How Business Sector Competition Influences Public Sector Corruption: The Case of Korea*

기업부문의 경쟁이 공공부문의 부패에 어떻게 영향을 주는가: 한국의 경우

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ABSTRACT

1986년부터 2004년까지 연간시계열자료를 사용하여 Cochrane-Orcutt방법으로 추정한 결과 기업부문의 경쟁은 공공부문의 부패감소에 본질적으로 기여함을 보여준다. 부패는 어떤 목표를 추구하는데 필요한 제도와 조직 그리고 운영능력으로 정의되는 사회적 기술(social technology)의 중요한 요소들 중의 하나이다(강철규 · 이재형, 2009). 본 연구에서는 공공부문의 부패지표로 공공부문의 부패건수와 공공부문의 직원 1인당 실질부패금액의 두 종류의 대용변수를 사용하여 추정하였다. 또한 기업부문의 경쟁의 대용변수로 사용한 일반집중도는 공공부문의 부패건수보다 공공부문의 직원 1인당 실질부패금액에 더욱 민감함을 보여준다. 한편 오차수정모형 (error correction model)을 사용하여 추정한 결과는 공공부문의 직원 1인당 실질부패금액이 이듬해 평균 1.27% 감소하는 반면에, 공공부문의 부패건수는 통계적 유의성이 없는 것으로 나타났다. 따라서 한국의 정책수단의 선택은 규제개혁뿐만 아니라 시장감시기능(market monitoring system)을 통하여 기업부문의 경쟁향상을 토대로 해야 한다. 시장감시기능은 독점을 감소시키고 이는 공공부문의 부패수준을 감소시킨다.

Key Words: the market monitoring system(시장감시기능), two indicators of public sector corruption (public sector corruption in numerical terms and real corrupt money per public worker)(두 종류의 공공부문의 부패지표들(공공부문의 부패건수와 공공부문의 직원 1인당 실질부패금액)), business sector competition(기업부문의 경쟁)

JEL-classification: D73; L41; O10

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Ⅰ. Introduction

One criterion used to discern the level of corruption, an important component of social technology defined as institution, organizations, and operational capabilities that are required in pursuing any goal or goals (Kang, Chul-kyu and Lee, Jae-Hyung, 2009), in a country is a level of competition as well as economic development indicator. For example, Korea was ranked 17th in terms of competitive advantage index across 102 countries as of 2004 by Global Competitiveness Report by World Economic Forum (WEF), whereas Korea was ranked 47th in the Corruption Perception Index (CPI) by Transparency International (TI). This suggests that Korea has a higher level of corruption as compared to the level of competition.

A variety of empirical literatures has revealed a significant inverse relationship between competition and corruption. For example, Clarke&Xu (2002) hypothesised that corruption to utilities is lower in countries with greater competition in infrastructure. Based on data for 1822 cellular companies in 21 countries over the period 1999 from the World Business Environment Survey of the World Bank, they find that the number of cellular companies by one reduces the share of revenues paid as bribes to utilities by about 0.2% at the 1% significance level on a two-tailed test. Lopez&Mitra (2000) examine the implications of corruption and rent-seeking behavior on the part of the government for the relationship between pollution and growth, and claim that corruption takes the form of cooperative interaction between the govemment and the private firm.

On the contrary, Shleifer&Vishny (1993) suggest that corruption spreads because of competition both between the officials and between the consumers, whereas competition between buyers of government services does not help the spread of corruption without theft. More recently, Vinod (1999) also argues that more intense competition involves greater risk, bigger governments are needed to reduce this risk, which in turn lead to corruption. Using the cross-sectional data of 31 countries for 1989-1990 from the World Competitiveness Report by WEF, for example, Ades&Di Tella (1999) present the ordinary least squares (OLS) estimates that countries with markets dominated by a few firms have lower corruption, though its coefficient is not statistically significant; a one-standard-deviation increase in Market Dominance reduces corruption by 0.03 points, almost 2.1% of a standard deviation in the World Competitiveness Report corruption index.

In their comparative static results, however, Bliss&Di Tella (1997) propose that an increase in competition decreases the proportion of firms operating and has an ambiguous effect on corrupt payments per firm.

Therefore theoretically business sector competition can either increase or decrease the

level of public sector corruption. Thus, it is an empirical question whether more intense business sector competition will decrease public sector corruption. To this question, we use annual time series data over 1986－2004. To our knowledge, however, none have shown empirical evidence on the relationship between business sector competition and public sector corruption in Korea.

On the basis of these arguments we seek to ascertain if the relationship between business sector competition and public sector corruption is supported by Korea's annual time series data.

Corruption implies that the agent (an official) entrusted with carrying out a task by the principal (the public) engages in some sort of malfeasance for private enrichment which is difficult to monitor for the principal (Bardhan, 1997). From this we classify corruption into that by business and that by the public sector.

Given the accessible corruption indicators the number of unfair business practices stands as a proxy for business corruption, while the number of exposures (hereafter public sector corruption in numerical terms) and the real amount of money per public worker exposed (hereafter real corrupt money per public worker) as a result of audit and inspection in the public sector are proxies for two indicators of public sector corruption.

With unique business and public sector level annual time series data for the period 1986 to 2004 from Korea, we explore the possibility that business sector competition affects public sector corruption.

We estimated it using two alternative measures of public sector corruption; public sector corruption in numerical terms and real corrupt money per public worker. We use the general concentration ratio, hereafter, referred to as the concentration ratio, for the top 100 leading companies as a proxy for competition (Encaoua &Jacquemin, 1980). This implies a negative effect, so that a lower score in the variable will be associated with relatively more intense competition.

We organise the rest of the paper as follows. Section Ⅱ develops the analytical model that highlights the effect of business sector competition on public sector corruption. Section Ⅲ describes the data. Section Ⅳ presents and discusses the empirical results. Specifically, we estimate an error correction model to study the short-run dynamics in the relationship between business sector competition and two indicators of public sector corruption in this section. Section Ⅴ concludes the paper.

Ⅱ. The Model

In order to test for the hypothesis that the differences in business sector competition are causal to the differentials in two indicators of public sector corruption, the following function can be formulated (Klidgaard, 1988; Torrez, 2002; Larraín&Tavares, 2004):

$$GC1_t = f(CR_t, PC_t, GC2_t, gOPEN_t, \textit{INWARD}FDI_t, T_t, T_t*RR_t) \quad (1)$$
$$GC2_t = h(CR_t, PC_t, GC1_t, gOPEN_t, \textit{INWARD}FDI_t, T_t, T_t*RR_t) \quad (2)$$

where $GC1_t$ denotes public sector corruption in numerical terms expressed as the number of exposures. $GC2_t$ denotes the real corrupt money per public worker. CR_t refers to the concentration ratio for the top 100 leading companies as a proxy for competition.

PC_t is the proxy for business sector corruption. It is the number of unfair business practices. $OPEN_t$ is the proxy for the degree of trade openness. It is the percentage of the sum of exports and imports of goods and services measured as a share of total factor cost national income. g denotes the growth rate. Therefore, $gOPEN_t$ denotes the growth rate in trade openness. For example, Jauntte et al. (2008) use the ratio of imports and exports to GDP_t as a proxy for trade openness. $\textit{INWARD}FDI_t$ denotes a dummy variable (1998-1999=1, corresponding to the period of an increase in *inward* Foreign Direct Investment(FDI); otherwise=0).

T_t denotes a time trend variable. RR_t denotes a dummy variable (2000-2004=1, for the period of regulatory reform enacted by the government; otherwise=0). T_t*RR_t denotes an interaction variable interacted RR_t with T_t. t represents year. Table 1 provides a description of the variables used in the model.

An error correction model (ECM) allows us to study the short-run dynamics in the relationship between business sector competition and public sector corruptions. For example,

$$\triangle GC1_t = h(\triangle CR_t, \triangle PC_t, \triangle GC2_t, \triangle gOPEN_t, \textit{INWARD}FDI_t, T_t, T_t*RR_t, S_{t-1}) \quad (3)$$

where S_{t-1} denotes the error correction term(see Wooldridge,2000).

Equations (1) and (2) represent for well-behaved production functions exhibiting everywhere diminishing returns to inputs.

Ⅲ. Data

Although we estimated the OLS model for each pair of public sector corruption (i.e., public sector corruption in numerical terms and real corrupt money per public worker), we analyse the two iterated Cochrane-Orcutt estimates over the OLS results because the Durbin-Watson (D.W.) tests indicate that there is evidence of autocorrelated disturbances or misspecification in the OLS regressions (Pindyck&Rubinfeld, 1981). Table 1 provides a description of the variables used in the model as well as their means and standard deviations (SDs).

The total factor cost national income (NI) measured in current Korean Won converted to real 2000-levels by applying the Gross Domestic Product (GDP)-deflator (see, e.g., Mahlberg&Url, 2003).

Least squares regression assumes that the dependent variable and (less critically) the explanatory variables are normally distributed (Pagan&Vella, 1989). This assumption is reasonably satisfied by our data. Table 1 contains the commonly used Kolmogorov and Smirnov tests for normality. As can be seen, the tests fail to reject the hypothesis of normal distribution for two indicators of public sector corruption and concentration ratio.

On the other hand, the problem with a preassigned significance level is that if the sample size is large enough, every null hypothesis can be rejected. Therefore, the significance level should depend on the sample size. For example, Leamer (1978) argues that the significance level must be made a decreasing function of sample size. Maddala (1992) also argues that the significance levels to be used should be much higher for small sample sizes (sometimes 25 to 50%). In this study, small time-series datasets with nineteen years have been used. On the basis of their arguments we use the 20% level of significance in this study.

Table 1. Variable definitions and sources

Variables	Definition (Source)	Mean (SD)	Robustness checks z-value (p-value)[1)]
$GC1_t$	Public sector corruption[2)] (The board of audit and inspection of Korea)	5.550 (1.579)	0.600 (0.865) Accept H_0
$GC2_t$	Real corrupt money per public worker[3)] (The board of audit and inspection of Korea)	2.333 (1.131)	0.814 (0.522) Accept H_0
CR_t	Concentration ratio for the top 100 leading companies[4)] (Korea Fair Trade Commission)	41.753 (3.855)	0.921 (0.364) Accept H_0

PC_t	Business sector corruption[5] (Korea Fair Trade Commission)	0.277 (0.099)	0.509 (0.958) Accept H_0
NI_t	Total factor cost national income[6] (Korea National Statistical Office)	299828 (163433)	0.409 (0.996) Accept H_0
$TRADE_t$	Total amount of exports and imports[7] (Korea Institute for Industrial Economics and Trade)	234505 (147817)	0.763 (0.606) Accept H_0
POP_t	Population[8] (Korea National Statistical Office)	44916.4 (2236.2)	0.434 (0.992) Accept H_0
P_t	GDP Deflator (Korea National Statistical Office)	80.932 (23.120)	0.675 (0.752) Accept H_0
EX_t	Exchange rate (The ministry of strategy and finance)	962.890 (243.728)	1.048 (0.222) Accept H_0

Notes: 1) The Kolmogorov-Smirnov tests for normality. The alternative includes: H_0=normal distribution. By "Accept H_0" we strictly mean" cannot reject H_0. "The α risk controlled at 0.10 on a two-tailed test.

2) Unit: '000 cases. The number of exposures as a result of audit and inspection in public sector.

3) Unit: 100 million Korean Won. The real amount of money per public worker exposed as a result of audit and inspection in public sector. Converted with GDP Deflator.

4) Scale of 0 to 100. The general concentration ratio.

5) Unit: '000 cases. The number of unfair business practices.

6) Unit: billion Korean Won.

7) Unit: billion Korean Won. It is the sum of exports and imports of goods and services.

8) Unit: '000 persons.

Ⅳ. Estimation Results

In Table 2, the estimated partial correlation coefficient between CR_t(business sector concentration ratio) and $GC1_t$(public sector corruption in numerical terms) is 0.549, and the correlation coefficient CR_t and $GC2_t$ (real corrupt money per public worker) is 0.655. These results indicate the positive and significant correlations between CR_t and $GC1_t$ and between CR_t and $GC2_t$, suggesting that more intense business sector competition reduces two indicators of public sector corruption.

The estimated partial correlation coefficients between PC_t and each of $GC1_t$ and $GC2_t$ show the positive sign, although the correlation coefficients are close to zero. Table 2 also provides the estimated partial correlation coefficients between $gOPEN_t$ and $GC1_t$ and between $gOPEN_t$ and $GC2_t$, suggesting that two indicators of public sector corruption are negatively but

insignificantly correlated.

Table 2. The Partial Correlation Coefficiens Among Selected Variables

Variables	CR_t	PC_t	$gOPEN_t$
$GC1_t$	0.549	0.171	-0.174
	(0.034)***	(0.543)	(0.535)
$GC2_t$	0.655	0.056	-0.221
	(0.008)****	(0.844)	(0.429)

Notes: the number of degrees of freedom is thirteen. Values in parentheses are the estimated p-values. **** and *** denote significance at the 1% and 5% levels on a two-tailed test, respectively.

We have dealt with the functional form issue using the Box-Cox transformation framework in Table 3 and have found the double-natural logarithmic transformation suitable (Maddala, 1977).

Table 3. Box-Cox Procedure of Double Logarithmic Versus Linear Models of each of Two Public Sector Corruption Indicators[1)]

Equation			
$GC1_t$		$GC2_t$	
Logarithmic model (H_1)	Linear model (H_0)	Logarithmic model (H_1)	Linear model (H_0)
RSS=0.393	RSS=0.923	RSS=0.478	RSS=2.657
Reject H_0		Reject H_0	

Notes:1) For the test procedure see Maddala (1977). In each of $GC1_t$ and $GC2_t$ equations, the double natural logarithmic model with the smaller residual sum of squares (RSS) is chosen. The values of *ln*gOPEN are less than zero. Therefore, the double natural logarithmic model for the tests is obtained by relying upon the first-order Taylor series approximation $ln(1+X) \fallingdotseq X$. For example, $lngOPEN = ln(1+gOPEN-1) \fallingdotseq gOPEN-1$.

Table 4. The Cochrane-Orcutt estimates of the public sector corruption equation

Explanatory Variables[2]	Dependent Variables[1]			
	$lnGC1_t$		$lnGC2_t$	
	(1)-(1)	**(1)-(2)**	**(2)-(1)**	**(2)-(2)**
$lnCR_t$	6.783	5.480	15.149	11.868
	(1.946)****	(1.805)***	(6.338)***	(5.042)***
$lnPC_t$	0.234	0.363	0.340	0.462
	(0.132)*	(0.104)****	(0.402)	(0.367)
$lnGC1_t$	—	—	-1.164	-0.873
			(0.857)	(0.783)
$lnGC2_t$	-0.161	-0.138	—	—
	(0.119)	(0.125)		
$lngOPEN_t$	-0.009	-0.006	-0.021	-0.014
	(0.004)**	(0.003)*	(0.012)*	(0.008)*
$INWARDFDI_t$	-0.947	-0.575	-2.244	-1.518
	(0.375)***	(0.278)**	(1.092)**	(0.673)**
T_t	-0.025	-0.032	-0.070	-0.075
	(0.018)*	(0.019)*	(0.047)*	(0.047)*
T_t*RR_t	-0.021	—	-0.036	—
	(0.015)*		(0.043)	
ρ	-0.541	-0.506	-0.544	-0.515
	(0.280)**	(0.273)**	(0.280)**	(0.271)**
constant	-22.635	-18.078	-52.117	-40.412
	(7.006)***	(6.469)***	(21.843)***	(16.984)***
Endogeneity[3]	1.903*	0.109	0.007	0.616
R^2(Adj.R^2)	0.886 (0.772)	0.851 (0.736)	0.711 (0.423)	0.678 (0.427)
F	(1,8)=8.909***	6,9)=8.621****	(1,8)=2.815*	(6,9)=3.154**
D.W.[4]	1.620	1.628	1.836	1.960
SEE	0.132	0.140	0.356	0.350

Notes: 1) Values in parentheses are the estimated absolute standard errors of the regression coefficients. ****, ***, **, and * denote significance at the 1%, 5%, 10%, and 20% levels on a two-tailed test, respectively.

2) ρ indicates the estimate of autocorrelation coefficient.

Under the columns "(1)-(1)" and "(2)-(1)" the F-statistic for the joint significance of the added coefficient is larger than the 80% critical value, implying that the null hypothesis of no structural change in T_t during the period of regulatory reform (RR_t) is rejected. For the test procedure see Beggs (1988). Values in parentheses are the number of degrees of freedom. ****, ***, **, and * denote significance at the 1%, 5%, 10%, and 20% levels,

respectively.

3) Individual t-tests are reported. The tests for endogeneity are carried out by augmenting the OLS regression with the predicted value of the suspected regressor of endogeneity (i.e., lnCR$_t$) from the reduced-form estimations(Skaife et al.,2006). T*RR, the interaction variable interacted Twith RR, has too low tolerance (1.00E-04 limits reached) and therefore the variable is not entered into the respective equations for the test.
4) D.W.; D.W.$_u$=2.566 with k′=8 at α=1%. If the estimated D.W. value lies between D.W.$_u$ and 4-D.W.$_u$, the null of no serial correlation is not rejected.

In a comparison of the standard errors of the estimates (SEE), we choose the results reported in Table 4 under the columns "(1)-(1)" and "(2)-(2)" with the smaller SEE.

The Cochrane-Orcutt estimates suggest that business sector concentration ratio is indeed highly significant in two indicators of public corruption. For example, a 1% decrease in business sector concentration ratio reduces public sector corruption in numerical terms by 6.78% and real corrupt money per public worker by 11.87%. Therefore, two indicators of public sector corruption appear to be lower the more intense competition is. These results suggest that business sector concentration ratio is more sensitive to real corrupt money per public worker than to public sector corruption in numerical terms.

The estimated coefficient of business sector corruption (lnPC$_t$) is significant in lnGC1$_t$, and maintains a constant positive sign, whereas the business corruption indicator has a positive, although statistically insignificant, impact on lnGC2$_t$. In order to confirm this, the Stock and Watson tests for causality(Stock&Watson, 1989) are adopted. For example, we do not reject the null that lnPC$_t$ does not cause lnGC2$_t$ conditional on lnCR$_t$, lnGC1$_t$, and lngOPEN$_t$ (the estimated absolute t-value=0.891). Therefore, a decrease in business sector corruption reduces public sector corruption in numerical terms. These results are primarily due to the reason that PC$_t$ and GC1$_t$ are measured as the number of business sector corruption and public sector corruption, respectively.

On the other hand, lnGC2$_t$(lnGC1$_t$) is not significantly related to lnGC1$_t$(lnGC2$_t$). For example, the Stock and Watson tests for causality do not reject the null that lnGC2$_t$ does not cause lnGC1$_t$ conditional on lnCR$_t$, lnPC$_t$, and lngOPEN$_t$(the estimated absolut et-value=1.206). It also suggests that the tests do not reject the null that lnGC1$_t$ does not cause lnGC2$_t$ conditional on lnCR$_t$, lnPC$_t$, and lngOPEN$_t$(the estimated absolut et-value=1.529). In sum, the differences in public sector corruption in numerical terms are not causal to the differentials in real corrupt money per public worker, and vice versa.

The growth rate in trade openness (lngOPEN$_t$) shows a statistically significant coefficient with the predicted negative sign. The regression results suggest that trade openness is, as predicted by all previous studies, associated with lower public sector corruptions. For example, Serra(2006) presents the evidence that even though the sum of

merchandise exports and imports measured in current U.S. dollar divided by the value of GDP converted to international dollars using purchasing power parity rates as a proxy for openness to trade loses statistical significance in nearly 40% of the regression run, openness to foreign trade is a primary factor for experiencing relatively low corruption. Serra employed the average value of CPI(Corruption Perception Index) by TI(Transparency International) for the period of 1997-1999.

The dummy for *inward* FDI_t(*INWARDFDI*$_t$) shows that an increase in *inward* FDI_t during 1998-1999 may be a causal factor for lower public sector corruptions. An implication of this is that financial openness reduces corruption due to advanced management practices.

Two indicators of public sector corruption display downward trend; each of $GC1_t$ and $GC2_t$ is decreasing by about 2.5% and 7.5% per year over the period. The observed joint F(1, 8) statistic suggests that the coefficient of T_t*RR_t shows strong significance with the expected negative sign. This point is based on the view that regulatory reform is associated with lower corruption. For example, Treisman(2000) analyses the regulation-corruption relations. With cross-national data for thirty six countries in 1998 he provides results that state intervention in the form of regulation leads to more corruption(t-value=1.813).

The Cochrane-Orcutt estimates reveal that the null hypothesis of no endogeneity between CR_t and each of $GC1_t$ and $GC2_t$ is not rejected. These results identify the direction of causality that business sector competition affects two indicators of public sector corruption, and not vice versa.

The estimated ECM results in Table 5 indicate that the error correction coefficient is negatively and significantly related to real corrupt money per public worker ($GC2_t$). This implies, for example, that real corrupt money per public worker in the previous period has overshot the equilibrium; real corrupt money per public worker falls by 1.2%~1.27% on average in the next year. However, public sector corruption in numerical terms ($GC1_t$) appears to be insignificant.

Table 5. Estimates of the error correction terms[1)]

Error correction term	Endogenous variables: $\Delta lnGC1_t$		$\Delta lnGC2_t$	
	(1)-(1)	**(1)-(2)**	**(2)-(1)**	**(2)-(2)**
S_{t-1}	-0.261 (0.422)	0.106 (0.501)	-1.269 (0.380)****	-1.196 (0.341)****
R^2	0.701	0.473	0.600	0.588
Adj. R^2	0.436	1.104	0.245	0.299
D.W.	1.885	1.463	1.943	1.847

Notes:1) Obtained from the OLS regressions. Values in parentheses are the estimated absolute standard errors of the regression coefficients. **** denotes significance at the 1% level on a two-tailed test, respectively. D.W.; $D.W._U$=2.566 with k'=8 at α=1%. If the estimated D.W. value lies between $D.W._U$ and 4-$D.W._U$, the null of no serial correlation is not rejected. A full estimates are given in Appendix Table 1.

Ⅴ. Conclusions

With unique business and public sector level annual data for the period 1986 to 2004 from Korea, the Cochrane-Orcutt estimates are consistent with the hypothesis that more intense business sector competition makes a substantial contribution to a decrease in public sector corruption, an important component of social technology defined as institution, organisations, and operational capabilities that are required in pursuing any goal or goals (Kang, Chul-kyu&Lee, Jae-Hyung, 2009).

We estimated it using two alternative measures of public sector corruption; public sector corruption in numerical terms and real corrupt money per public worker. We use the concentration ratio for the top 100 leading companies as a proxy for competition.

It is observed that business sector concentration ratio is more sensitive to real corrupt money per public worker than to public sector corruption in numerical terms.

On the other hand, the estimated ECM results imply that real corrupt money per public worker falls by 1.2%~1.27% on average in the next year, whereas public sector corruption in numerical terms appears to be insignificant.

In order to reduce the level of public sector corruption, therefore, the choice of Korea's policy instruments should be based upon the intensity of business sector competition through the market monitoring system of large companies (e.g., private lawsuits for damage compensation in antitrust cases) as well as regulatory reform. The market monitoring system will reduce monopoly, thus reducing the level of public sector corruption (Klitgaard,1988)..

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Appendix

Appendix Table 1. Estimates of the error correction terms: OLS[1)]

	Dependent Variable			
Explanatory Variables	$\Delta lnGC1_t$		$\Delta lnGC2_t$	
	(1)-(1)	(1)-(2)	(2)-(1)	(2)-(2)
$\Delta lnCR_t$	-6.010	-2.564	0.394	-1.812
	(2.322)***	(2.411)	(5.396)	(3.360)
$\Delta lnPC_t$	-0.249	-0.212	0.171	0.111
	(0.186)	(0.234)	(0.358)	(0.328)
$\Delta lnGC1_t$	-	-	-0.114	-0.318
			(0.576)	(0.418)
$\Delta lnGC2_t$	-0.123	-0.075	-	-
	(0.133)	(0.166)		
$\Delta lngOPEN_t$	-0.003	-0.002	0.001	0.001
	(0.003)	(0.003)	(0.005)	(0.005)
$INWARDFDI_t$	-0.229	0.104	0.167	0.019
	(0.334)	(0.389)	(0.607)	(0.521)
T_t	0.049	-0.030	0.011	0.038
	(0.033)*	(0.016)**	(0.057)	(0.025)*
T_t*RR_t	-0.057	-	0.027	-
	(0.022)***		(0.050)	
S_{t-1}	-0.261	0.106	-1.269	-1.196
	(0.422)	(0.501)	(0.380)****	(0.341)****
Constant	-0.721	0.493	-4.018	-3.923
	(0.969)	(1.072)	(1.218)****	(1.161)****
F	2.640**	1.283	1.690	2.036*
SEE	0.249	0.313	0.437	0.421

Notes:1) Values in parentheses are the estimated absolute standard errors of the regression coefficients. ****, ***, **, and * denote significance at the 1%, 5%, 10%, and 20% levels on a two-tailed test, respectively. S_{t-1} denotes the error correction term.