(t)=a+b[p(t)-p^*(t)]$$

$$Ho : a=0,\ b=1.$$

In equation(6), e is the rate of change of trade-weighted effective exchange rate(weights are shown in the next section), p and p* denote the inflation rate of Korea and the trade-weighted foreign inflation rate, respectively.

In testing PPP, we used consumer prices data as well as the wholesale prices data to check whether use of different price indices make significant difference. Assuming the existence of the first order autocorrelation, we show the following results applying Cochrane-Orcutt iteration procedure. The results are, first,

$$e(t)=0.011+0.629[p(t)-p^*(t)]$$

$$[0.007]\quad [0.254]$$

$$\bar{R}^2=0.165,\ D.W.=1.795,\ rho=0.405$$

Second, in case of using the consumer price indices,

$$e(t)=0.014+0.472[p(t)-p^*(t)]$$

$$[0.007]\quad [0.325]$$

$$\bar{R}^2=0.055,\ D.W.=1.893,\ rho=0.375$$

1) Not exactly the same but similar formulation is adopted by Brissimis and Leventakis(1984) in a dynamic context. It seems plausible future extension of the exchange market pressure model with respect to purchasing power parity deviation or other form of(such as partial adjustment) money demand.

2) As for the brief reference with respect to PPP, Officer(1976), Isard(1977), Frenkel(1978), Magee(1978), Frenkel(1981), Daniel(1986), Kravis and Lipsey(1988), among others.

, where values in parentheses refer to the standard errors of the estimates.

Summarizing the above-mentioned results, the hypothesis of a=0 cannot be rejected at 5% level of significance. Second, though the initially hypothesized value of b=1 is rejected, signs of the coefficients in the above-mentioned equations conform to our expectation. Consequently, it seems that the use of PPP in our EMP model makes sense at least in the Korean experience.[3)]

IV. Estimation and Stability of the EMP

Up to the end of 1970s, Korea was on an adjustable peg exchange rate system. This was followed by the managed floating exchange rate system from Feb. 1980 until the present. For the purpose of empirical work, quarterly data from 1980: I till 1987: IV are used. Kim(1985) is available with regard to the application of the exchange market pressure model to Korea. However, due to the shortage of data despite the use of purchasing power parity which makes more sense in the longer rather than in the shorter period data, his work contains the shortcoming resulting from the short data period. I relax this shortcoming by using quarterly data and extend the sample period. In addition, considering that our data period includes the period showing change in the direction of the balance of payments, we check whether the estimated coefficients have remained stable over our data period.

Variables shown in eq. (1)-(4) are chosen in the following manner.

P : Korean wholesale price index(1980=100)

P* : trade-weighted foreign wholesale prices(weights are U.S.:0.49, Japan : 0.37, West Germany: 0.06 , Canada: 0.04, U.K.: 0.04)

Y : industrial production index(1980=100)

M : M1+quasi-money, R: Bank of Korea foreign assets,

D : domestic credit, S: trade-weighted effective exchange rate(Source: Internatonal Financial Statistics)

When we test the exchange market pressure model through eq. (5), we can hypothesize the sign of coefficients as $d<0$, $p^*>0$, $y>0$ and $a<0$. The empirical results for eq. (5) using Cochrane-Orcutt iteration method are shown in Table 1.

First, the empirical estimates for eq. (1) show that all estimated coefficients have the correct sign, supporting the exchange market pressure model. In particular, the domestic credit and the money multiplier are shown to affect the dependent variable quite strongly. Compared with Kim's earlier result, our results show by far greater coefficients of determination presumably due to our use of appropriate data(quarterly instead of monthly data).

To test the efficacy of the EMP type monetary model, it is compared between using r or e as the sole dependent variable and using the sum of(r+e). When ronly is used as the dependent variable,

3) I extend Mah(1990) in terms of checking ppp in the test of EMP.

the coefficients are qualitatively similar to those in case of using the sums of(r+e) as the left hand side variable. The use of e only as the dependent variable does not yield a satisfactory result in any aspect. Therefore, the result of using e only is not included in Table 1.

The second test was undertaken to determine whether EMP is independent of its composition. It is hypothesized that the magnitude of market pressure, defined as r+e, is independent of whether the authorities absorb EMP in the exchange rate or foreign exchange reserves.

Following the earlier literature, this notion is tested by introducing another independent variable, Q=(e-1)/(r-1), into eq. (5). The result, reported in Table 1, shows that the variable Q is insignificant, with its coefficient and t value 0.04 and 0.027, respectively. Other coefficients estimated are in essence the same irrespective of the inclusion of Q.

Furthermore, considering that the Korean economy has experienced a drastic turn in its balance of payments situation from long periods of BOP deficits to BOP surplus, we check whether this change in the BOP situation has also altered the behavior of variables affecting the exchange market pressure. BOP situation in Korea was changed at the latter half of 1985. After dividing the period into 2 subperiods showing different BOP situation, we adopt Chow(1960) test for the stability of the coefficients during the data period, which is divided into the first subperiod(covering the BOP surplus period, 1980: Ⅱ-1985: Ⅲ) and the second subperiod(covering the BOP deficit period, 1985: Ⅳ-1987: Ⅳ). As seen in Table 2, we do not reject the hypothesis that the same exchange market pressure model applies over the whole period.

The above-mentioned Chow test checking the structural change is based on the assumption that the disturbance variance of the first set of observations is equal to that of the second set of observations. However, adopting Honda(1982) test which uses the chi-square distribution, we can check whether structural break happened or not, irrespective of the equality of the 2 disturbance variances. The test result, shown in Table 2, shows that the null hypothesis of the same coefficients between the two subperiods is not rejected, even if we don't assume the equality of disturbance variances.

Overall, the tests show the coefficients of the exchange market pressure model have remained stable over the data period.

V. Conclusion

The empirical results suggest that the Korean experience under the managed floating exchange rate system is a good example of applying the exchange market pressure model. The evidence shows that the exchange market pressure model is highly superior to the model that concentrates solely on the exchange rate change or the foreign exchange reserves change. Inclusion of Q which was included to determine whether EMP is independent of its composition in the exchange market pressure model as one of the explanatory variables does not affect the explanatory power and its coefficient is shown to be insignificant. Use of more appropriate data(quarterly data) guarantees our result. Over the estimation period, the coefficients are shown to have remained stable, despite the change in the BOP to large surpluses.

Table 1. The estimated coefficients for the EMP model

Dependent variable	d	p*	y	a	Q	$\bar{R}^2$	d.w.
r+e	−1.404	0.041	0.366	−1.728		0.897	1.956
	(−13.702)	(0.035)	(0.778)	(−14.132)			
r	−0.883	0.954	0.262	−1.071		0.571	1.974
	(−5.746)	(0.621)	(0.385)	(−4.545)			
r+e	−1.400	0.045	0.365	−1.724	0.004	0.897	1.950
	(−7.788)	(0.038)	(0.755)	(−7.914)	(0.027)		

Source : The empirical results are based on quarterly data for the period between 1980: I and 1987: IV. All data were obtained from the International Financial Statistics. The t values are reported in parentheses below the estimated coefficients.

Table 2. Structural Change Test Results

Test	Statistic a)	Result
Chow test	F(5,26)=2.520	Ho not rejected b)
Honda test	X^2(5d.f.)=7.527	Ho not rejected b)

a) lst subperiod; 1980: II-1985: III vs. 2nd subperiod; 1985: IV-1987: IV

b) Ho: no change in the regression coefficients. Results were the same at the 5(or 1)% level of sign-

〈References〉

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요 약

이 논문은 관리변동환율제도하의 한국경제에서 구매력평가설이 과연 현실적 타당성을 갖는지를 점검한 후, 이것이 하나의 지주가 되는 외환시장압력모형을 추정하고, 그 안정성을 보이고자 한다. 80년대의 초중반동안 무역액으로 가중한 환율과 물가 간에는 대체로 구매력평가관계가 성립하는 것으로 나타난다. 아울러 외환시장압력모형은 관리변동환율제도 하의 시기에 있어서는 환율이나 외환보유고의 변화중 어느 하나만을 종속변수로 삼는 경우보다 설명력이 큰 것으로 나타난다. 안정성의 측면에서는 1985년 하반기 이래 국제수지가 지속적 흑자로 바뀌는 전환이 발생했음에도 불구하고, 연구대상기간중 외환시장압력에서의 안정성은 깨지지 않는 것으로 보인다.