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REPUBLIC OF KOREA

Selected Issues

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I. Potential Output, the Output Gap, and Inflation in Korea[1]

This chapter uses several approaches to estimate the output gap in Korea since the onset of the financial crisis in 1997. It is found that Korea's real GDP fell almost 10 percent below potential during 1998-99, but that by early-2000, the gap had been closed. Historical analyses of Korea's growth performance indicate that productivity growth had been slowing during the period leading to the crisis. For the medium term, growth rates of physical capital and labor inputs are expected to slow, but higher growth of total factor productivity arising from structural reforms could keep potential output growth at around 6 percent per year. Econometric tests of the gap model show that the output gap provides useful information regarding future inflation rates, but that the role of import prices may now be larger, perhaps due to the increased openness of the economy.

A. Introduction

1. **The Korean economy's spectacular recovery following the financial crisis in 1997-98 raises the question of the economy's sustainable rate of growth in the medium term.** After contracting by almost 7 percent in 1998, the economy grew by almost 11 percent in 1999, and an estimated 9½ percent in 2000. The rapid recovery raised concerns in the first half of 2000 about whether the economy was in danger of overheating. With the economy projected to slow in 2001, concerns about overheating have been replaced by concerns about a possible recession. Estimates of potential growth and the output gap can help shed light on these issues.

2. **Potential output is defined as the maximum output that an economy can produce without generating inflation**. In the short run, the size of the output gap provides information on inflationary pressures. In the medium to long run, the estimate of potential growth helps in evaluating the sustainable rate of growth. For policy analysis, for example, the stance of fiscal policy can be gauged by measuring the cyclically adjusted budget balance, which is the actual budget balance corrected for the effects of differences between actual and potential output.

3. **This chapter discusses estimates of potential output and the output gap in Korea, projections of the sustainable rate of growth, and the economic relationship between measures of the output gap and inflation.** The historical analysis covers the period 1970-2000, while the forward-looking part covers 2001-05. The sharp break that occurred in most macroeconomic series during the crisis period in 1997-99 means that quantitative analyses of the current state of the economy are more difficult than usual. Hence, estimates of potential output and the output gap are subject to considerable uncertainty. Nevertheless, the three approaches used in this study point to broadly the same results.

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[1] This chapter was prepared by Henry Ma. Aung Thurein Win provided helpful research assistance. All calculations are based on data available as of December 15, 2000.

- The Korean economy suffered a negative output gap of around 7 percent in 1998, and around 1½ percent in 1999.[2] **By 2000 Q1, the gap had closed, and real GDP is projected to exceed potential output by around 1½ percent in 2000-01**, and to settle to approximate balance in 2002-05. The positive output gap in 2000-01 is modest and is unlikely to spark inflationary pressures.

- For the medium term, the growth rates of physical capital accumulation and labor inputs can be expected to be slower compared to past trends. This is due to a move away from the system of easy credit for favored corporations and excessive focus on investment and expansion, as well as demographic and labor market developments. However, total factor productivity growth should pick up, due to a restructuring of the economy to become more open, competitive, and market oriented. Hence, **the annual growth rate of potential output could be around 6 percent**. Total factor productivity growth would account for around one-half of total growth, up from one-third before the crisis.

- Tests of the relationship between estimates of the output gap and CPI inflation suggest that **the output gap estimated using the production function approach provides a useful signal** to the monetary authority. That is, when actual output exceeds estimated potential output, an increase in inflationary pressures can be expected. However, the role of supply shocks in the form of import prices has grown, very likely due to the increased openness of the Korean economy.

B. Estimates of the Output Gap

4. **Although intuitive in concept, estimating potential output is difficult in practice.** A wide range of approaches can be used for estimating potential output, ranging from simple detrending techniques, to more structural approaches, such as the production function approach. However, there is currently no single widely accepted approach. As De Masi (1997) notes, "country-specific circumstances have tended to influence the methodology used." Useful surveys of the various methods available include St-Amant and Van Norden (1997) and Khatri and Lee (2000). Three approaches were used to estimate potential output in Korea: the Hodrick-Prescott filter (HP), the cubic spline smoothing method (CS), and the production function approach (PF).

Time series sechniques (HP and CS)

5. The HP and CS methods are readily applicable using standard econometric software, but may not produce reliable results (St-Amant and Van Norden, 1997). These two

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[2] The output gap is defined as the difference between actual and potential output. Hence, a negative (positive) gap implies that actual output is below (above) potential.

approaches are purely statistical and attempt to decompose a time seies into its permanent and cyclical components. Further technical descriptions of the HP and CS methodologies can be found in Khatri and Lee (2000).

6. As Khatri and Lee (2000) note, HP and CS estimates can become ill-defined at the beginning and end of samples, and also if there is a structural break in the data. In the Korean context, the sharp decline in output in 1998-99 would tend to bias downward the filtered estimates of potential output (the "end-point problem"). To address this problem, the quarterly real GDP series was extended to 2005 Q4, using projections derived from the PF approach (see the following section), and the HP and CS filters were then applied to the extended series.

Production function approach

7. The PF approach is appealing for its close links to growth theory and empirics, but in practice can be very data intensive and require substantial judgment in estimating the trends of the production function's components. The PF approach used in this study follows the methodology described in Congressional Budget Office (1995). A Cobb-Douglas production function was set up with two inputs, physical capital (K) and raw labor (L):

$$\ln Y_t = \ln A_t + \alpha \ln K_t + (1-\alpha) \ln L_t \qquad (3)$$

where ln is the natural log of a variable, A_t is the level of total factor productivity (TFP), α and $(1-\alpha)$ are the shares of physical capital (K) and labor (L), respectively, and are assumed to be 0.30 and 0.70.[3] The level of TFP (A_t) is derived as a residual, using historical data on real GDP, real gross fixed capital formation (which is used to compute a capital stock series)[4], and employment (adjusted by average hours worked). Table I.1 shows the results, while Box I.1 provides a comparison of Korea's productivity performance over time and across countries.

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[3] The time-varying factor shares that Kim and Hong (1997) calculated from the national income accounts were also tried, but the results were unsatisfactory. One reason is that, for the earlier periods (i.e., the 1970s), the calculated shares may underestimate the share of labor, due to the presence of wage repression. As noted by Dornbusch and Park (1987), during that period: ". . . politics, certainly. . . left little room for organized labor and even less for union militancy."

[4] The perpetual inventory method described in Young (1995) was used. This method requires assumptions to be made regarding the initial capital stock and the depreciation rates (6 percent per annum). However, over a sufficiently long period of estimation (as in this case), the development of the capital stock series becomes relatively invariant to initial assumptions. In fact, the estimated growth rates of capital turn out to be quite close to estimates made by Kim and Mun (1999).

Table I.1: Korea: Growth Accounting 1/ 2/

	Real GDP	Capital	Labor	Ave Hours	TFP
			(percent change)		
1971	8.6	9.8	3.3	-0.8	3.0
1972	4.9	6.2	4.6	2.4	-0.2
1973	12.3	10.1	5.4	1.8	5.2
1974	7.4	10.5	3.9	1.9	1.2
1975	6.5	10.6	0.8	0.8	1.8
1976	11.2	11.3	7.2	3.0	3.2
1977	10.0	13.2	4.9	-1.1	3.7
1978	9.0	18.1	5.3	1.1	0.6
1979	7.1	17.5	3.0	-0.5	0.6
1980	-2.1	12.5	-0.6	-0.7	-6.6
1981	6.5	9.2	4.3	-0.6	1.6
1982	7.2	9.0	14.2	4.3	0.7
1983	10.7	10.1	1.4	-0.9	7.8
1984	8.2	10.5	1.6	-0.5	5.3
1985	6.5	9.5	3.5	0.0	0.8
1986	11.0	9.7	4.7	-2.2	5.1
1987	11.0	10.1	4.4	2.8	3.9
1988	10.5	11.1	3.4	0.7	4.7
1989	6.1	11.4	4.4	-2.3	-0.1
1990	9.0	13.6	2.7	-1.3	3.0
1991	9.2	14.0	3.5	-1.1	2.6
1992	5.4	12.3	1.0	-1.5	0.3
1993	5.5	10.4	2.6	0.4	1.2
1994	8.3	10.4	2.4	-0.6	2.9
1995	8.9	10.9	2.9	0.2	3.6
1996	6.8	10.3	2.2	-0.4	2.2
1997	5.0	9.1	0.1	-1.9	1.2
1998	-6.7	5.4	-5.7	-2.6	-5.1
1999	10.7	4.4	5.2	-0.2	7.7
2000	9.5	5.2	2.2	-1.3	3.7
2001 3/	6.5	5.3	1.7	0.0	3.8
1970-1999	7.3	10.7	3.3	0.0	2.1
1980-1997	8.0	10.7	3.4	-0.3	2.7
1980-1998	7.7	10.7	3.2	-0.4	2.7
1980-1999	7.8	10.4	3.2	-0.5	2.8
1980-2000	7.7	10.1	3.1	-0.5	2.8
1970-1980	7.2	11.9	3.8	0.8	1.1

1/ The shares of capital and labor are assumed to be 0.3 and 0.7 percent.
2/ The contributions to growth may not add up horizontally, due to the aggregation of quarterly data.
3/ Potential output growth

Box I.1. Korea: Total Factor Productivity Growth

Estimating the sources of economic growth has been a veritable growth industry in applied economic research. Due to the record of rapid and sustained growth in output, East Asia has attracted a large share of researchers' attention. The table below summarizes the results of previous studies of TFP growth in Korea and a selection of East Asian economies.

	TFP Growth (percent per year) 1/	
	Economy	Manufacturing
Korea		
Kim and Park (1985)		
1963-72	4.0	...
1972-82	1.5	...
Pyo, Kwon, and Kim (1993)		
1970-90	1.3	1.1
World Bank (1993)		
1960-89	3.1	...
Kim and Lau (1994)		
1960-90	1.2	...
Young (1995)		
1970-80	1.0	2.3
1980-90	2.5	2.9
Collins and Bosworth (1996)		
1973-84	1.1	...
1984-94	2.1	...
Kim and Hong (1997)		
1972-79	3.5	...
1979-95	3.2	...
Kim (2000)		
1971-80	2.2	...
1981-90	2.7	...
Hong Kong SAR		
World Bank (1993)		
1960-89	3.6	...
Young (1995)		
1981-86	0.9	...
1986-91	2.4	...
Singapore		
World Bank (1993)		
1960-89	1.2	...
Young (1995)		
1970-80	-0.9	-0.9
1980-90	-0.5	...
Taiwan Province of China		
World Bank (1993)		
1960-89	3.8	...
Young (1995)		
1970-80	1.5	0.1
1980-90	3.3	2.8

1/ To facilitate comparison between the pre-1980 and post-1980 subperiods for Korea, the implicit growth rates have been calculated from the original results, where warranted and feasible.

The above results point to the following observations.

- **First, Korea's productivity performance has been striking.** Accumulation of physical and human capital has been rapid, but does not seem to have been so excessive as to lead to decreasing returns, as for instance Young (1992, 1995) concluded in the case of Singapore.
- **Second, Korea's productivity record can be divided into roughly two phases.** In the first phase, from 1970 to around 1980, productivity grew modestly. After the 1980 recession, however, the pace sped up. The results presented in this chapter are also consistent with these findings.

8. To estimate potential output, trend levels of physical capital, labor inputs, and TFP are derived and substituted into the following equation (where asterisks denote trend):

$$\ln Y^*_t = \ln A^*_t + 0.30 * \ln K^*_t + 0.70 * \ln L^*_t \qquad (4)$$

Trend levels of labor (L*) were calculated by smoothing the historical labor force series, and adjusting it by the nonaccelerating inflation rate of unemployment (NAIRU), which in turn was calculated using a method described in Giorno et al (1995). Trend levels of physical capital (K*) were assumed to be equal to the estimated capital stock series. Trend TFP (A*) was estimated in three steps. First, trend TFP was estimated for the period 1970-1997 by applying an HP filter on the TFP series calculated as a residual using the procedure described above. Second, the series was then extended to 1999 Q4 by assuming that trend TFP grows by 3 percent per annum, the same rate as it did over the period 1982-1997 (i.e., between the 1980-81 recession and the 1998 financial crisis). Finally, the TFP series was extended to 2000 Q4, by assuming a slight increase in TFP growth, to 3.2 percent per annum, to incorporate the effects of the structural reforms adopted in 1998-2000 (increased labor market flexibility, increased openness to foreign direct investment, corporate restructuring, financial restructuring, etc.).

9. The method described above does not incorporate the role of increases in human capital through education (as in Young, 1995) or R&D investment (as in Kim and Mun, 1999). Instead, these components of growth are subsumed in TFP growth. Although their inclusion in this study would have been desirable, a balance had to be struck between comprehensiveness and ease of use for purposes of this study as measurement and projection of these variables can be difficult.

10. The above analysis can also be used to make a reasoned estimate of medium-term growth. In the 1990s, physical capital grew by around 10 percent per year; labor inputs (the labor force, adjusted for average hours worked), by 1.2-1.5 percent; and TFP, by around 3 percent. Assuming that the growth rate of the capital stock slows to some 6 percent (due to the shift away from debt-financed overinvestment and towards deleveraging and improved profitability), labor input growth falls to 1 percent (due to slower population growth and decreases in hours worked), and TFP growth modestly increases to 3.5 percent (due to efficiency-enhancing structural reforms, especially corporate and financial restructuring), **potential output growth could be approximately 6 percent per year over the period 2000-05.**

Results

11. Table I.2 shows the estimated output gaps using the three approaches for selected years before 1997 and on a quarterly frequency for 1997-2000, along with estimates obtained

Table I.2. Korea: Estimates of Potential Output Growth and the Output Gap

	Real GDP	Potential GDP 1/					Output Gap 3/				
	Growth 1/ 2/	HP	CS	PF	BOK 4/	OECD 5/	HP	CS	PF	BOK 4/	OECD 5/
1975	6.5	8.6	8.8	7.4	10.1	8.1	-3.0	-2.4	-2.4	11.2	-0.9
1980	-2.1	5.5	4.5	5.6	8.5	8.1	-1.5	-1.6	-5.0	1.4	-6.1
1985	6.5	9.1	9.2	10.1	8.7	8.4	-1.6	-1.2	-1.2	-0.8	-8.6
1990	9.0	8.3	8.2	8.2	8.2	8.4	-0.4	-0.4	0.1	7.7	-4.0
1995	8.9	6.0	6.7	6.8	7.9	6.1	2.3	1.3	1.4	3.6	-1.9
1996	6.8	5.2	5.2	6.2	7.3	5.7	3.6	2.6	1.9	3.0	-1.0
1997	5.0	4.5	3.7	5.6	6.3	5.3	4.0	3.8	1.4	1.7	-1.2
Q1	4.9	4.7	4.2	6.9	...	...	4.0	3.4	2.6	...	...
Q2	6.2	4.6	3.8	6.1	...	...	5.3	5.0	1.9	...	...
Q3	5.5	4.5	3.5	5.2	...	...	4.7	4.7	1.8	...	...
Q4	3.6	4.4	3.3	4.4	...	...	1.9	2.1	-0.4	...	...
1998	-6.7	4.5	3.5	2.8	4.1	5.1	-7.0	-6.3	-8.0	-8.0	-12.3
Q1	-4.6	4.3	3.2	3.0	...	...	-5.1	-4.6	-5.1	...	...
Q2	-8.0	4.4	3.3	2.9	...	...	-7.6	-6.9	-9.3	...	...
Q3	-8.1	4.5	3.5	2.6	...	...	-8.3	-7.5	-9.3	...	...
Q4	-5.9	4.6	3.8	2.6	...	...	-7.1	-6.1	-7.3	...	...
1999	10.7	5.1	5.0	3.6	4.0	...	-2.1	-1.2	-1.7	-5.2	...
Q1	5.4	4.8	4.3	2.7	...	...	-5.4	-4.4	-3.4	...	...
Q2	10.8	5.0	4.8	3.2	...	...	-2.8	-1.8	-2.8	...	...
Q3	12.8	5.2	5.3	3.9	...	...	-0.9	0.0	-0.6	...	...
Q4	13.0	5.4	5.7	4.6	...	...	0.5	1.3	1.1	...	...
2000	9.5	5.8	6.3	6.2	...	...	1.2	1.7	1.4	...	...
Q1	12.7	5.6	6.0	7.6	...	...	0.8	1.4	1.0	...	...
Q2	9.6	5.8	6.3	5.2	...	...	0.5	1.0	1.2	...	...
Q3	9.3	5.9	6.4	5.7	...	...	2.3	2.7	3.1	...	...
Q4	6.9	6.0	6.5	6.3	...	...	1.4	1.6	2.8	...	...
2001	5.0	6.1	6.5	6.5	...	...	0.2	0.3	0.0	...	...
2002	6.0	6.2	6.3	...	...	...	0.0	0.0	...	...	...
2003	6.0	6.1	6.1	...	...	...	0.0	-0.1	...	...	...
2004	6.0	5.9	5.9	...	...	...	0.1	-0.1	...	...	...
2005	6.0	5.6	5.7	...	...	...	0.4	0.2	...	...	...

HP: Hodrick Prescott filter.
CS: Cubic spline smoothing.
PF: Production function approach.

1/ Year-on-year growth, percent.
2/ For 2000-05, the growth rates are projections.
3/ As percent of estimated potential output.
4/ Kim and Mun (1999), results from their production function estimates.
5/ Scarpetta et al (2000).

by researchers at the Bank of Korea and the OECD. [5] The three estimated series of the output gap are highly correlated (see Figure 1). All three series suggest that there was a large positive output gap (i.e., excess demand) in 1997—amounting to 2-4 percent of potential output—which turned into a substantial shortfall during the crisis in 1998. The HP and CS series suggest that at the trough in 1998, Korea suffered an output gap that was much worse than during the previous recession that Korea experienced in 1980. All three series also suggest that **actual output moved above potential output in the second half of 1999**. Given current estimates of growth in 2000 and projections for 2001, it is estimated that actual output exceed potential output in 2000 by around 1½ percent, and by 0.2-1.7 percent in 2001. The output gap is projected to close again in 2002.

	2000			2001			2002		
	CS	HP	PF	CS	HP	PF	CS	HP	PF
Output gap	1.7	1.3	1.8	0.3	0.2	1.7	0.0	0.0	...
Potential growth	6.3	5.8	6.2	6.5	6.1	6.5	6.3	6.1	6.0

C. The Output Gap and Inflation

12. The relationship between the output gap and inflation was also tested. Following Coe and McDermott (1997) and Claus (2000), a simple version of the gap model was used, which relates the change in inflation to the level of the output gap:

$$\text{Model 1:} \qquad \Delta\pi_t = \alpha_1 + \sum_{k=0}^{p} \beta_{1k} GAP_{t-k} + \varepsilon_{1t} \qquad (1)$$

where π_t is the year-on-year percentage change in the consumer price index, GAP_t is the estimate of the output gap, ε_{1t} is a stochastic disturbance term, and Δ is the first difference operator. All data are quarterly. A constant is included to avoid imposing the constraint that the noninflationary level of the output gap is exactly zero. If the output gap is a significant determinant of the change in inflation, then an F-test should show that the β_{1i}s are jointly significantly different from zero. Some of the β_{1i}s could be negative, but their sum should be positive.

13. To incorporate the effect of supply side factors, the following alternative specification was also employed:

$$\text{Model 2:} \qquad \Delta\pi_t = \alpha_2 + \sum_{k=0}^{p} \beta_{1k} GAP_{t-k} + IMP_t + \varepsilon_{2t} \qquad (2)$$

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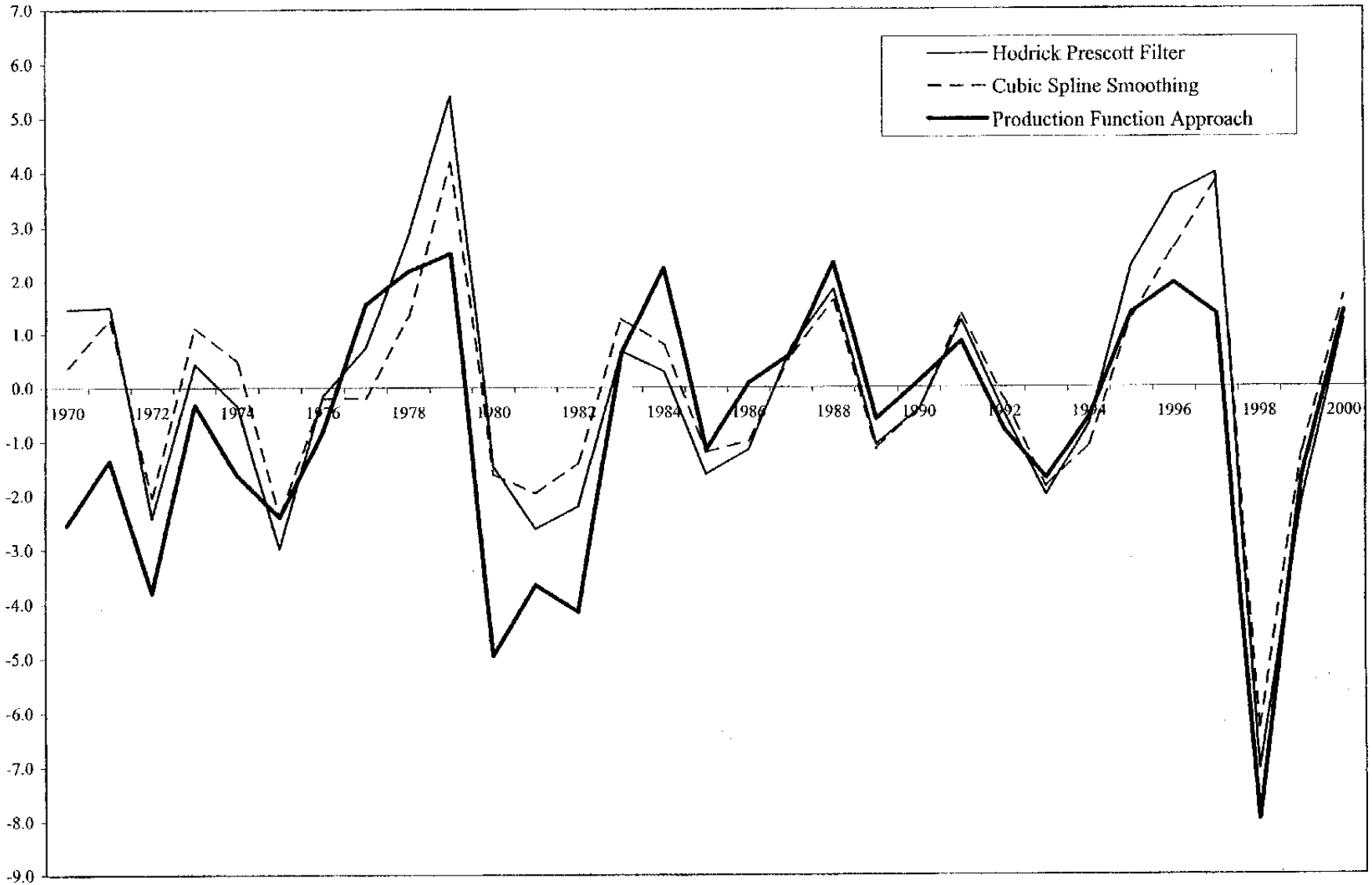
[5] For all three estimates of the output gap in this paper, estimated potential output was compared to the *seasonally adjusted* real GDP series provided by the Bank of Korea.

Figure I.1. Korea: Measures of the Output Gap



where IMP_t is the year-on-year percentage change in the import price index denominated in won. This specification assumes that supply shocks originate from the external sector. The two models were estimated over the period 1970-2000, and over the subperiods 1980-2000 and 1990-2000.[6] All estimates used four lags. The results are shown on Table I.3.

14. Estimates of Model 1 are modestly satisfactory. In all periods studied, the sums of the output gap coefficients are positive, consistent with the gap model. Furthermore, F-tests indicate that the lagged levels of the output gap (for all three estimated series) are jointly significant in explaining the change in inflation, at confidence levels of 1-5 percent. However, Model 1 explains only a small portion of the total variance in inflationary pressures (i.e., no more than 20 percent in the case of the HP and CS gaps in the period 1990-2000). Furthermore, comparing the two periods 1980-2000 and 1990-2000, the sums of the output gap coefficients are substantially smaller in the latter period, indicating a smaller role in the 1990s for the output gap in explaining inflationary pressures. It is interesting to note that Coe and McDermott (1997), in their precrisis study, conclude that the gap model works well in Korea, as in most other Asian countries. They test the simple gap model, as well as one augmented with money. They find that the gap coefficients are statistically significant and that the models explain around 37 percent of the variance of inflation.

15. The explanatory power of the gap model improves with the inclusion of import prices. Focusing on the period 1990-2000, the adjusted R-squared of the estimated equations increases by around 10 percentage points, compared to the simple gap model which does not include the proxy for supply shocks. In all cases, the import price coefficient is statistically significant. However, the sum of the output gap coefficients shrinks (to zero in the cases of the HP and CS gaps), and F-tests of their joint significance indicate rejection at the 1 and 5 percent confidence levels.[7] The results of the estimates suggest that: (a) the role of external supply shocks has grown, and may now be more important than the output gap, and (b) of the three estimates of the output gap, the PF series may be a better indicator of inflationary pressures.

D. Conclusion

16. **The three approaches used to estimate the output gap in Korea in 1997-2005 broadly point to similar conclusions.** Less than two years after the onset of the crisis in November 1997, Korea's GDP had recovered to its potential level. Growth was strong in

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[6] Time series tests (not shown) indicate that the null hypothesis of a unit root in the level of output gap can be rejected for all three measures of the output gap, and that inflation becomes stationary after being differenced once.

[7] However, the F statistics are quite close to the 5 percent confidence level, suggesting that the two measures of the output gap may nevertheless provide useful information to monetary policymakers.

Table I.3. Korea: Testing the Gap Model

		Output gap coefficients		Import price				
		Sum	Signs	Coefficient 2/		F test 1/		Adj R-sq
Period: 1970:1-2000:3								
HP	1	0.37	+++++	...		2.92	**	0.08
	2	0.25	+++--	0.07	*	2.12	***	0.20
CS	1	0.49	-+++-	...		3.30	*	0.09
	2	0.35	+++-+	0.06	*	2.12	***	0.20
PF	1	0.40	+++++	...		3.00	**	0.08
	2	0.29	++++-	0.06	*	2.54	**	0.21
Period: 1980:1-2000:3								
HP	1	0.49	-+-+-	...		3.59	*	0.14
	2	0.24	++-+-	0.04	*	2.46	**	0.19
CS	1	0.35	-+-+-	...		3.36	*	0.09
	2	0.29	++-+-	0.04	*	2.22	***	0.18
PF	1	0.36	+++++	...		4.03	*	0.16
	2	0.31	++++-	0.04	*	3.52	*	0.23
Period: 1990:1-2000:3								
HP	1	0.04	-++--	...		3.06	**	0.20
	2	0.00	+++--	0.05	*	2.38	***	0.30
CS	1	0.06	-++--	...		3.08	**	0.20
	2	0.00	+++--	0.05	*	2.31	***	0.29
PF	1	0.15	++++-	...		1.98	***	0.10
	2	0.07	-+-+-	0.05	*	2.30	***	0.29

* H0 of non-significance is rejected at the 1 percent level.
**H0 of nonsignificance is rejected at the 5 percent level.
***H0 of nonsignificance is rejected at the 10 percent level.

1/ H0: The gap variables jointly have no effect on the change in inflation.
2/ Estimates including the import price coefficient start from 1972 Q1.

2000, which would normally be expected to lead to a modest increase in inflationary pressures. However, due to the increased openness of the Korean economy, external price shocks (including from exchange rate movements) are likely to be a more significant source of concern as regards inflation in the short run. To the extent that measures of the output gap provide a useful signal of inflationary pressures, the output gap estimated using the PF method is slightly more informative than the HP and CS series.

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II. The Information Content of Inflation Indicators in Korea[1]

The Bank of Korea adopted inflation targeting in 1998, and the monetary authorities use a wide array of information to guide monetary policy. This chapter explores the information content of potential leading indicators of inflation, using Granger causality tests and bivariate and multivariate vector autoregressions. M3 appears consistently useful in the various tests. Other promising indicators are measures of economic slack (based on industrial production and unemployment) and measures of cost-push pressures (the nominal effective exchange rate and unit labor costs).

A. Introduction

1. **With the revised Bank of Korea Act (1997), Korea joins the growing list of countries that have adopted inflation targeting (IT).** The revised act enshrines price stability as the "primary goal" of monetary policy, and accordingly:

- requires the Bank of Korea (BOK) each year to set an inflation target in consultation with the government and to formulate and publish an operational plan for monetary and credit policies to meet this target;[2]

- guarantees the independence of the BOK, neutrality in the establishment of monetary policy, and autonomy in implementation; and

- requires the BOK to publish the minutes of the Monetary Policy Committee meetings, and prepare a detailed report on monetary policy for the National Assembly.

2. **The move to inflation targeting marks a major switch in Korea's monetary policy framework.** (Box II.1 surveys the BOK's inflation targeting framework and some of the recent research on inflation and monetary policy in Korea.) The central feature of a monetary regime is a nominal anchor. Some countries (most prominently the United States) have gone without an explicit nominal anchor but have nevertheless achieved excellent macroeconomic performance (Mishkin, 1999). Those that have explicitly adopted nominal anchors have usually targeted exchange rates, monetary aggregates, or the inflation rate itself. In Korea's case, from 1957 to 1998, the BOK targeted a succession of monetary aggregates, but as the movements of a particular designated aggregate grew harder to interpret, the BOK had to keep switching its target to another aggregate (Kim and Kim, 1999).

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[1] This chapter was prepared by Henry Ma and Aung Thurein Win.

[2] For the medium term (2001 onward), the BOK has set a target of 2.5 percent core inflation (on an annual average basis), but for 2001 itself, the target has been set at 3.0±1 percent.

Box II.1. Inflation Targeting in Korea

Since the introduction of the revised Bank of Korea Act (1997), Korea has made significant progress in operating an inflation targeting framework. This box reviews the key features of the current monetary policy framework and several research findings.

Institutional framework

- *Legal framework.* The revised Act establishes price stability as a central objective and ensures the BOK's instrument independence.
- *Definition of the inflation target.* The headline CPI can be seriously affected by temporary supply-side shocks, such as oil price increases or natural disasters. Hence, the BOK targets the core inflation rate, which it has defined as headline inflation excluding the price changes of selected petroleum products and non-cereal agricultural products. These items were found to have exceptionally volatile price movements (BOK, 2000).
- *Target range.* In both 2000 and 2001, a range of 1 percent above and below the announced target was established. This practice is also preferred by most countries that practice inflation targeting, given uncertainties associated with hitting targets.
- *Target horizon.* As is typical for countries with low inflation, Korea has announced a medium-term target (2.5 percent) for core inflation. However, the revised Act also provides for the announcement of an annual target. In view of Korea's circumstances, there should ideally be only a medium-term target with an indefinite horizon.

Operational issues

- *Inflation forecasting.* Hoffmaister (1999) had concluded that inflation forecasting was highly feasible in Korea. The BOK has good technical capacity to implement inflation forecasting. Currently, the BOK's inflation forecasting framework relies on a suite of macroeconometric models of varying sizes and complexity. In June, the Monetary Policy Committee (MPC) receives a forecast for the second semester, and an informal projection for the following year. Forecasts are updated four times a year, but also more frequently if needed, and are supplemented with information from other economic indicators and informal surveys of inflation expectations.
- *Policy implementation.* The BOK implements monetary policy through changes in the overnight call rate. In turn, the call rate is set through open market transactions involving repos or monetary stabilization bonds. These practices are consistent with empirical research (Oh, 2000) which finds that: (1) the call rate has unilateral causality over long-term interest rates and real economic variables; and (2) the repo rate has unilateral causality over the call rate.
- *Transmission mechanism.* Kim (2000) and Oh (2000) concur that an increase in the overnight call rate begins to affect the rate of inflation in the third-to-fourth quarter after the increase, reaching maximum impact in eight to nine quarters. However, there are concerns that the interest rate channel is still weak, due to the narrowness and current fragility of financial markets. Most recently, financial instability arising from the problems of the ITCs and troubled conglomerates has muted the signaling effect of interest rates in the bond markets.

Organizational issues

- *Accountability and transparency.* Decisions reached in the monthly meetings of the MPC are widely disseminated, and an inflation report is submitted twice yearly to the National Assembly. The MPC's minutes are published with a 3-month lag. However, coverage in the press of inflation developments seems to indicate that the concept of core inflation and the definition of the target (period coverage and target horizon) are not yet well understood by the public.

3. **Under IT, monetary authorities use all available information to determine what policy actions are required to achieve the inflation target** (Mishkin, 1999; Svenson, 2000). By contrast, monetary targeting and exchange rate targeting can be seen as "rule-like" strategies that rely on targeting a variable (e.g., monetary aggregates or exchange rates) that has a causal relationship with inflation, and which the monetary authorities can influence. Baumgartner and Ramaswamy (1996) argue that the reliance on many indicators under IT, which they call an "information variable approach," is an advantage, especially when (a) an economy is subject to large structural changes, and variables that used to predict inflation become less informative, or (b) there is no consensus on the structural properties of the monetary transmission mechanism. Furthermore, as opposed to an intermediate targeting approach, the monetary authorities under information variable approach would aim to extract information even from nonfinancial indicators. A full suite of analytical and forecasting tools, such as models of the monetary transmission mechanism and short-term forecasting models would be helpful, but it can be argued that the minimum technical framework for operating an IT regime is somewhat less demanding. Or, as Baumgartner and Ramaswamy (1996) put it, "a full understanding of the structural features of the transmission mechanism is not a necessary condition for targeting inflation successfully. Instead the need is for identifying a set of indicators that contain information on future inflation."[3]

4. **This chapter explores the information content on future inflation of several potential indicators**, for the period January 1990-June 2000, using methods from existing empirical work on the subject.[4] First, Granger causality tests are conducted as an initial test of promising leading indicators. Second, nonstructural bivariate vector autoregressions (VARs) are estimated to gauge the predictive power of the variables. Finally, multivariate VARs are estimated, which include more than one of the candidate indicators, to test the robustness of the bivariate tests and to allow for feedbacks among the different sets of indicators.

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[3] In any case, Brazil's experience illustrates that establishing an inflation forecasting framework can be done in a relatively short period of time. Bogdanski et al (2000) describe the Brazilian central bank's experience of setting up from scratch an inflation forecasting framework to aid monetary policy formulation.

[4] Baumgartner and Ramaswamy (1996) on the United Kingdom, Baumgartner et al (1997) on Sweden, and Halikias (1999) on the Euro zone; Trecroci and Vega (2000) on M3; and Emery and Chang (1996, 1997) on wages and capacity utilization as leading indicators. This study is not as exhaustive as Chauvet's (2000) work on Brazil, which examines *200* potential leading indicators, or Stock and Watson's (2000) exploration of alternative economic indicators as inputs into Phillips curve equations for the United States.

B. Inflation Indicators

5. **This study employs the following indicators:**[5]

- *Monetary and credit aggregates*: M1, M3, and credit to the private sector.
- *Measures of economic activity and/or slack*: real GDP growth, the output gap[6], capacity utilization, and the unemployment gap (i.e., the difference between unemployment and the NAIRU, or nonaccelerating inflation rate of unemployment).
- *Domestic cost-push factors*: wages and unit labor cost (ULC).
- *External cost-push factors*: the nominal effective exchange rate and import prices.
- *Asset prices*: stock market prices and the slope of the yield curve.[7]

The above list has much in common with the set of variables that the BOK currently follows, namely: the output gap, capacity utilization ratios, unemployment, yield curve, M3, stock prices, real estate prices, exchange rates, and import prices.[8]

C. Granger Causality Tests

6. Granger causality tests essentially use F-statistics to test whether lags of the candidate variable are significant in explaining inflation. Although they do not provide information on the structural relationships between inflation and the variables tested, they provide information on the leading indicator properties of those variables. The results, shown in Table II.1, indicate that:

- the growth rate of **credit to the private sector, industrial production, M3, the nominal effective exchange rate, and unit labor costs "Granger-cause" inflation**;

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[5] Annex II.1 describes the variables in more detail.

[6] For more details, refer to Chapter I, "Potential Output, the Output Gap, and Inflation in Korea."

[7] The slope of yield curve is defined as the difference between the three-year corporate bond rate and the overnight call rate. Although ideally, the yield on risk-free government debt should be used, this may not be suitable in the Korean context because until recently, the market for government bonds was not very active or liquid.

[8] Response by the BOK to a query by the National Assembly.

Table II.1: Korea: Granger Causality Tests

Null Hypothesis	Observations	F-Statistic	Probability
Monthly Data			
CAPUTIL does not Granger Cause CPI	152	1.1	0.4
CPI does not Granger Cause CAPUTIL		1.2	0.3
CREDIT does not Granger Cause CPI	149	5.3 **	0.0
CPI does not Granger Cause CREDIT		2.6 *	0.0
IP does not Granger Cause CPI	152	2.8 *	0.0
CPI does not Granger Cause IP		1.2	0.3
IPGAP does not Granger Cause CPI	146	1.5	0.2
CPI does not Granger Cause IPGAP		1.1	0.4
IMP does not Granger Cause CPI	152	0.6	0.7
CPI does not Granger Cause IMP		1.4	0.2
UNEMGAP does not Granger Cause CPI	107	1.4	0.2
CPI does not Granger Cause UNEMGAP		9.8 **	0.0
M1 does not Granger Cause CPI	152	0.9	0.5
CPI does not Granger Cause M1		2.2 *	0.0
M3 does not Granger Cause CPI	150	2.5 *	0.0
CPI does not Granger Cause M3		0.9	0.5
NEER does not Granger Cause CPI	150	4.5 **	0.0
CPI does not Granger Cause NEER		0.5	0.8
STOCK does not Granger Cause CPI	152	1.5	0.2
CPI does not Granger Cause STOCK		3.3 **	0.0
WAGE does not Granger Cause CPI	108	1.2	0.3
CPI does not Granger Cause WAGE		0.6	0.7
YIELD does not Granger Cause CPI	152	0.6	0.8
CPI does not Granger Cause YIELD		1.4	0.2
Quarterly Data			
GAPCS does not Granger Cause CPI	48	1.42	0.23
CPI does not Granger Cause GAPCS		0.45	0.84
GAPHP does not Granger Cause CPI	48	1.43	0.23
CPI does not Granger Cause GAPHP		0.46	0.83
GAPPF does not Granger Cause CPI	48	1.09	0.39
CPI does not Granger Cause GAPPF		1.44	0.23
RGDP does not Granger Cause CPI	48	1.41	0.24
CPI does not Granger Cause NGDP_R_SA		0.85	0.54
ULC02 does not Granger Cause CPI	48	2.36 *	0.05
CPI does not Granger Cause ULC02		0.52	0.79

* indicates rejection of the null hypothesis at the 5 percent confidence level.
** indicates rejection of the null hypothesis at the 1 percent confidence level.

All equations were estimated with 6 lags.

- there is bidirectional Granger causality between credit and inflation; and
- inflation "Granger-causes" M1 and the unemployment gap.

D. Bivariate VARs

7. Turning to the results of VAR estimates, the general strategy followed in identifying promising leading indicators of inflation consists of: (a) examining the variance decomposition of inflation to spot the variables that have substantial predictive power; and (b) checking that the predictive power of the variable in question is strong *at least four quarters* after the start of the simulation period. This cutoff was chosen because existing studies of the lag of monetary policy in Korea (Kim, 2000; Oh, 2000) concur that an increase in the overnight call rate begins to affect the rate of inflation in the third-to-fourth quarter after the increase, reaching maximum impact in eight to nine quarters.

8. **Simple bivariate systems were estimated**, with each system consisting of the year-on-year rate of CPI inflation and the year-on-year-rate of change of a potential leading indicator—except for the output and unemployment gap measures and the slope of the yield curve, where levels were used. Each system also included a dummy variable that takes the value of 1 from November 1997 onward, to incorporate the impact of structural changes that may have taken place since the outbreak of the financial crisis. Lag lengths were chosen based on the Akaike information criterion. The results are shown in Table II.2.

9. **The money and credit variables perform well**. Early in the simulation period, M1 and credit explain more than 50 percent of the variance of inflation, and by the end of the simulation, they explain 70-85 percent. In contrast, M3's predictive power reaches more than 50 percent only by the seventh quarter. Nevertheless, because most of M3's impact is felt from one year onward, it would appear to be a suitable leading indicator of inflation. Conversely, although the impact of credit is felt relatively quickly, it retains significant explanatory power throughout the simulation period and hence would also appear to be a suitable indicator. In sum, although the BOK has moved away from monetary targeting, it would seem that monetary and credit aggregates are still helpful information variables.

10. **Of the two external cost-push variables, NEER seems to be a more promising indicator**. The explanatory power of import prices never rises above 50 percent, whereas NEER explains 50 percent of the variance of inflation by the fifth quarter, and its contribution steadily rises thereafter. Two possible reasons for the relative unimportance of import prices compared to the NEER are: (a) the relative closedness of and low degree of competition in the Korean economy prior to the reforms implemented after the 1997-99 financial crisis; and (b) domestic policy changes to offset the impact of import prices. Most recently, for instance, despite the sharp increase in international oil prices, domestic fuel prices were kept steady until mid-2000 through cuts in fuel taxes.

11. **Of the two asset price variables, stock market prices appear to be a more useful indicator**. The contribution of the yield curve remains below 5 percent, whereas the

Table II.2. Korea: Bivariate VARs 1/ 2/
Variance Decomposition: Year-on-year Inflation

Monthly Data

Quarter	M1 (36)	M3 (36)	CREDIT (36)	NEER (15)	IMP (15)	Yield (3)	Stock (36)	WAGE (36)	IP (36)	IPGAP (36)	UNEMGAP(36)	CAPUTIL(36)
1	2.9	4.1	22.6	23.6	3.3	0.2	0.2	16.2	3.0	6.8	57.0	6.9
2	16.4	9.3	52.5	36.1	7.3	0.2	0.5	53.5	2.9	18.7	47.1	24.1
3	42.2	14.1	65.5	35.8	10.0	0.7	3.8	36.1	14.7	31.1	66.0	38.0
4	58.4	15.1	75.2	35.5	11.0	1.3	9.7	33.8	21.5	45.1	56.1	40.4
5	71.6	19.1	72.9	48.6	15.3	1.9	14.9	30.7	29.2	59.1	59.7	45.5
6	79.2	33.5	70.8	64.2	20.1	2.5	14.6	31.7	32.8	61.6	60.0	45.7
7	83.4	61.5	70.1	71.7	24.4	2.9	15.4	31.0	33.2	62.4	57.2	45.2
8	85.2	71.0	71.2	75.5	28.1	3.3	20.0	31.3	33.0	62.7	50.6	44.9
9	85.8	72.9	71.1	74.6	29.3	3.5	23.6	31.1	32.9	62.8	52.4	43.4
10	85.8	72.8	70.7	73.2	29.4	3.7	29.2	31.2	32.9	63.3	56.1	42.8
11	85.4	73.1	71.7	72.1	29.3	3.8	36.9	31.1	33.5	65.4	57.4	44.8
12	86.5	76.0	71.6	71.4	29.6	3.8	39.1	31.2	35.6	69.7	56.0	48.3

Quarterly Data

Quarter	GAPCS (12)	GAPHP (12)	GAPPF (12)	RGDP (12)	ULC (12)
1	31.8	29.8	35.0	20.3	0.0
2	30.9	27.6	31.2	15.9	8.7
3	20.1	18.0	23.9	16.4	9.1
4	12.5	11.7	18.8	16.6	9.0
5	20.6	20.8	31.0	29.4	6.1
6	29.1	29.1	37.7	33.9	9.0
7	32.8	32.4	36.8	33.9	11.4
8	33.1	32.5	35.0	34.0	17.0
9	32.9	32.2	34.6	34.1	22.6
10	33.1	32.3	34.3	32.7	31.6
11	33.4	32.5	33.5	32.7	40.3
12	34.8	33.9	35.1	35.1	42.4

1. All VARs include a dummy variable which takes the value 1 for the period November 1997 (or 1997 Q4) onward.
2. Numbers in parentheses denote the lag length of the VAR, determined on the basis of the Akaike information criterion.

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contribution of stock prices reaches almost 40 percent by the end of the forecasting horizon. The low predictive power of the yield curve would indicate that the risk premium associated with corporate bonds obscures the information provided by the yield curve regarding inflationary expectations.

12. **Turning to domestic cost-push variables, wages and ULC show only modest predictive power**. Although the contribution of wages to the variance of inflation jumps to 54 percent in the second quarter, it drops thereafter to around 30 percent for the rest of the simulation period. ULC's contribution remains low up to the eighth quarter, and rises to 40 percent only toward the twelfth quarter.

13. **Measures of economic slack do better than measures of economic activity in explaining the variance of inflation**. This is evident in the contrasting performance of IP (industrial production) and IPGAP (the difference between industrial production and its trend, taken to be a measure of monthly potential output). Whereas the contribution of IP rises to only 36 percent by the end of the simulation period, the contribution of IPGAP rises to 45 percent by the fourth quarter and to 70 percent by the twelfth. Similarly, the contributions of the unemployment gap and capacity utilization (both monthly data) are substantially higher than the contribution of real GDP growth. The three measures of the output gap perform about as well as real GDP growth.

E. Multivariate VARs

14. **Several small multivariate VARs were estimated to take into account the comovement of certain groups of indicators**. In this way, two objectives are accomplished: (1) hypotheses regarding the mechanism through which, to take one example, M3 growth affects the exchange rate and in turn inflation, can be explored; and (2) the "true impact" of a nonmonetary variable (say, the output gap) can be better identified, by controlling for the effect of monetary variables.

15. **Because there are a vast number of possible combinations of variables, only a few systems were tried**, using the promising indicators identified from the results of the bivariate VARs described previously, and combined in systems reasonably based on economic theory. Halikias (1999) argues that the small systems thus estimated can be regarded as reduced-form subsystems embodying relations that can be traced back to standard theoretical models. For each system estimated, a schema of the transmission process is briefly described in Annex II.2, together with a detailed discussions of the results. Briefly, the results indicate that:

- Of the money and credit variables considered, **M3 almost consistently has strong predictive power for inflation**, while credit to the private sector also performs well.

- Among the slack indicators, the **industrial production and unemployment gaps also provide useful information** on future inflation. The three estimates of the

output gap are somewhat informative, but the patterns of their impulse response functions are problematic and would bear further, more rigorous, investigation.

- Consistent with their promising performance in the bivariate VARs, the cost variables **NEER and ULC can also be good leading indicators of inflation.**

F. Overall Assessment

16. **An inflation targeting regime can be seen as being more demanding than a monetary or exchange rate targeting regime**. First, the link between the monetary authorities' actions and the results is highlighted both under the statutes establishing the regime, and through the process of publication and discussion of the monetary authorities' actions. Second, under IT, the monetary authorities will have to consider all available information to guide their actions.

17. In turn, the expanded use of information under IT has two implications. On one hand, it enhances the flexibility of the central bank because **it is no longer limited to the information extracted from the movements of exchange rates or monetary aggregates.** As noted earlier, a full-blown analytical and forecasting framework is not imperative, but can be helpful. On the other hand, it becomes all the more important for the central bank to gather as much information as it can, and to have reliable indicators of inflation as an input to monetary policy monitoring and deliberations.

18. This paper has shown that a number of potential leading indicators of inflation in Korea have very helpful explanatory power. **One striking result is that M3 comes out well in the various tests**. Currently, along with the inflation targets, the BOK publishes targets for M3, probably as a holdover from the previous practice of targeting monetary aggregates. However, the M3 targets do not gain much attention, and the BOK is considering relegating M3 to be just another information variable. Making inflation the sole target would be more consistent with an IT regime, but the results of this study show that M3 should still be in the set of information variables. In addition, **nonmonetary variables also contain significant information about future inflation.** In particular, two indicators of economic slack (the industrial production and unemployment gaps) and two indicators of cost-push pressures (the nominal effective exchange rate and unit labor costs) would warrant inclusion in the set of information variables.

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List of Variables

M1	Narrow money
M3	Broad money
CREDIT	Credit to the private sector on a financial survey basis.[9]
IP	Industrial production
RGDP	Real gross domestic product
GAPCS	Output gap estimated using the cubic spline smoothing method
GAPHP	Output gap estimated using the Hodrick Prescott filter
GAPPF	Output gap estimated using the production function approach
IPGAP	Output gap estimated based on monthly industrial production and a trend extracted using the Hodrick Prescott filter
CAPUTIL	Average capacity utilization ratio in manufacturing
UNEMGAP	Unemployment gap; the difference between actual unemployment and the NAIRU (nonaccelerating inflation rate of unemployment)[10]
WAGES	Average monthly wage in the whole economy (obtained from the CEIC database)
ULC	Unit labor cost based on value-added (estimated quarterly by the Korea Productivity Center)
NEER	Nominal effective exchange rate (defined as foreign currency per won)
IMP	Import prices in won (obtained from the CEIC database)
STOCK	Korea Stock Price Index (KOSPI)
YIELD	Three-year corporate bond rate less the overnight call rate

[9] Credit to the private sector on a monetary survey basis comprises only credit extended by deposit money banks. Credit on a financial survey basis is broader, since it includes nonbank financial institutions, such as investment trust companies. The importance of nonbank institutions has grown apace with financial development in Korea. Recently, the growth rates of the two credit aggregates have sharply diverged, due to portfolio shifts by savers, occasioned by the crisis in the investment trust sector in 1999.

[10] A time-varying NAIRU series for Korea was estimated for the period January 1999-May 2000 by LEE Woosung of the LG Economic Research Institute, using the method described in Gordon (1997, 1998) and Staiger et al (1997). According to Lee's estimates, as of May 2000, the NAIRU stood at 2.5 percent, compared to the actual unemployment rate of 3.9 percent.

Results from Estimated Multivariate VARs

Money, the exchange rate, and inflation

19. Trivariate VAR systems are estimated, consisting of M1 (or M3), the nominal effective exchange rate, and inflation, in that order. A priori, the impact of a positive shock to money is ambiguous. To the extent that it represents monetary easing, the NEER would depreciate. However, to the extent that it reflects stronger economic growth or an increase in the demand for money, the NEER would appreciate. In either case, a depreciation should lead to higher inflation.

20. The variance decomposition of inflation for this system is shown in Table II.3. Not surprisingly, the inclusion of NEER reduces the predictive power of both monetary variables. However, M3's contribution to the variance of inflation remains substantial and its impact is felt most visibly during the second half of the simulation period, making it a suitable leading indicator. With either system, **the predictive power of NEER is substantial throughout the simulation period.**

21. The impulse response functions of the system that includes M3 are shown in Figure II.1. A positive shock to M3 causes the NEER to fall below its baseline (i.e, a depreciation), while a positive shock to NEER leads to a statistically significant fall in inflation around a year after the shock. Figure II.1 also shows that a positive shock to M3 leads to significantly higher inflation, which persists even three years after the shock. **In sum, the results for this section show that M3 has more explanatory power than M1 and that expansionary monetary policy leads to depreciation and higher inflation.**

Money, credit, and inflation

22. Table II.4 shows the results for two systems consisting of M1 or M3, credit to the private sector, and inflation. These systems portray monetary easing leading to higher credit and, implicitly through increased economic activity, to higher inflation.

23. The two sets of results are contrasting. **When credit is included, M1's predictive power sharply decreases, whereas M3's remains significant.** Based on the variance decomposition of inflation, therefore, M3 and credit are promising indicators. This impression is confirmed by the impulse response functions, shown in Figures II.2. Positive shocks to M3 significantly raise credit and inflation above their baseline even after a year, with a similar result for the effect of shocks to credit on inflation.

Money, slack, and inflation

24. The third set of trivariate VARs estimated are systems consisting of money, three different measures of economic slack (the unemployment gap, unit labor cost, and the output gap), and inflation, in that order. These systems aim to portray the impact of expansionary

monetary policy on economic activity and production costs. It is postulated that a positive shock to money reduces the unemployment and output gaps (in turn reducing inflation) or raises unit labor cost (in turn raising inflation).

25. Table II.5 shows that **M3 and the unemployment gap are useful indicators of inflation**, but that M1 and the unemployment gap together do not constitute an informative system. The predictive power of both M3 and the unemployment gap remain significant throughout the simulation period, with most of the effect being felt around the eighth quarter. Focusing on M3 and the unemployment gap, the impulse response function in Figure II.3 show that a positive shock to M3 does not have much effect on the unemployment gap As expected, an increase in the unemployment gap causes inflation to fall below its baseline path, and this effect peaks around one year after the shock.

26. Table II.6 (the VARs incorporating ULC) shows that M3 remains useful, but M1 is less so. **ULC also seems to be a helpful leading indicator**, as its predictive power remains above 30 percent all through the simulation period. Hence, focusing on the impulse response functions for M3 and ULC, Figure II.4 shows that a positive shock to M3 raises ULC above its baseline and that this effect peaks at a year after the shock, but that the impact of ULC on inflation is not statistically significant throughout the simulation.

27. Tables II.7a and II.7b show the variance decomposion of systems consisting of money, measures of the output gap, and inflation. In all six cases considered, **money and the output gap have moderate to high predictive power and have lags that make them suitable as leading indicators**. In the case of systems with M1, the contribution of M1 peaks at around the eighth quarter, while the contribution of the output gap steadily rises until the end of the simulation period. In the case of systems with M3, the respective contributions of M3 and the output gap remain the same in all combinations. However, turning to the feedbacks among the indicators (Figures II.5-II.7), the relationship between M3 and the output gap, and the output gap and inflation are contrary to theory and expectations. That is, in all cases, a positive shock to money is associated with a lower output gap (i.e., actual output falls below potential output). Also in all cases, a higher output gap is associated with a decrease in inflation, rather than an increase.

28. In sum, the results bolster the earlier findings that M3 is a promising leading indicator. They also indicate that the unemployment gap and unit labor costs provide significant information.

Output, slack/production costs, and inflation

29. The final set of trivariate VARs estimated portray the relationship between economic activity, slack (or production costs), and inflation. It is postulated that increased economic activity (as measured by the excess of industrial production over its trend) leads to higher capacity utilization and unit labor costs, or a lower unemployment gap, and hence higher inflation.

30. Industrial production emerges as relatively useful in predicting inflation, except when interacted with the unemployment gap. The unemployment gap and ULC are also useful indicators, while capacity utilization's predictive power is rather low. The impulse response functions (results not shown) indicate that, as expected, a positive shock to industrial production is associated with higher capacity utilization and a lower unemployment gap. However, the relationship with ULC is not as expected, with ULC basically falling below its baseline path for much of the simulation period. With regard to inflation, a positive shock to capacity utilization is weakly associated with higher inflation, but a higher unemployment gap and higher ULC are associated with inflation falling below its baseline path.

Table II.3. Trivariate VARs: Money-Exchange Rate-Inflation

Quarter	Variance Decomposition: Year-on-year Inflation					
	M1	NEER	CPI	M3	NEER	CPI
	(12 lags)			(12 lags)		
1	2.2	45.3	52.4	0.6	66.2	33.3
2	4.6	48.3	47.2	5.0	75.0	20.0
3	5.8	41.1	53.1	10.8	71.2	18.0
4	5.8	34.2	60.0	15.2	67.5	17.4
5	5.4	32.9	61.8	24.1	59.3	16.6
6	5.8	33.8	60.4	30.8	54.6	14.6
7	7.4	35.6	57.0	37.1	50.2	12.7
8	10.0	37.4	52.6	41.9	46.7	11.4
9	11.8	38.1	50.1	43.7	44.6	11.7
10	13.1	37.9	49.0	45.0	43.2	11.7
11	13.7	37.6	48.8	45.0	43.0	11.9
12	13.7	37.3	49.0	44.9	43.1	12.0

Table II.4. Trivariate VARs: Money-Credit-Inflation

Quarter	Variance Decomposition: Year-on-year Inflation					
	M1	CREDIT	CPI	M3	CREDIT	CPI
	(12 lags)			(12 lags)		
1	2.4	16.8	80.8	0.8	14.7	84.5
2	2.4	55.4	42.2	5.3	41.0	53.7
3	3.6	67.4	29.0	12.3	47.7	39.9
4	4.7	71.0	24.3	16.6	48.5	34.9
5	4.9	72.8	22.4	26.5	40.3	33.2
6	4.9	74.0	21.0	34.2	36.9	29.0
7	4.8	74.8	20.4	40.7	33.8	25.5
8	4.8	75.0	20.2	44.7	32.1	23.2
9	4.8	74.6	20.6	45.0	31.3	23.7
10	4.7	74.3	20.9	45.0	30.8	24.2
11	4.7	74.1	21.2	45.0	30.7	24.3
12	4.8	73.3	21.9	45.3	30.4	24.4

Table II.5. Trivariate VARs: Money-Unemployment Gap-Inflation

Quarter	Variance Decomposition: Year-on-year Inflation					
	M1	UNEMGAP (12 lags)	CPI	M3	UNEMGAP (12 lags)	CPI
1	1.0	3.7	95.3	2.2	2.6	95.2
2	1.1	4.1	94.8	16.6	2.0	81.3
3	1.1	9.9	89.0	30.9	3.9	65.1
4	3.6	21.9	74.4	33.3	11.1	55.6
5	7.7	25.0	67.2	39.4	11.3	49.3
6	10.5	27.7	61.8	41.8	13.5	44.6
7	12.9	27.3	59.9	43.9	13.5	42.6
8	13.5	27.0	59.5	46.1	12.9	41.0

Table II.6. Trivariate VARs: Money-Unit Labor Cost-Inflation 1/

Quarter	Variance Decomposition: Year-on-year Inflation					
	M1	ULC (12 lags)	CPI	M3	ULC (12 lags)	CPI
1	1.5	0.2	98.3	7.6	0.6	91.8
2	1.0	18.9	80.1	12.5	20.8	66.7
3	2.7	27.6	69.6	12.7	29.0	58.3
4	2.6	30.6	66.7	11.9	32.4	55.8
5	5.0	24.6	70.4	15.4	28.6	56.0
6	4.8	28.2	67.0	41.2	19.7	39.1
7	4.0	40.2	55.8	52.2	18.5	29.3
8	6.5	48.7	44.8	53.5	19.2	27.3
9	10.0	56.2	33.8	48.3	27.0	24.8
10	20.6	55.4	24.0	48.8	30.1	21.1
11	26.0	56.3	17.7	47.7	31.0	21.3
12	28.4	57.2	14.4	47.1	31.5	21.4

1/ Quarterly data.

Table II.7a. Trivariate VARs: M1-Output Gap-Inflation 1/

	Variance Decomposition: Year-on-year Inflation								
	M1	GAPCS	CPI	M1	GAPHP	CPI	M1	GAPPF	CPI
Quarter		(12 lags)			(12 lags)			(12 lags)	
1	58.7	31.4	10.0	60.1	22.9	17.0	59.8	1.9	38.3
2	75.7	18.0	6.3	78.9	11.6	9.5	59.1	1.8	39.1
3	74.5	17.1	8.4	79.4	9.2	11.4	43.1	20.1	36.8
4	74.3	16.2	9.5	80.4	7.7	12.0	42.0	21.2	36.9
5	71.4	15.5	13.1	78.5	6.2	15.3	45.5	27.6	26.9
6	68.5	18.5	13.0	76.7	7.7	15.6	58.2	20.8	21.0
7	57.4	27.6	15.0	68.9	12.2	18.9	51.4	19.2	29.4
8	51.5	33.5	15.0	64.9	15.6	19.4	52.4	18.3	29.2
9	48.5	36.8	14.7	62.5	17.9	19.6	47.8	24.6	27.6
10	45.4	40.5	14.1	59.7	20.8	19.5	41.5	33.9	24.6
11	41.3	44.9	13.8	56.2	23.9	19.9	45.2	32.3	22.5
12	36.5	50.4	13.1	51.7	28.4	19.9	37.5	42.5	20.0

Table II.7b. Trivariate VARs: M3-Output Gap-Inflation 1/

	Variance Decomposition: Year-on-year Inflation								
	M3	GAPCS	CPI	M3	GAPHP	CPI	M3	GAPPF	CPI
Quarter		(12 lags)			(12 lags)			(12 lags)	
1	3.4	63.8	32.8	1.4	67.0	31.5	0.7	72.2	27.1
2	3.7	75.5	20.8	1.1	77.9	21.0	0.5	78.3	21.2
3	10.3	71.2	18.5	5.4	75.6	19.0	11.6	69.7	18.7
4	15.7	67.5	16.9	9.9	72.7	17.4	13.5	68.1	18.4
5	11.2	65.2	23.6	7.3	68.5	24.2	10.7	65.9	23.4
6	19.4	57.6	23.0	18.1	58.8	23.1	20.2	59.5	20.3
7	21.8	54.4	23.7	20.9	55.2	23.9	21.3	55.7	23.0
8	25.9	53.1	21.0	23.2	55.8	21.0	29.6	50.4	20.0
9	25.4	55.3	19.3	21.6	58.6	19.8	30.9	48.3	20.9
10	25.9	57.1	17.1	21.3	61.3	17.5	31.8	48.0	20.2
11	25.0	58.6	16.4	20.2	63.0	16.8	31.0	50.7	18.3
12	25.2	58.3	16.6	20.5	62.3	17.2	29.2	53.6	17.2

1. Quarterly data

GAPCS: Output gap estimated using a cubic spline smoothing filter.
GAPHP: Output gap estimated using a Hodrick Prescott filter.
GAPPF: Output gap estimated using the production function approach.

Table II.8. Trivariate VARs: Industrial Production-Slack/Unit Labor Cost-Inflation 1/

	Variance Decomposition: Year-on-year Inflation								
	IPGAP	CAPUTIL	CPI	IPGAP	UNEMGAP	CPI	IPGAP	ULC	CPI
Quarter		(12 lags)			(12 lags)			(8 lags)	
1	5.3	0.7	93.9	0.9	7.0	92.1	82.6	8.1	9.3
2	7.4	5.2	87.4	2.4	8.5	89.0	60.2	32.2	7.6
3	5.7	6.6	87.7	2.2	16.9	80.9	60.5	32.0	7.6
4	5.8	5.2	89.0	2.5	30.0	67.5	53.1	36.5	10.3
5	9.6	5.2	85.2	4.8	32.9	62.4	56.4	34.1	9.5
6	12.5	5.1	82.4	6.2	34.8	58.9	46.5	44.6	8.9
7	14.4	6.3	79.3	6.7	34.8	58.6	40.7	49.1	10.2
8	15.5	7.3	77.2	6.7	34.4	58.8	40.4	49.2	10.4
9	15.3	8.7	76.0	6.9	34.4	58.7	44.5	46.2	9.3
10	15.0	10.3	74.8	7.1	34.3	58.6	43.6	46.8	9.6
11	15.0	11.2	73.8	7.3	34.2	58.5	47.3	43.2	9.5
12	15.2	11.5	73.2	7.5	34.0	58.4	45.1	46.8	8.1

1. The trivariate VAR with unit labor cost usese quarterly data.

IPGAP: Output gap estimated using industrial production and the Hodrick Prescott filter.
UNEMGAP: Difference between unemployment and NAIRU.

Figure II.1. Korea: M3-NEER-Inflation

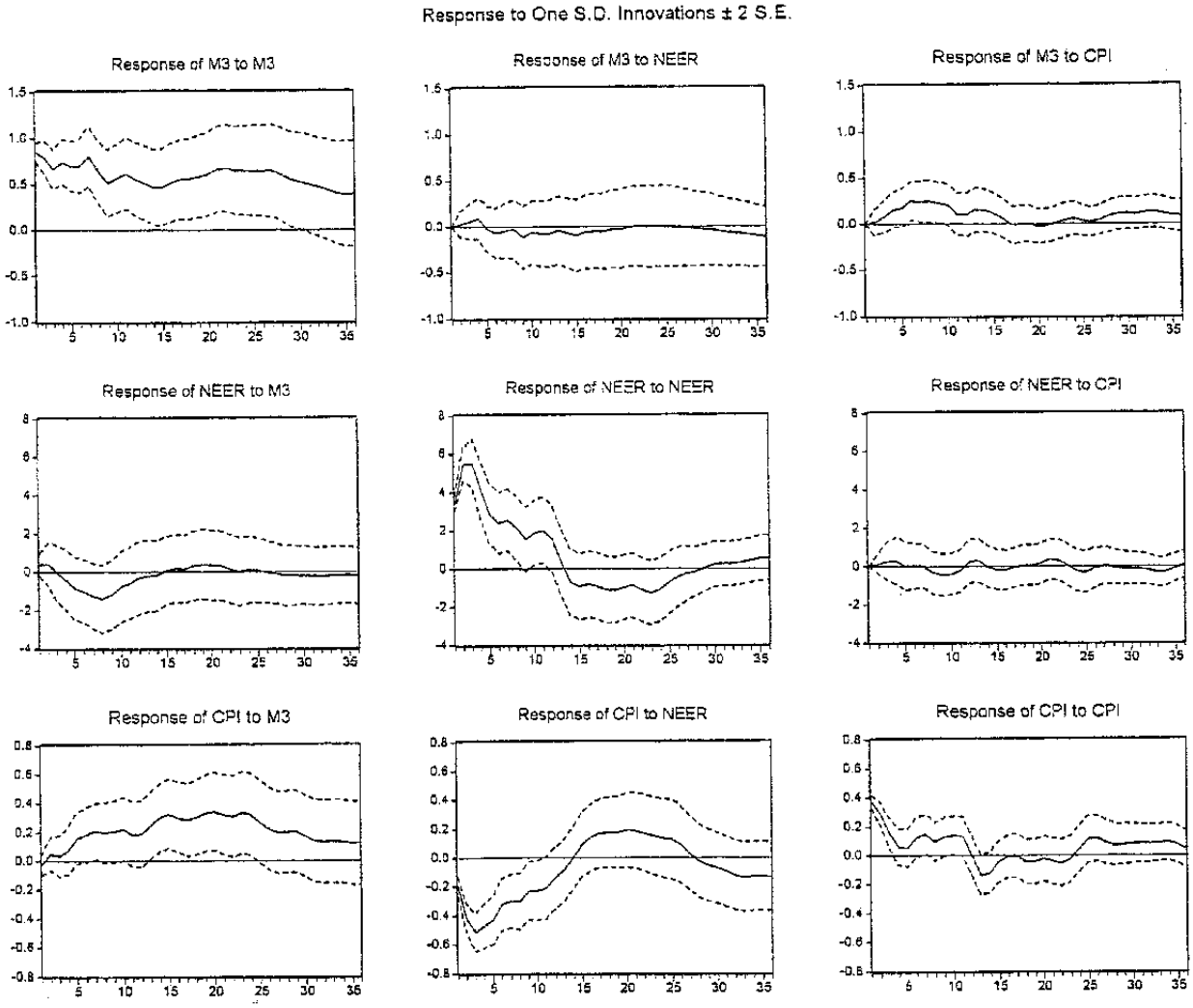


Figure II.2. Korea: M3-Credit-Inflation

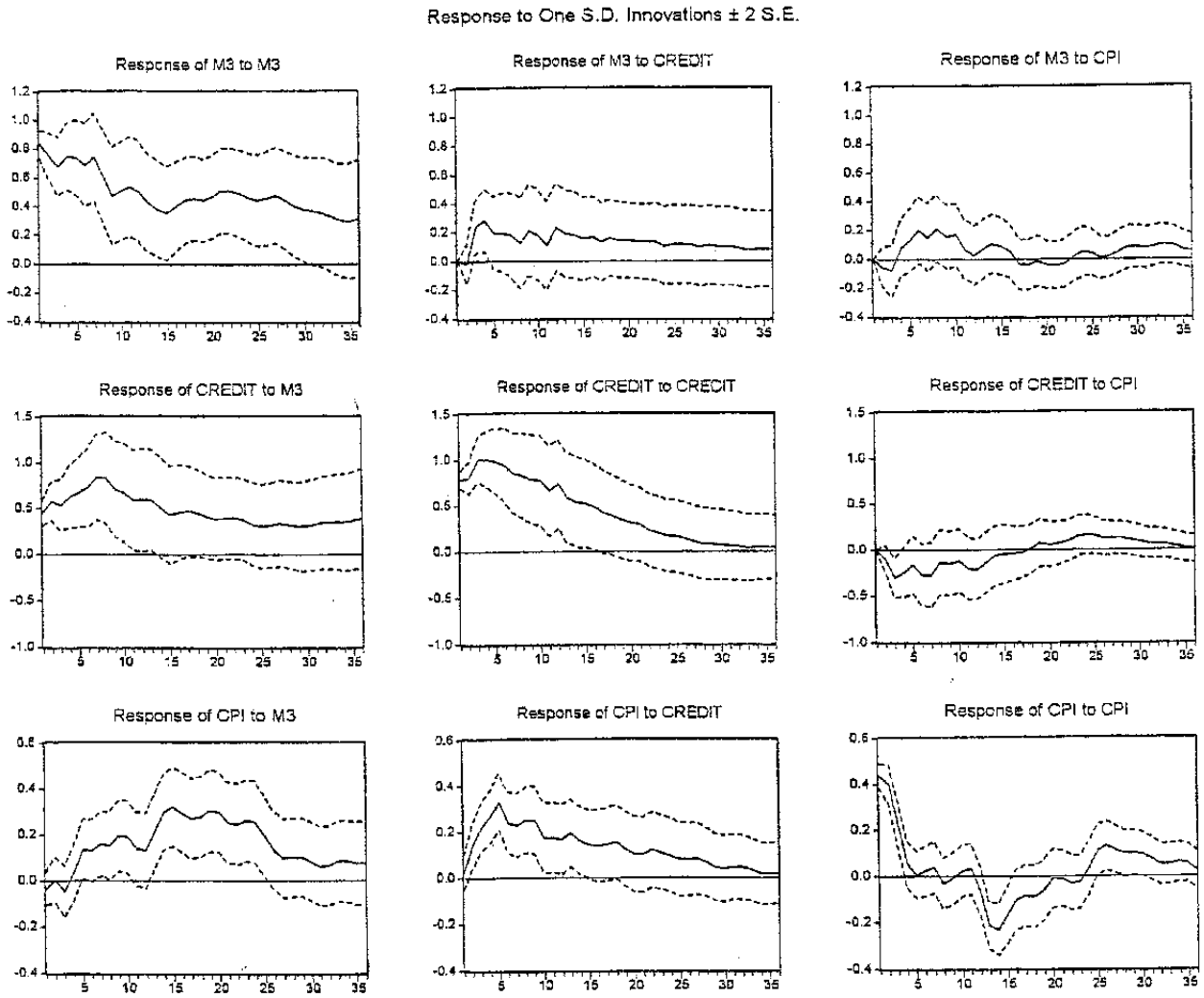
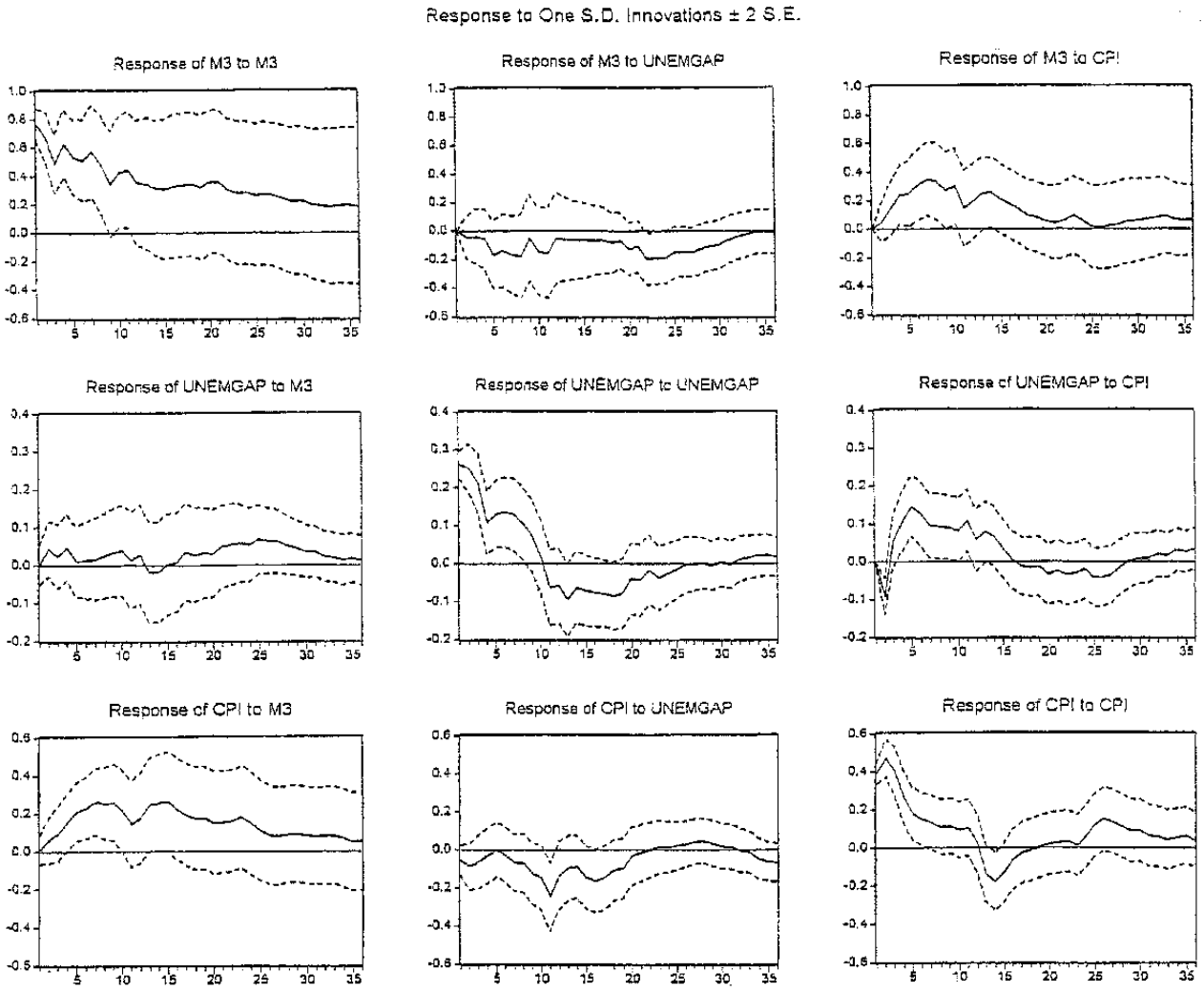
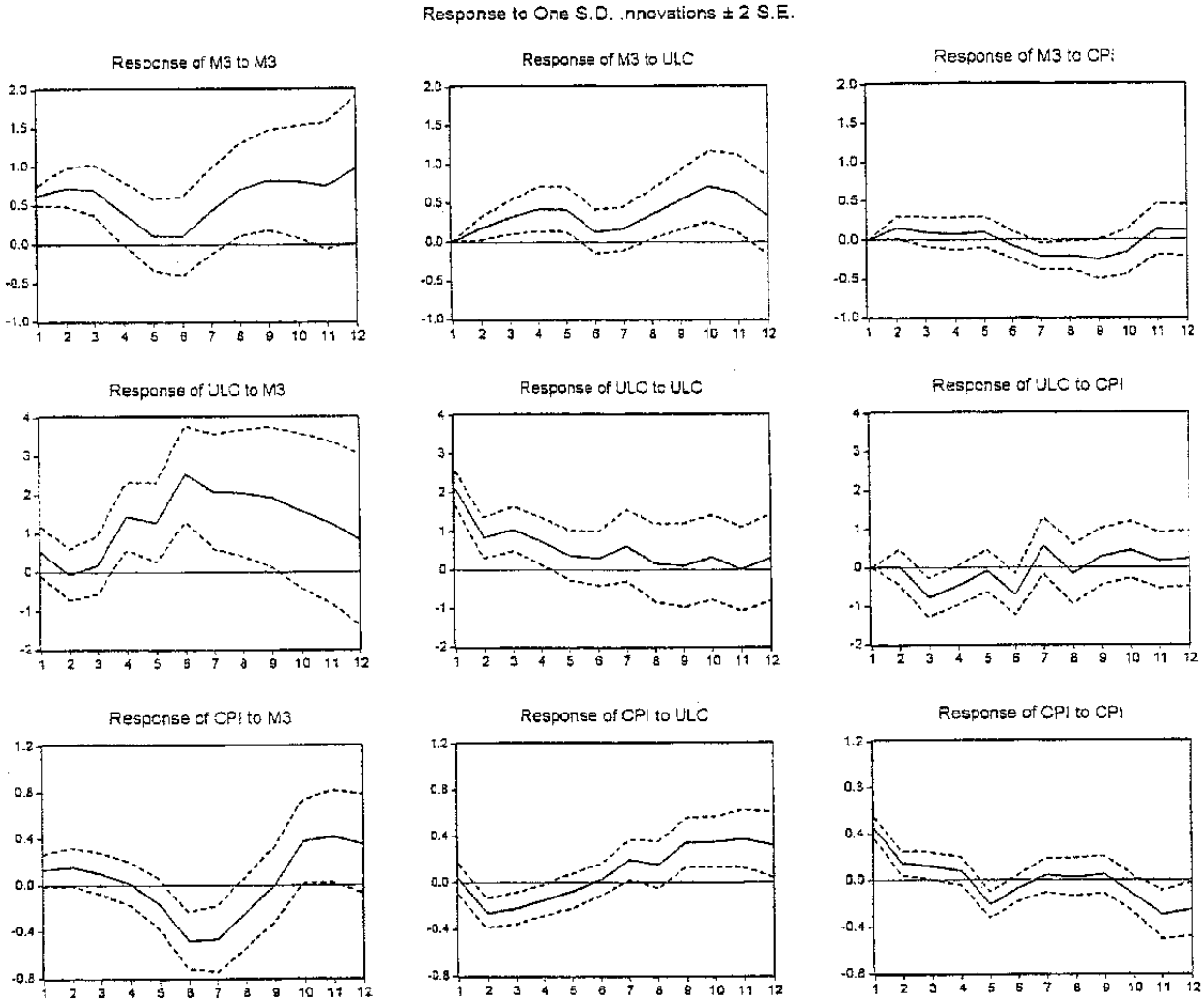


Figure II.3. Korea: M3-UNEMGAP-Inflation



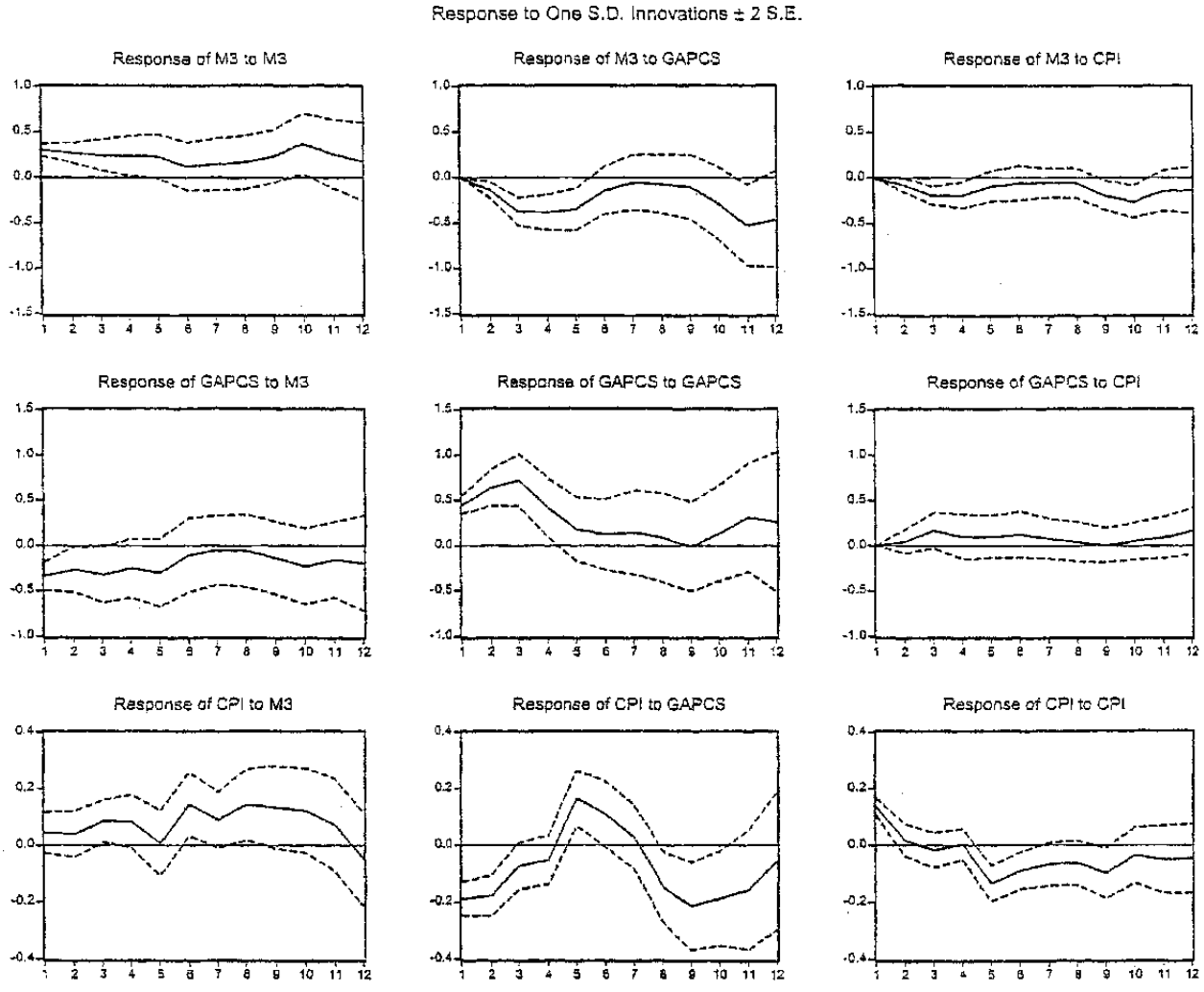
UNEMGAP: Actual unemployment less the NAIRU.

Figure II.4. Korea: M3-ULC-Inflation



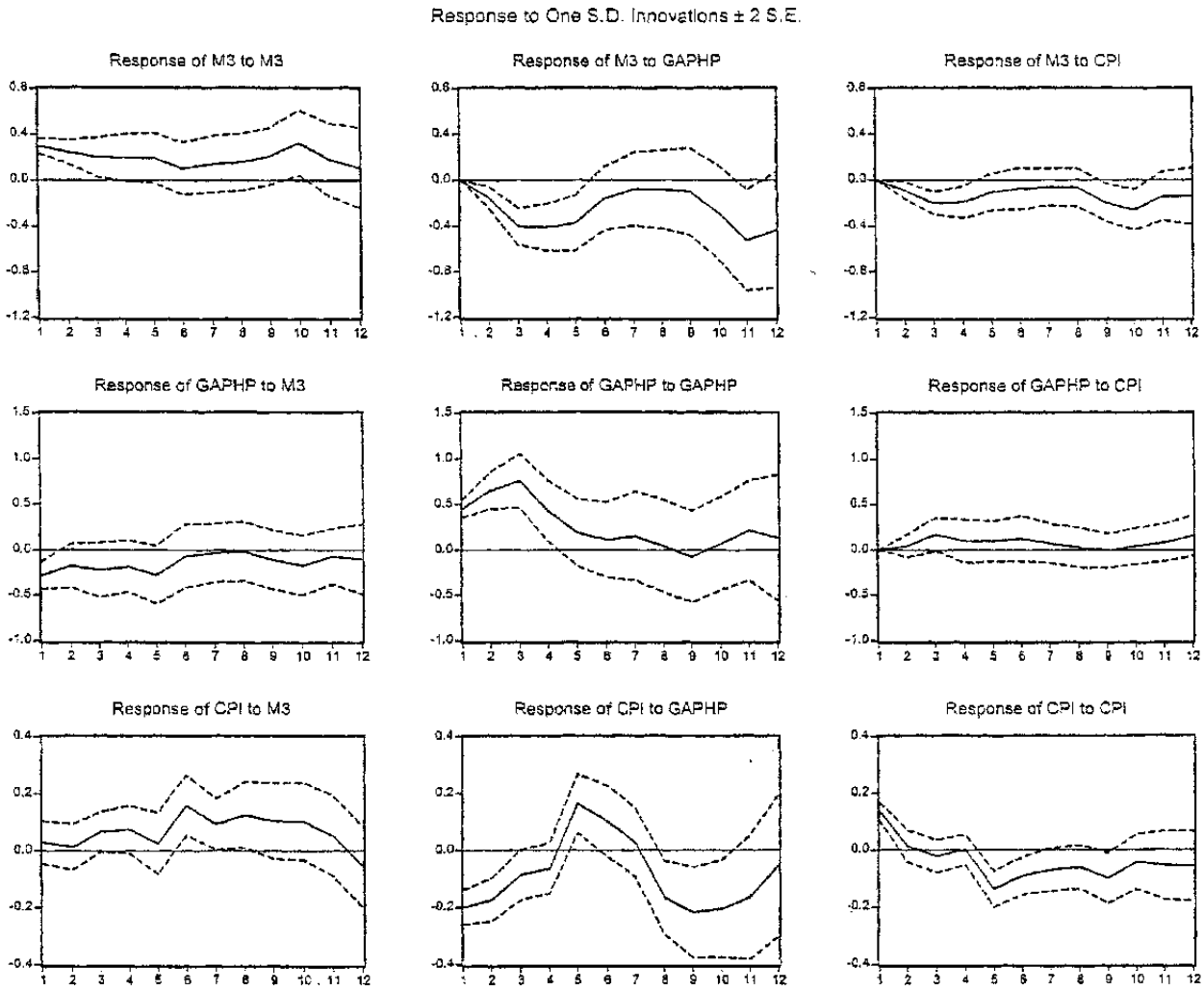
ULC: Unit labor cost based on value-added.

Figure II.5. Korea: M3-GAPCS-Inflation



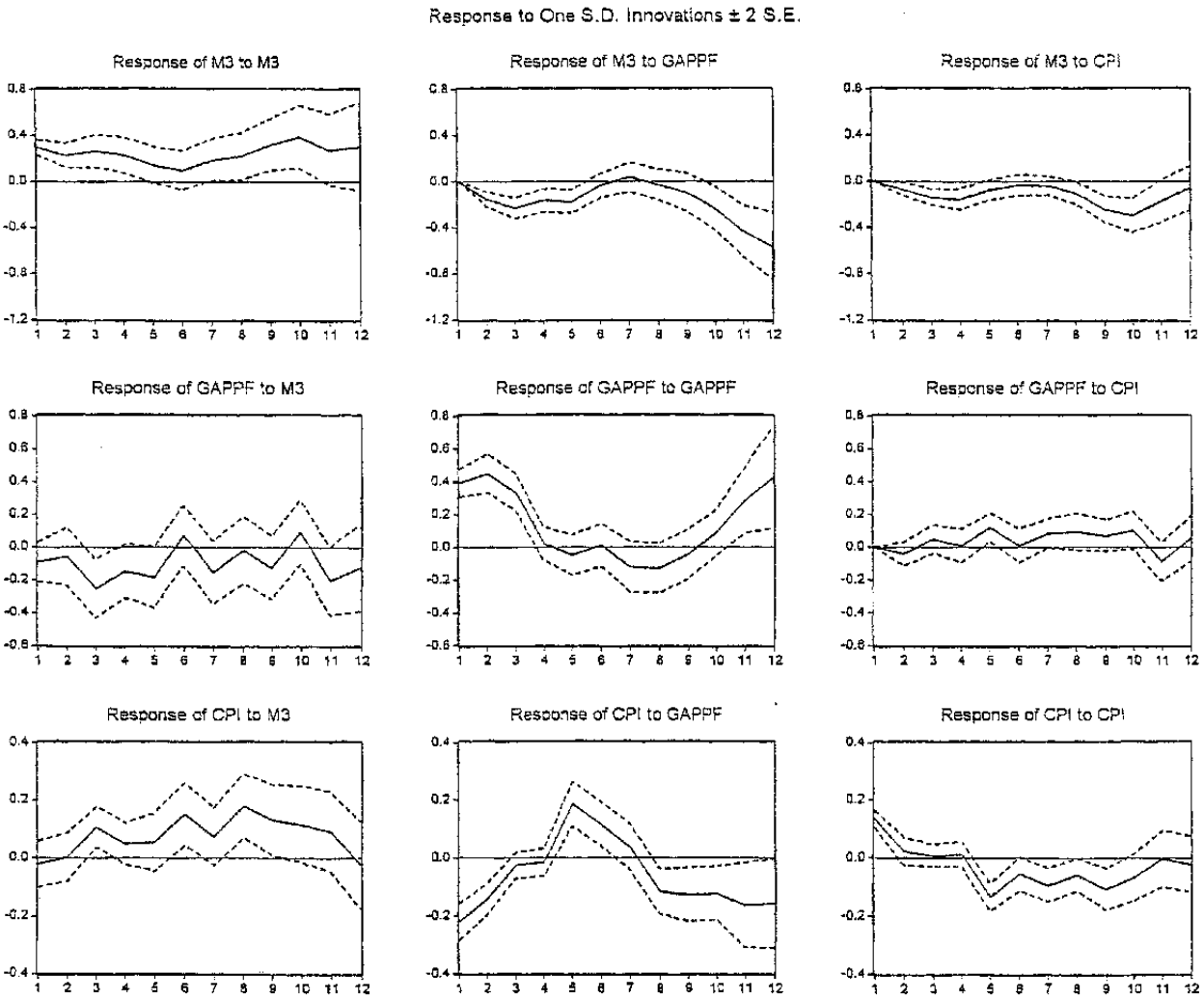
GAPCS: Output gap estimated using the cubic spline smoothing method.

Figure II.6. Korea: M3-GAPHP-Inflation



GAPHP: Output gap estimated using the Hodrick Prescott filter.

Figure II.7. Korea: M3-GAPPF-Inflation



GAPPF: Output gap estimated using the production function approach.

III. The Current Account Balance and Saving-Investment Norms in Korea[1]

This chapter develops an empirical measure for equilibrium current account balances for Korea from the perspective of the fundamental medium to long-run determinants of saving and investment behavior. The emphasis is on the need to correct some of the heterogeneity problems of earlier studies. The results suggest a broadly balanced current account as the norm for Korea over the medium term.

A. Introduction

1. This chapter discusses the "equilibrium" level of the current account for Korea by assessing the "normal" level of the saving and investment balance (S-I) from a medium-term perspective. It extends earlier studies on the issue by obtaining country-specific parameter estimates from a panel dataset which includes ten other similar economies. The S-I norms for Korea estimated in this chapter are significantly different from other studies that ignore heterogeneity (and dynamics).

2. The determinants of current account balances are of considerable interest in open economy macroeconomics. As the current account is equal to the difference between domestic saving and investment, it can be examined from the perspective of the fundamental medium to long-run determinants of saving and investment behavior. Using cross-country cross-sectional and panel data, a number of empirical studies have found that fiscal, demographic, and stage of development variables play significant roles in determining the S-I balances. For example, Faruqee and Debelle (1998, hereafter FD) use a saving-investment perspective to identify the structural determinants of current account for industrial countries. Chinn and Prasad (2000, hereafter CP) build on the work of FD by extending the analysis to developing countries and by exploring a wider range of static and dynamic specifications. This study modifies the CP methodology to derive alternative S-I norms for Korea.

3. A key feature of Korea's development experience has been a rapid rise in savings, high levels of investment, and large swings of current account balances in the past three decades (Collins, 1994). The current account in Korea swung from deficits prior to 1986, to surpluses until 1989, and then again into deficit until the Asian crisis in 1997. In the immediate aftermath of the crisis, the current account shot up to a surplus of 13 percent of GDP in 1998, declining rapidly thereafter to 6 percent of GDP in 1999 and 2¼ percent of GDP in 2000. Against this background, and as external imbalances have played a crucial role in the formulation of economic policy in Korea, it is important to set up an appropriate framework for quantifying levels of S-I balances that can be regarded as "historically normal" over the medium run.

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[1] This chapter was prepared by Sanjay Kalra and Hong Liang. The authors are grateful to Eswar Prasad for providing the Chinn and Prasad (2000) dataset.

4. The chapter is organized as follows. Section A outlines the S-I norms for Korea derived from the panel data parameter estimates of the CP study. Section B presents our alternative set of S-I norms constructed by using parameter estimates derived from a panel dataset which includes ten other "similar" economies. The last section concludes.

B. S-I Norms for Korea: Application of the CP Parameters

5. The S-I norms derived by using parameters and methodology of the CP study show rising surpluses during 2000-05 in Korea. The CP model specification for constructing the norms involves a fully pooled dataset of industrial and developing countries. The specification is estimated for non-overlapping, five-year averages of the underlying annual data for the period 1971-95. The estimated equation used in the construction of the norms is:

(1) CAGDP = -0.023 + 0.250 FBGDP + 0.042 NFAGDP(initial) -0.092 RELY + 0.256 $RELY^2$ - 0.041 RELDEPY + 0.145 RELDEPO + 0.040 TOTSD/100 - 0.024 OPEN +0.038 FDEEP + Time dummies

where: CAGDP = Current-account to GDP ratio
FBGDP = General government balance to GDP ratio
NFAGDP = NFA to GDP ratio during the initial five year period
RELY = Real income per capita relative to the US
RELDEPY = Youth dependency ratio (relative to the sample average)
RELDEPO = Old dependency ratio (relative to the sample average)
TOTSD = Standard deviation of the terms of trade
OPEN = Imports plus exports of goods and services as a ratio of GDP
FDEEP = Broad money to GDP ratio (as a measure of financial deepening)

6. The parameter estimates obtained by CP can be applied to annual, country-specific data from the World Economic Outlook (WEO) database to generate the S-I norms for Korea. First, the CP parameter estimates and the data series are used to construct "unadjusted" historical and projected fitted values for a country's current account balances. Second, following the CP methodology, the estimated intercept term is adjusted for individual countries to obtain zero mean residuals between the actual and fitted values over the historical sample period 1980-95. This adjustment induces a one-time, level adjustment, where applicable, to the historical S-I norm for the country. The net effect of this adjustment is to replace the common cross-country intercept by a country-specific intercept.

7. Computation of S-I norms for Korea, based on this procedure, implies an increase in the norm by 2½ percentage points of GDP, from a current account surplus of 0.7 percent of GDP in 2000 to 3.2 percent in 2005 (Table III.1 and Figure III.1).[2] Such large surpluses

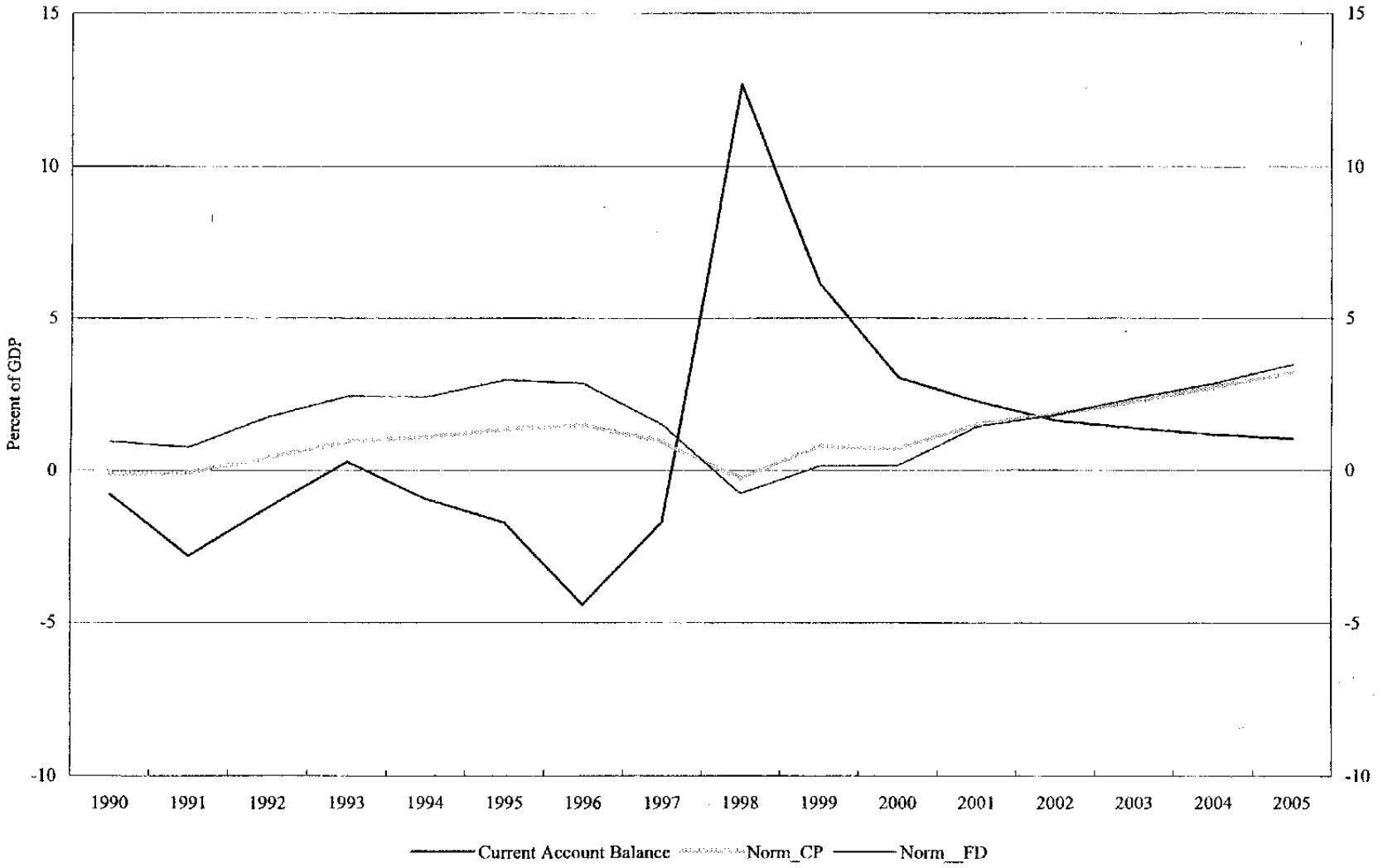
[2] The norms based on industrial country parameter estimates of FD call for an even higher surplus of about 3½ percent in 2005.

Table III.1. S-I Positions Generated by the CP Parameters: Selected Economies 1/
(In percent of GDP)

	Base year (1999) Level	S-I Position for 2004		S-I Position for 2005	
	(1)	(2)		(3)	
China	1.64	3.26		3.33	
India	-1.19	-0.93		-0.85	
Indonesia	3.57	-1.63		-1.56	
Korea	6.14	2.69	(2.82)	3.16	(3.45)
Malaysia	18.38	-0.88		-0.57	
Philippines	9.15	-3.03		-3.06	
Singapore	25.28	15.62	(6.14)	16.31	(6.44)
Thailand	9.07	-3.93		-3.79	
Nigeria	-10.78	-5.19		-5.01	
South Africa	-0.36	-0.62		-0.58	
Egypt	-3.16	1.55		1.60	
Iran	3.05	-1.61		-1.33	
Pakistan	-2.64	-1.74		-1.66	
Israel	-1.60	-2.03		-2.02	
Turkey	-0.48	1.36		1.53	
Argentina	-4.34	-0.55		-0.35	
Brazil	-4.11	-1.56		-1.58	
Chile	-0.12	-1.14		-0.95	
Colombia	-1.22	-2.33		-2.34	
Mexico	-2.90	-1.31		-1.28	
Peru	-3.51	-3.95		-4.00	
Venezuela	5.36	1.40		1.40	

1/ Numbers in parenthesis are alternative calculation based on panel estimations that include the industrial countries only.

Figure III.1. Korea: Current Account Balance and Saving-Investment Norms, 1980-2005



Source: Staff calculations.

appear to be counterintuitive given the current state of the economy and its medium-term prospects, especially as risk-adjusted rates of return may be higher in an emerging market economy such as Korea than elsewhere. The sharp increase in current account surpluses is derived, in part, from the quadratic term of relative income in the estimated equation, which magnifies the catch-up effect of Korea's relative income from the low levels during the Asian crisis. Dropping this quadratic term, however, does not lead to a reasonable solution either, as the model will then suggest current account *deficits* of over 3½ percent over the medium term.

8. The counterintuitive S-I norms for Korea obtained by applying the CP methodology is partly related to the *ad hoc* adjustment of the intercept term which does not lend itself to an economic or statistical interpretation.[3] Mechanically, while the adjustment for the intercept parameter was, ostensibly, intended to improve the fit between country specific historical data and the fitted values, this fit remains rather poor for Korea (the correlation coefficient between the actual and fitted values is 0.37). In addition, the estimation procedure assumes slope homogeneity across countries for all explanatory variables.[4]

C. Alternative S-I Norms

9. This section estimates alternative S-I norms for Korea by exploring alternative assumptions regarding the common intercept and coefficients in the CP methodology. In addition, it examines the impact on the estimates of using a different group of countries.

10. First, using annual data from the CP dataset, a panel which includes ten other Asian and non-Asian economies (Australia, Greece, Israel, Indonesia, Malaysia, New Zealand, Philippines, Portugal, Singapore, and Thailand) is constructed. The new parameter estimates are then applied, as before, to the WEO data, but without the *ad hoc* adjustment on the intercepts. Second, the panel is restricted to the East Asian economies to see if the choice of countries for the panel makes a substantial difference to the computed norms. We find that (1) the norms proposed by the new parameter estimates from these two computations are significantly different from the CP norms; and (2) the computed S-I norms are not substantially affected by the choice of countries in the panels we selected.

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[3] In particular, the resulting country-specific "intercept" terms cannot be interpreted as a fixed-effect estimates.

[4] See Haque, Pesaran, and Sharma (1999). FD also report that in their panel regressions, the joint hypothesis that all parameter coefficients, collectively, are the same for each variable across all countries was not accepted by the data. FD show, however, that when the coefficients for the large industrial countries are allowed to differ from each other and the small industrial countries, the (pooled) estimates for the latter are broadly similar to the overall panel, with somewhat larger coefficients on some variables.

11. The choice of these ten economies for our first panel could be justified on a number of grounds, including similarities in their development stages. Per capita income (relative to the US) in these economies (except Philippines) is within a relatively narrow band. Nevertheless, there are some differences among these countries, notably in the evolution of their current account and fiscal balances. The model specifications used, therefore, focus on these differences.

12. The estimation procedure follows the framework suggested by FD. Three alternative specifications of a parsimonious, partial adjustment model for the determinants of the current account are estimated. The explanatory variables in these specifications include, as before, the fiscal balance, dependency ratios, relative per capita income (including the quadratic term), changes in the real effective exchange rate and the terms of trade, and measures of current and capital account restrictions. To facilitate a comparison, the model is first estimated under the common intercept and slopes coefficient assumption. The second specification attempts to capture the country-specific factors through a fixed effects estimation, but retains the assumption of slope homogeneity for all variables. Finally, the slope coefficient for the fiscal balance is allowed to differ across countries to capture the differences in the adjustment of the S-I balances to changes in government savings. The models estimated using these three specifications are reported in Table III.2.

13. The estimated equations fit the data well. Including fixed effects and allowing for different slopes, however, clearly improves the fit of the regressions. Among the regressors, only changes in the terms of trade and the real effective exchange rate, and the lagged current account appear to be robust explanatory variables across three model specifications. Interestingly, contrary to the findings of CP and FD, the relative income variables and (old age) dependency ratio become significant only in the fixed effects specification. The same is true for the fiscal balance. Furthermore, while the signs of coefficients are generally preserved across specifications, their values differ significantly. For the fiscal balance in particular, moving to the slope heterogeneity specification, the estimated coefficient becomes insignificant for some countries in the panel, and changes signs for some others. Estimates for this coefficient lie in the range of -0.1 to 2.0, with the largest for Korea. The error terms for individual country series are plotted in Figure III.2, and appear to be well-behaved.

14. The estimated parameters of the partial adjustment model are then used to construct the medium-term S-I norms. For this exercise, the real exchange rate changes are set to zero and the impact of current and capital account restrictions is also suppressed. Using the fixed effects, heterogeneous slope model, the long-run coefficient for each regressor can be computed by:

$$\beta_i^* = \frac{\beta_i}{1-\beta_{CA}}$$ where β_i is the short - run slope coefficient for regressor i and β_{CA} is the coefficient for lagged CAGDP.

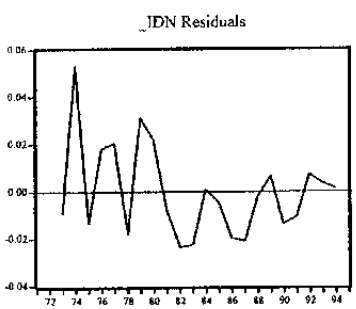
Table III.2. Partial Adjustment Model of the Current Account for Selected Economies, 1971-95

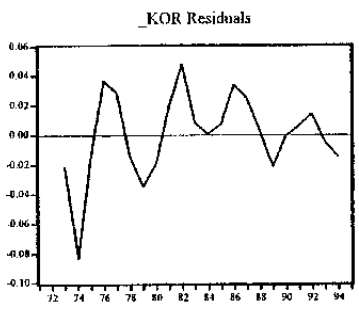
Dependent variable: CAGDP

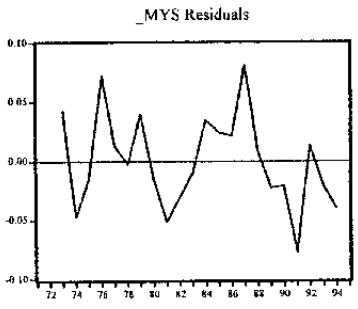
	Common coefficients		Fixed effects Slope homogeneity		Fixed effects Slope heterogeneity	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
CAGDP(-1)	0.69	12.90	0.63	12.87	0.54	9.34
RELDEPO	-0.03	-0.41	0.48	2.01	0.39	1.69
RELDEPY	-0.02	-0.77	-0.02	-0.45	-0.04	-0.85
RELY	-0.02	-0.35	-0.27	-2.04	-0.34	-2.56
RELY squared	0.01	0.24	0.31	2.31	0.32	2.36
DLTOTC (-1)	-0.04	-2.32	-0.03	-2.35	-0.03	-1.72
DLREER (-1)	-0.06	-2.93	-0.06	-3.16	-0.06	-3.01
Current account restrictions	0.00	0.62	0.00	0.13	0.00	0.29
Capital account restrictions	0.00	-0.32	0.02	2.82	0.02	3.09
Intercept	-0.01	-0.87	...	...	...	...
Australia	...	...	-0.03	...	0.02	...
Greece	...	...	-0.02	...	-0.01	...
Israel	...	...	0.00	...	0.04	...
Indonesia	...	...	0.04	...	0.04	...
Korea	...	...	0.04	...	0.06	...
Malaysia	...	...	0.07	...	0.09	...
New Zealand	...	...	-0.02	...	0.03	...
Philippines	...	...	0.02	...	0.02	...
Portugal	...	...	-0.01	...	0.01	...
Singapore	...	...	0.05	...	0.06	...
Thailand	...	...	0.02	...	0.02	...
FBGDP	0.05	0.92	0.12	2.13	...	...
Australia	...	...	...	...	0.14	1.38
Greece	...	...	...	...	-0.04	-0.80
Israel	...	...	...	...	0.18	1.73
Indonesia	...	...	...	...	0.45	2.52
Korea	...	...	...	...	2.04	3.29
Malaysia	...	...	...	...	0.30	1.16
New Zealand	...	...	...	...	0.41	1.92
Philippines	...	...	...	...	-0.08	-0.20
Portugal	...	...	...	...	0.07	0.18
Singapore	...	...	...	...	0.63	1.88
Thailand	...	...	...	...	-0.06	-0.37
R-squared	0.56		0.60		0.63	
Adjusted R-squared	0.54		0.56		0.58	
S.E. of regression	0.03		0.03		0.03	
Log likelihood	591.28		598.56		606.83	
Durbin-Watson stat	1.83		1.86		1.79	
Mean dependent var	-0.04		-0.04		-0.04	
S.D. dependent var	0.05		0.05		0.05	
Sum squared resid	0.21		0.19		0.17	
F-statistic	28.17		35.39		18.50	
Prob(F-statistic)	0.00		0.00		0.00	

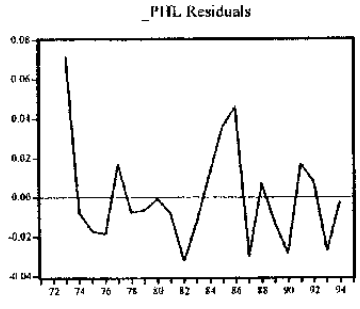
Sources: Chinn and Prasad (2000), and staff computations.

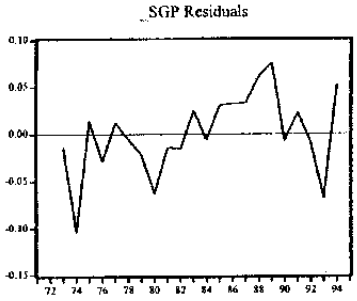
Figure III.2. Country Residuals of the Partial Adjustment Model of Current Account Determinants for Selected Economies
(Fixed effects, Heterogenous Slope Specification)

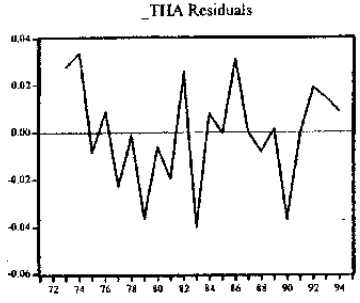


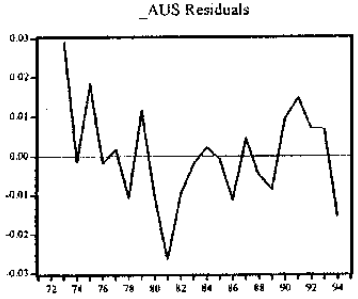


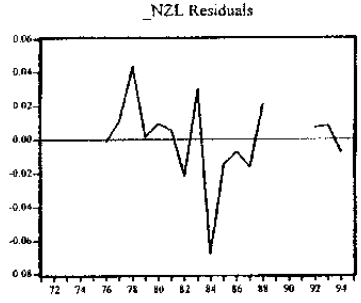


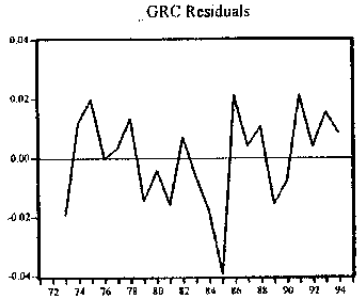


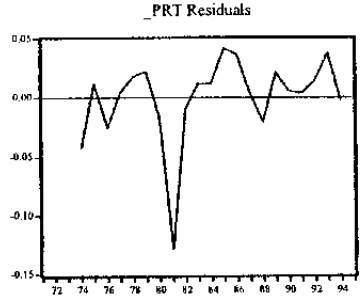


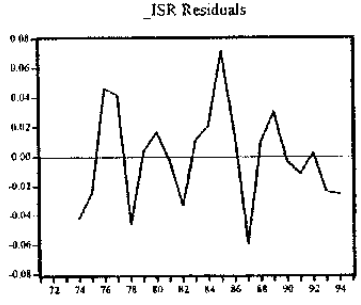












15. First, the medium-term S-I norm for Korea is constructed by using parameters derived from the panel analysis of ten economies. It thus equals:

(2) CAGDP = 0.140 + 4.446 FBGDP + 0.861 RELDEPO - 0.090 RELDEPY - 0.752 RELY + 0.701 $RELY^2$

16. Then, to examine the sensitivity of the computed S-I norms for Korea to the choice of countries, the panel is restricted to include only the East Asian economies (Indonesia, Malaysia, Philippines, Singapore, Thailand). These economies are chosen because they had similar experiences of rapid growth over the last three decades and they also share some common demographic factors. The model specifications and estimation procedure are the same as above. The estimated equations fit the data well, and the results are reported in Table III.3. Using the estimated parameters from the fixed effects, heterogeneous slope model, the medium-term S-I norms are given by:

(3) CAGDP = 0.126 + 4.343 FBGDP - 1.545 RELDEPO - 0.271 RELDEPY - 1.174 RELY + 1.431 $RELY^2$

17. The S-I norms for Korea derived from equations (2) and (3) are plotted in Figure III.3. These norms suggest, broadly, a balanced current account as the norm for Korea over the medium term. In addition, it can be seen from Figure 3 that restricting the model to just include the Asian economies raises the S-I norms for Korea only marginally, and hence, does not alter the qualitative result of our analysis.

D. Conclusion

18. This chapter has provided an empirical measure for current account balances for Korea from the perspective of the fundamental medium to long-run determinants of saving and investment behavior. We used a narrower sample of economies that are broadly similar to Korea to overcome the problems of heterogeneity present in the CP study. The S-I norms derived from our panel dataset are significantly different from the CP norms, which shows a rising current account surplus. Our estimation suggests a broadly balanced current account as the norm for Korea over the medium term.

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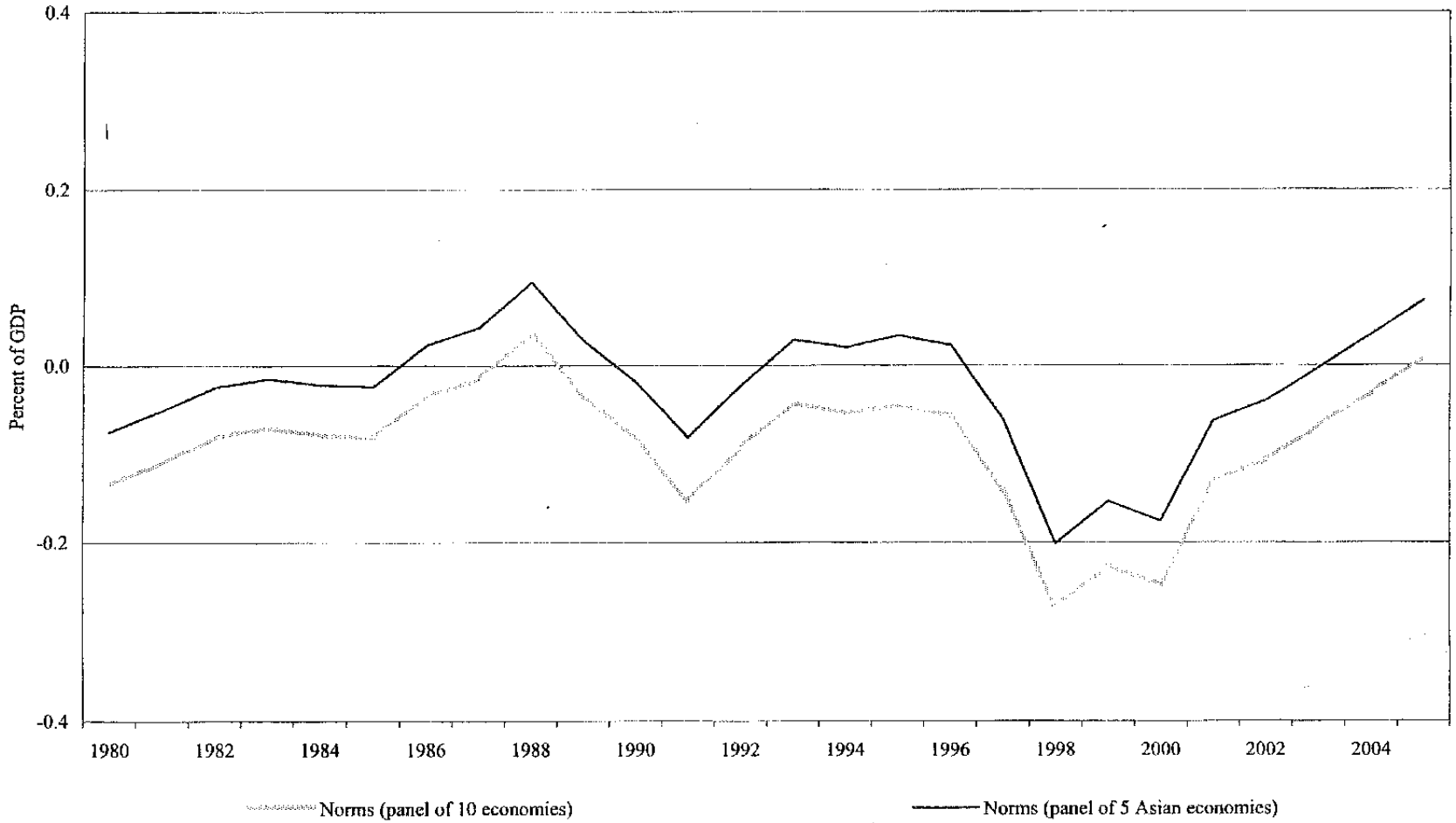
Table III.3. Partial Adjustment Model of the Current Account for Selected Asian Economies, 1971-95

Dependent variable: CAGDP

Variable	Common coefficients		Fixed effects Slope homogeneity		Fixed effects Slope heterogeneity	
	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
CAGDP(-1)	0.66	10.43	0.60	9.75	0.53	8.24
RELDEPO	0.38	0.51	-0.18	-0.22	-0.73	-0.88
RELDEPY	0.00	-0.07	-0.06	-1.12	-0.13	-2.25
RELY	-0.15	-1.54	-0.38	-2.69	-0.56	-3.20
RELY squared	0.24	1.84	0.53	3.19	0.68	2.85
DLTOTC (-1)	-0.04	-1.48	-0.03	-1.57	-0.02	-0.87
DLREER (-1)	-0.09	-3.34	-0.09	-3.47	-0.08	-3.37
Current account restrictions	0.01	1.19	0.01	0.62	0.01	0.83
Capital account restrictions	0.00	-0.74	0.01	0.27	0.00	-0.06
Intercept	0.02	0.69	...	...	...	...
Indonesia	...	...	0.02	...	0.02	...
Korea	...	...	0.03	...	0.06	...
Malaysia	...	...	0.06	...	0.09	...
Philippines	...	...	0.01	...	0.01	...
Singapore	...	...	0.01	...	0.03	...
Thailand	...	...	0.02	...	0.03	...
FBGDP	0.06	0.46	0.12	0.79	...	...
Indonesia	...	...	...	...	0.56	3.03
Korea	...	...	...	...	2.06	3.00
Malaysia	...	...	...	...	0.28	1.04
Philippines	...	...	...	...	-0.18	-0.52
Singapore	...	...	...	...	0.15	0.41
Thailand	...	...	...	...	-0.14	-0.88
R-squared	0.63		0.65		0.68	
Adjusted R-squared	0.60		0.61		0.62	
S.E. of regression	0.03		0.03		0.03	
Log likelihood	295.03		297.69		299.50	
Durbin-Watson stat	1.92		1.90		1.79	
Mean dependent var	-0.03		-0.03		-0.03	
S.D. dependent var	0.05		0.05		0.05	
Sum squared resid	0.13		0.12		0.11	
F-statistic	20.73		24.16		16.85	
Prob(F-statistic)	0.00		0.00		0.00	

Sources: Chinn and Prasad (2000), and staff computations.

Figure III.3. Saving-Investmcnt Norms for Korea, 1980-2005



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IV. Developments in the Corporate Bond Market[1]

Financing pressures in the corporate bond market grew through 2000 and are expected to remain substantial through 2001. These pressures reflect the coincidence of greater investor sensitivity to credit risk, the decline of those institutions that historically were the major buyers of corporate bonds, and the upcoming maturity of the large stock of 3-year bonds issued in 1998. The authorities have taken several steps to reduce the liquidity crunch associated with the debt rollovers. The challenge for the authorities will be to ensure that the measures they adopt keep distortions to a minimum, and help build a more robust bond market that prices risk appropriately. In addition, it will be important to maintain momentum in corporate restructuring and the exit of nonviable firms.

A. Background

1. **Korea has a fairly active bond market, with the second largest corporate bond and asset-backed securities market in Asia (after Japan).** The corporate bond market began to grow in the early 1970s following the passage of the Capital Markets Promotion Act of 1968. Most corporate bonds—about 85 percent immediately prior to the crisis—carried guarantees from banks, securities companies, or guarantee funds. With little issuance of government debt until recently, the three-year corporate bond was considered the benchmark bond yield. Foreign investment in the market was fully closed until 1994, when nonresidents were permitted to buy non-guaranteed convertible bonds issued by small and medium sized companies. Some further liberalization occurred in 1996 in conjunction with OECD membership, but complete liberalization of access by nonresidents did not occur until December 1997.

2. **The bond market has changed substantially in the aftermath of the crisis.** The development of the market has been stimulated by measures taken both by the authorities and the industry group (the Korea Securities Dealers Association). There are now several domestic rating agencies, some with links to the major international agencies. Since the crisis, the proportion of guaranteed bonds has fallen rapidly—in 1998, this proportion fell to about 30 percent, and it is now only about 3 percent, increasing the importance of credit rating agencies and credit risk assessment by investors. The implementation of mark-to-market accounting was completed in July 2000, and there are now several bond indices published. Finally, there has been very strong growth in government issuance, and a concerted attempt to improve the functioning of the government bond market, including by the implementation of a primary dealer system, a bond futures contract, delivery-versus-payment (DVP), and an inter-dealer broker system. The government yield curve was also extended substantially during 2000, via the first issues of ten-year government bonds.

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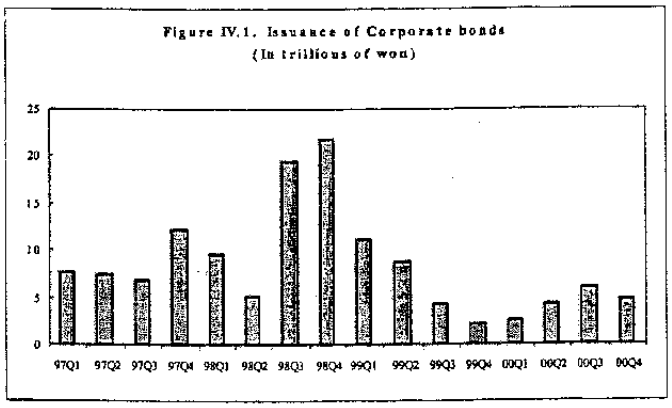
[1] This chapter was prepared by Anthony Richards.

3. **The primary investors in the corporate bond market have traditionally been the investment trust companies (ITCs).** These institutions were established in the 1970s and are similar to unit trusts or mutual funds in other countries (except that ITCs may undertake proprietary trading activity). As discussed below, there was a sharp increase in funds managed by ITCs in the aftermath of the crisis, reflecting the high interest rates offered on their products. Problems in the ITC industry became apparent in the wake of the Daewoo collapse, as losses by ITCs and uncertainty over the true value of funds prompted large redemptions by investors.[2] The authorities have moved to tighten the regulation of ITCs to ensure improved investment, sales and management practices. In addition, several of the smaller ITCs have been closed and the larger ones have been recapitalized by major shareholders and the injection of public funds. Overall, the industry is far smaller than in mid-1999.

4. **As of mid-2000, corporate bonds accounted for about 45 percent of outstanding bond issues in Korea, but a much smaller proportion of secondary market turnover.** While there has been a sharp increase in overall secondary market turnover in recent years, most of this growth has been in government rather than corporate bonds. Indeed, market estimates now put corporate bond turnover at about only 7 percent of total secondary market turnover, down from more than 50 percent of turnover 2 years ago.

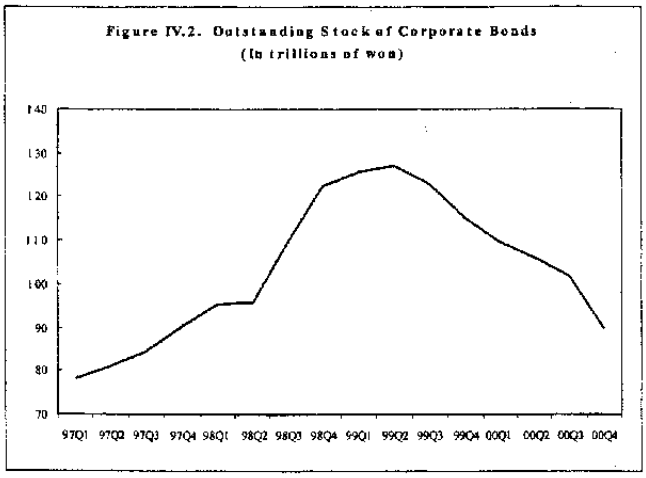
B. Recent Developments

5. **Corporate bond issuance surged in the wake of the crisis.** There was substantial corporate bond issuance in 1998 and early 1999, primarily of three-year bonds but also of some shorter maturity bonds. With only modest amounts of bonds maturing in 1998, net financing from corporate bonds in 1998 was W 33 trillion, even as companies lost bank financing.



[2] Further details on the ITC industry are provided in Chapter VI of "Republic of Korea: Economic and Policy Developments" (IMF Staff Country Report No 00/11, February 2000).

6. **Financing has been difficult in the corporate bond market since the collapse of Daewoo and the ITC problems of mid-1999.** Following the collapse of Daewoo in mid-1999, ITCs—which held a large proportion of the stock of corporate bonds—experienced large losses and large outflows. With limited demand from other investors, new issuance of corporate bonds has been weak since mid-1999, and issuers—especially those with weak profitability—are encountering problems as the bonds issued in 1998 are maturing. Issuance of corporate bonds (excluding ABS) fell by about 33 percent in 2000 to a level that was only one-third of the issuance in 1998. Further, maturities on newly issued bonds have tended to shorten, with three-year financing now available only to the strongest companies.



7. **About half of the existing stock of corporate bonds will mature in 2001.** Although there is a substantial amount maturing in the first quarter of 2001, there will be a far greater amount maturing in the final quarter, implying further financing pressures at that point. About 80 percent of the rated debt maturing in 2001 carries credit ratings above the cutoff for a Korean investment grade rating from Korean rating agencies, i.e. above BBB minus. The companies accounting for the remaining 20 percent of debt will presumably encounter substantial difficulty in rolling over their debt without some form of credit enhancement, or arrangement with investors and creditor banks.

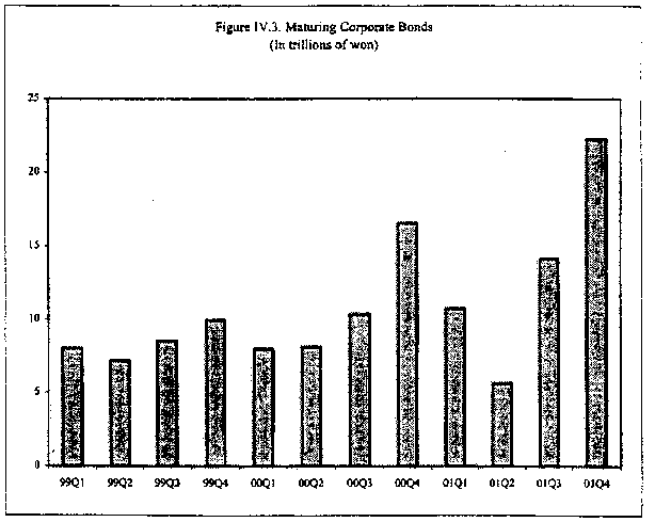


Table IV. 1. Korea: Credit Ratings of Debt Maturing in 2001 (in percent of total debt) 1/

A rating and above	39.2
BBB rating	41.1
BB rating and below	16.4
Unrated	3.3

Source: Bank of Korea.
1/ Excludes the debt of workout companies and privately placed bonds.

8. **The problems in the bond market are being exacerbated by difficulties in obtaining financing from other sources.** Banks have historically not been major holders of

corporate bonds, so modest recent increases in their bond holdings have done little to offset the withdrawal of other investors. Further, although (nonsecuritized) lending by banks has expanded, the desire to improve their asset quality has made banks reluctant to take on increased exposures to riskier borrowers. There has also been little interest by foreign investors in corporate bonds, presumably largely reflecting the low liquidity of the market, the poor health of many issuers, and the 27.5 percent withholding tax levied on fixed income products. Finally, although the equity market remained a source of financing into the first half of 2000, it has since dried up for most issuers.

9. **The problems in the corporate bond market have prompted numerous measures by the authorities.** The authorities' response to the initial problems in mid-1999 was two-pronged, involving reforms and support to the ITC industry as well as encouragement for the establishment of a bond market stabilization fund. The fund was financed mainly with contributions from commercial banks and government-owned banks and its goal was to overcome the disruption caused by redemptions by ITC investors and keep the benchmark three-year corporate yield below 10 percent. By most accounts it was successful in achieving its goals, bringing down the benchmark yield from 11 percent to 9-9½ percent, and reportedly yielding profits to its contributors when it was dissolved in March 2000.

10. **The difficulties experienced by low-rated and smaller firms in obtaining financing prompted a further set of measures in mid-2000.** These measures included the establishment of a W10 trillion bond fund, in which about 15 banks and other financial institutions were encouraged to participate, for the purchase of corporate bonds or collateralized bond obligations (CBOs). In addition, two state-owned guarantee funds (the Korea Credit Guarantee Fund in particular) were to provide partial guarantees for subinvestment grade bonds that were included in CBOs. By encouraging risk-pooling via CBOs and by providing guarantees on low-rated bonds, the authorities hoped to increase the amount of bond financing going to low-rated and smaller companies. This measure has been reasonably successful, and about W 7½ trillion of primary CBOs (CBOs consisting of newly issued bonds) were issued in the second half of 2000, accounting for about one-third of all corporate bonds issued in this period. About one-third of the bonds in the first nine CBO issues carried credit guarantees, and about 40 percent of the firms raising money in these CBOs were subinvestment grade (BB rated) firms. The primary CBOs have been structured in a way that is broadly consistent with market principles. On average, about 35 companies have been pooled in each CBO. Companies participating in the CBOs pay a yield that is supposedly appropriate for their risk, and the amount by which these yields exceed the yield on the senior tranche of the CBO has provided a buffer which is expected to cover most losses, with the KCGF covering any further defaults.

11. **As financing pressures in the corporate bond market worsened in late 2000, some further support measures for the bond market were announced.** A second W10 trillion bond fund was established, with similar goals to the first fund, with contributions from a smaller number of banks and in addition from post office deposits and pension funds. A further measure announced at the end of December 2000, was reportedly designed to provide funding to allow the rollover of bonds of larger firms described as

having temporary liquidity problems but good prospects of survival. If firms are deemed viable (by a committee consisting of the Korea Development Bank, creditor banks, and the KCGF, they would be allowed to participate if they repay 20 percent of their maturing bonds and present credible rehabilitation plans. The KDB would then act as underwriter for the rollover of the remaining 80 percent of maturing bonds at yields given by the average secondary market yield for similarly rated bonds, plus a margin for the use of the facility. The KDB would then resell the bonds via partially state-guaranteed CBOs (70 percent) and to main creditor banks (20 percent), and would hold the remainder itself. Details of this scheme continue to be refined.

12. **The growing use of CBOs has both positive and negative aspects.** The government's support of CBOs has the potential to jump-start an active private market for CBOs to allow risk pooling and provide both a new investment product for investors and increased financing to firms. Of course, risk pooling in principle can be provided directly by institutions such as ITCs which give small investors access to a portfolio of bonds from a large number of issuers. However, in current conditions of limited confidence in nonbank financial institutions, government encouragement of CBOs may have been necessary to boost investor demand for pooled investment vehicles. Interestingly, however, the CBOs have been purchased primarily by large institutional investors such as banks and ITCs, the very type of investors that have the capacity to create their own diversified portfolios. Hence, the attraction of the CBOs may be largely due to the government-backed guarantee on the lower-rated bonds included in the CBO. This raises questions as to whether the low-rated companies benefiting from guarantees are priced appropriately and whether there could be substantial contingent liabilities for the government. Another potential shortcoming is that the bonds included in the primary CBOs are not issued in the open market like other bonds, but carry a yield set by the sponsors of the CBO. Hence, there is a risk that the use of CBOs undermines the development of markets and blunts the effectiveness of the price signals provided by the usual market mechanism that applies when companies come to the market to issue bonds. Finally, there are issues about whether loss-sharing rules are clearly spelled out and whether holders of the residual or subordinated tranches of CBOs—known colloquially in U.S. bond markets as the "toxic waste" of CBOs—are valuing (or provisioning for) them appropriately.

13. **The growth of CBOs has been an element of a broader expansion in issuance of asset backed securities (ABS).** The growth in ABS issuance has been allowed by the passage of a law on ABS in 1998 and changes to the taxation of asset securitization, and spurred by the securitization activity of KAMCO. In addition to bonds (discussed above), there has also been securitization of loans (both performing and nonperforming), real estate, auto receivables, lease receivables, mortgages and credit card receivables. Indeed, while issuance of standard corporate bonds has fallen, there has been substantial growth in ABS issuance, from about W5 trillion in 1999 to W41 trillion in 2000. In addition to being used to clean up the balance sheets of banks and ITCs, securitization has in many cases been a response to difficulties in obtaining financing. Senior tranches with AAA or AA ratings have accounted for about three quarters of all ABS, and these have found strong demand. However, the junior tranches are typically held by the originating firm, and these have often

carried very low ratings and are far less likely to be repaid, and may already be nonperforming.

C. The Causes of the Recent Problems

14. **The heightened recent problems in the corporate bond market are a reflection of a bunching in maturities and a greater sensitivity to credit risk.** There have been pressures in the corporate bond market since mid-1999 as funds have flowed out of ITCs, and this pressure has been reflected in sharply reduced new issuance since mid-1999. However, the bunching of maturities going into 2001 and the need for companies to repay or roll over a large stock of issuance from 1998 is what has recently made the problems far more pressing.

15. **The lack of attention—until recently—to credit risk in the corporate bond market had its genesis in the system of guarantees that existed prior to the crisis.** As a result of these guarantees, and a system where losses from corporate failure were relatively rare, it was not particularly important for investors to be aware of the credit risk of the companies issuing bonds. Following the crisis, most bonds were no longer guaranteed and purchasers of bonds were now subject to credit risk, so one might have expected to see substantially greater awareness of credit risk. Hence it is puzzling that issuance of corporate bonds surged so dramatically in 1998 in an atmosphere where the credit risk of issuing companies had likely increased. The explanation appears to be that there was a massive surge in deposits at ITCs—traditionally the major investors in corporate bonds. This surge was presumably a reflection of the low interest rates offered by banks in the aftermath of the crisis, and the high interest rates offered by the poorly managed and less heavily supervised ITCs. There may have also been some elements of moral hazard as portfolio managers in ITCs continued to invest in the expectation that companies would never default—or be allowed to default—on their bond issues. In addition, some *chaebol* may have found that they could rely on ITCs affiliated with their groups to buy their bonds regardless of risk. These factors together may explain why so much financing went to companies that are now unable to obtain fresh financing or to repay their bondholders.

Table IV. 2. Korea: Balance Sheets of ITCs
(in trillions of won)

	Dec. 1997	June 1999	Aug. 2000
Total assets	102.4	268.6	159.5
Holdings of bonds	64.8	154.8	81.7
(percent change)		138.9%	-47.2%

Source: Bank of Korea.

16. **The collapse of Daewoo in mid-1999 was a major shock to the corporate bond market.** First, it provided a major wake-up call about credit risk and the lack of reliability of financial disclosure of firms—Daewoo Corporation had continued to issue corporate bonds in the lead-up to its default, and had been assessed by some domestic agencies as investment grade (BBB minus) until early in June 1999 (despite a foreign currency debt rating from international agencies of B minus, with a negative watch). Perhaps, more importantly it

signaled the beginning of the revelation of problems in the ITCs, and the outflows of funds from these institutions. As investors shifted funds to banks, which historically have not been major purchasers of bonds, there was an outflow of funds from the bond market. This was reflected in an immediate sharp decline in new bond issuance and an ongoing steady decline in the outstanding stock. With a large bunching in maturities from the fourth quarter of 2000, the decline in the stock of bonds would seem set to accelerate.

17. **Not surprisingly, the tightening of market access has hit lower rated borrowers hardest.** Aggregate net debt issuance in 2000 was negative, with substantial discrimination in market access across credit categories. Higher-rated companies (with domestic ratings of A and above) accounted for 38 percent of maturing bonds, but obtained 64 percent of new financing (excluding via primary CBOs). By contrast, the lowest rated companies (those rated BB and below) accounted for 25 percent of maturing bonds but obtained only 8 percent of new financing, thereby experiencing substantially negative net financing. Mid-rated companies also saw significantly negative net financing. More generally, the problems experienced by so many borrowers may not be especially surprising in light of the fact about 37 percent of issuers of corporate bonds had subinvestment grade credit ratings (BB or below) from domestic rating agencies, and a further 39 percent were in the lowest investment grade category (of BBB).[3] Among the lead companies for the 14 largest *chaebol*, only 5 now have domestic ratings of A or better.

Table IV. 3. Korea: Issuance and Maturity of Corporate Bonds by Credit Rating, 2000 1/
(in trillions of won)

Credit rating of firms	A and above	BBB	BB and below	All firms
Issuance	10.2	4.6	1.3	16.1
percent of total	63.6%	28.5%	7.9%	
Maturing bonds	12.2	12.1	8.2	32.6
percent of total	37.5%	37.2%	25.2%	
Net issuance	-2.0	-7.5	-7.0	-16.5

Source: Bank of Korea.
1/ Includes all firms for which ratings data were available.

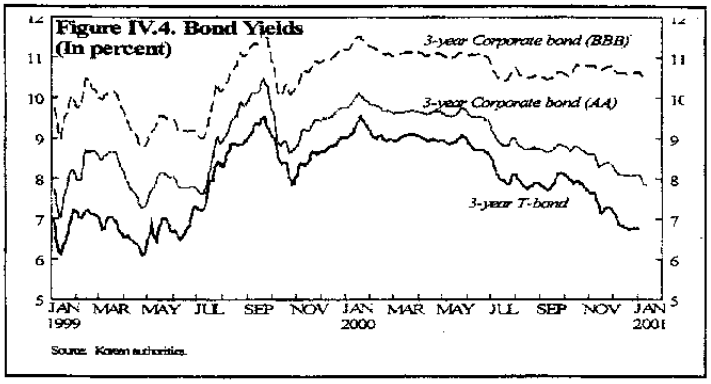
Table IV. 4. Korea: Domestic Credit Ratings of Korean Bond Issuers, October 2000

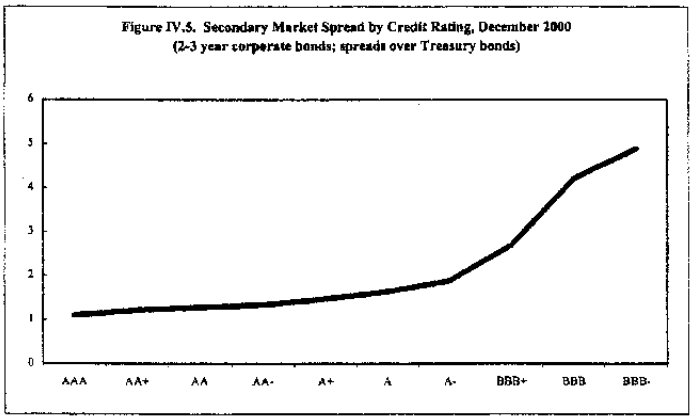
Credit rating	AAA	AA	A	BBB	BB	B	CCC or below
Number of firms	10	21	51	136	101	12	15
Percent of total	2.9%	6.1%	14.7%	39.3%	29.2%	3.5%	4.3%

Source: Korea Management Consulting and Credit Rating Corp.

[3] It should be noted that these ratings are from a leading domestic rating agency. A much smaller number of Korean companies have ratings from international agencies, and these international ratings tend to be substantially lower that the ratings from domestic agencies.

18. **Despite investors' reluctance to buy low-rated corporate bonds, there have been only relatively modest increases in yields on such bonds.** Data on secondary market yields for subinvestment grade bonds (domestic ratings of BB and below) are not available, but yields on BBB rated bonds show credit spreads that seem quite low by the international standards. For example, the spread between BBB and AA rated issuers had widened only modestly, to about 2.7 percentage points at end-2000. In the U.S. bond market, the spread between AA and BBB rated bonds at end-2000 was similar at about 2.5 percentage points, although a more relevant comparison might be the spread in the U.S. between A and BB rated bonds which was about 5.5 percentage points. The latter comparison would suggest that credit spreads in Korea remain lower than might have been expected, perhaps offering a clue as to why the market has been reluctant to absorb issuance by lower rated borrowers. It is, however, difficult to explain why (secondary market) yields might not have risen to market clearing levels—the extreme illiquidity of lower-rated bonds is presumably a contributing factor.





D. Conclusion

19. **The recent developments in the corporate bond market appear to reflect the fact that the market is now paying far more attention to credit risk, and the sudden impact of this is causing substantial pain.** Standard and Poor's has indeed noted that the fact that the authorities have been forced to intervene is an indication of their success in curtailing the "risk-blind investment decisions" by the private sector that prevailed in previous years. Further, the liquidity pressures in the bond market are a sign of the need for deeper corporate restructuring—principally deleveraging through asset sales and the exit of nonviable firms.

20. **The question arises as to whether the greater attention to risk has gone so far as to be excessive and as to whether there is a "credit crunch."** On the one hand, it appears that the better companies—both large and small—still have access to funds at reasonable rates, and that the increase in bond yields that has been seen for lower grade borrowers is not inappropriate. Indeed, a Bank of Korea survey in October 2000 indicated a continuing loosening of lending activity and enhanced competition for lending to highly rated

borrowers, accompanied—not surprisingly—by tightened credit conditions for lower-rated companies. Nonetheless, the decline of the ITCs, the risk aversion of banks and the bunching of maturities has resulted in conditions where rollover problems threaten to extend beyond those firms that probably do not deserve financing and to affect viable ones as well. The challenge for the authorities will be to ensure that any measures they adopt keep distortions to a minimum, and help build a more robust bond market that prices risk appropriately. As noted above, it will be important to maintain momentum in corporate restructuring and the exit of nonviable firms.

21. **For companies, one primary lesson from the current crisis is the perils of balance sheets with high debt/equity ratios and short debt maturities.** These factors mean that companies have to approach the market for fresh financing on a nearly continual basis, leaving them extremely vulnerable to changes in sentiment and reduced market access—the recent trend towards shorter maturities will exacerbate this further. In addition, there may well be questions as to whether short- and medium-term bond financing is the most appropriate type of financing for lower-rated companies. In mature economies, risk and informational factors combine to result in riskier borrowers typically relying mainly on equity financing such as venture capital, or bank lending with banks safeguarding their investment through collateral and close monitoring of cash flows and management behavior. Thus, the problems in the bond market may also be signaling that market participants do not view further bond financing as the appropriate form of financing for some companies.

V. Options for Pension Reform in Korea[1]

This chapter outlines the features of various pension schemes in Korea and the problems they face. Substantial financial risks are expected to emerge in the next three decades because of a rapidly aging population and the maturing of the pension system, which at present is still relatively young. The chapter also reviews the options for reform put forward by a task force established by the government.

A. Introduction

1. **Many mature social security systems around the world are experiencing financial difficulties.** Two factors have contributed to problem of large unfunded liabilities in public pension systems.[2] First, rapidly aging populations have increased dependency ratios, i.e., the number of retirees relative to the number of persons in the labor force. And second, generous retirement benefits in many countries have compounded the strains.

2. **Korea's public pension system is relatively young and has not yet suffered from large-scale financial distress, but pressures are likely to emerge in the medium term.** As the system is relatively new and has narrow coverage, the maturity ratio, defined as the number of beneficiaries to the number of contributors, is low.[3] The government employee pension system, nevertheless, has already run into cash flow deficit and its reserves will be depleted in the near-to medium term. Further, there are indications that the national pension system will suffer from similar financial distress at a later stage when the system matures if no reforms are implemented to improve actuarial balances and if the mismatch between contribution and benefits persists.

3. **The Korean government is aware of the potential financial risks in the public pension system.** A "Pension Reform Task Force" was established in December 1998 to outline options to improve the long-term financial viability of the system. The task force's report titled *Basic Plan for Pension System Reform* was made available for public debate in the latter part of 2000.

4. **This chapter discusses the various reform options outlined in the report of the task force.** Section B describes Korea's current pension system, Section C discusses the problems within the existing system, Section D reviews the reform options, and Section E offers some concluding remarks.

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[1] This chapter was prepared by Qingying Kong.

[2] See, for example, Gruber and Wise (2000) and World Bank (2000).

[3] See ADB (1999) and OECD (2000).

B. The Current System

5. **The National Pension Scheme was introduced in 1988.** Prior to this, there was no public pension scheme with wide coverage—most private sector workers were covered only by a loosely regulated private retirement scheme, while government employees, teachers and military personnel were covered by occupational pension schemes provided by the government. As a result, most elder persons in Korea, especially those living in lower income areas, still have to depend on their own earnings, family support, and social assistance for retirement. With the establishment of the National Pension Scheme (NPS), however, coverage has been expanded and steps have been taken to strengthen the institutional framework of public pension schemes. According to the World Bank (2000) study, most Korean workers who reach the statutory retirement age in 2025 will be eligible to receive pensions from one of the formal pension schemes.

Publicly-mandated retirement schemes

6. **There are several publicly mandated retirement schemes in Korea.** First, there are three occupational schemes targeted to specific groups: one instituted for government employees in 1960, one for military personnel in 1963, and one for private school staff in 1975. Second, the NPS covers private sector employees and its operations are overseen by the National Pension Corporation (NPC). This system is relatively young—in 1998 it was estimated to have 14.2 million participants but only 0.2 million recipients. And third, the government also mandates that employers must provide "retirement allowances" (RAS), a form of privately managed retirement savings. This program also serves as a severance payment scheme as the benefits can be received upon termination of employment.

Coverage and contribution

- Coverage under the NPS has been expanded recently to roughly 75 percent of the labor force. When the NPS was first introduced, it only covered employees in firms with more than four employees. In 1995, the self-employed in rural areas, farmers and fishermen were required to contribute to the scheme. In April 1999, an amendment to the National Pension Act extended coverage to the urban self-employed and small firms.

- Coverage under the three public occupational pension schemes is limited by design. The special pension schemes for government employees covers all public servants in the central and local governments, including judges, policemen, railroad workers and public school teachers.[4] Altogether, this group comprised about six percent of the labor force in mid 1999. The civil service pension scheme had 988,000 contributors and 73,000

[4] In view of similarities in benefit structure and financing, the rest of the analysis will focus only on the civil service pension scheme.

pensioners. The pension schemes for government employees and for military personnel are now reaching maturation.

- The RAS covers full-time employees in firms with more than five employees with an 8.3 percent of contribution from the employers.

- The contribution rate under the NPS is nine percent for those covered under the scheme prior to its expansion, and three percent for the new entrants into the plan. The lower contribution rate is expected to converge gradually to nine percent by 2005.

- Contribution rates are higher for the occupational schemes: 15 percent for the civil service and military schemes, and 13 percent for the teachers' scheme. The dependency ratios are also higher than that of the NPS.

Benefits and eligibility

7. **The several publicly-mandated pension schemes differ in terms of level of benefits, the accrual of the benefits, and forms of withdrawal.**

- The NPS is a defined benefit plan. The benefit formula is progressive and results in a 60 percent replacement ratio over a forty-year contribution horizon. The benefit is indexed to the CPI.

- The occupational scheme has a maximum replacement ratio at about 75 percent for a 33-year career. The benefit for the occupational schemes is indexed to wage levels.

- The RAS is mandated by the government for employers to provide a minimum one-time benefit equivalent to 1/12 of the worker's final wage for each year of employment. The benefit is payable whenever the employee leaves the job.

8. **Eligibility conditions also differ across schemes.** A full pension under the NPS can be obtained at age 60, but a recent amendment will lead to a gradual increase to 65 by 2033. New entrants in the civil service scheme would need to work until age 60 to receive a full pension, but the grandfathered beneficiaries can retire with unreduced pensions as soon as they meet the minimum length of service conditions.

Private pension schemes

9. **The government encourages investment in personal pension plans** offered by banks, investment trust companies and insurance companies, savings institutions, and cooperatives by granting favorable tax treatment on the contributions and benefits. To qualify for the tax deduction, the individual must agree to contribute continuously for at least ten years and cannot withdraw the pension until reaching the age of fifty five. Reliable information on the size of contribution by individuals is not available, but estimates suggest

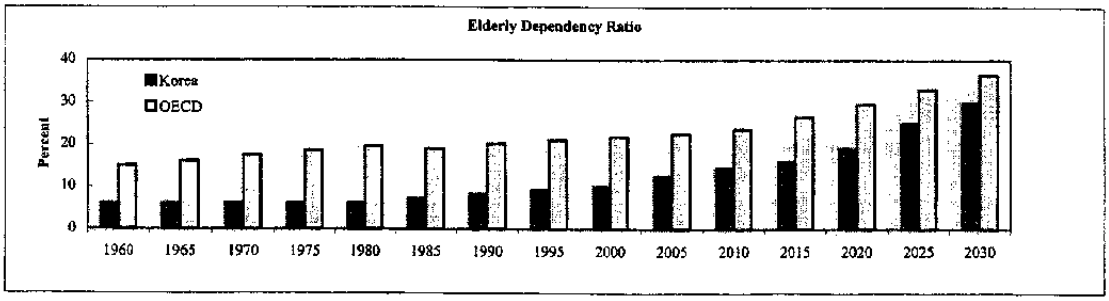
that total value of these private pension schemes amounted to about 11 trillion won as of mid 1996, or about 3 percent of GDP.

C. Problems with the Current System

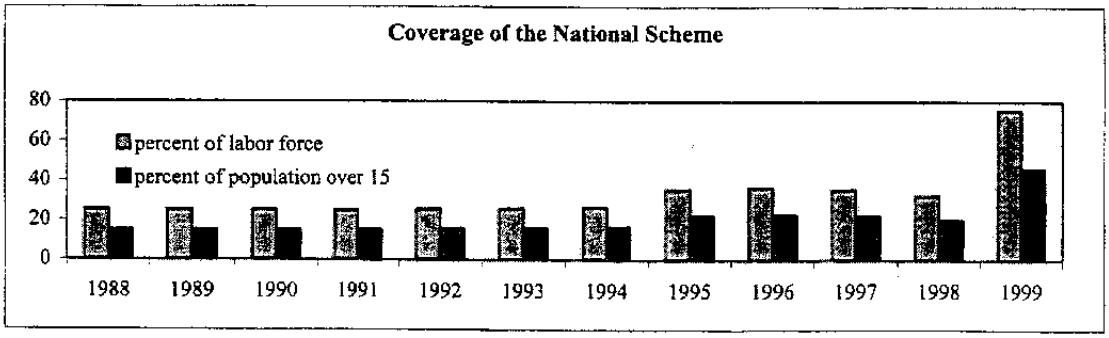
10. **Substantial financial risks in the pension system are expected to emerge in the next three decades** because of three main factors: a rapidly aging population, the expansion of the coverage, and the maturing of the pension system (see Box V.1). All existing public or publicly mandated pension schemes are going to be affected by these three factors, and there are also some specific problems that are germane to each scheme. The analysis in this section will show that the total burden of financing all the publicly mandated pension schemes would be very high if the benefits were to be kept at the existing generous levels.

Box V.1. The Changing Environment for the Pension System

Korea has a relatively young demographic structure compared to the OECD average. However, the speed of increase in the elderly dependency ratio—defined as the ratio of people over age 65 to the working-age population—is one of the highest in the world.



The coverage of the NPS has been expanded three times since its inception, and in 1999 it covered almost 75 percent of the labor force.



The number of beneficiaries will rise rapidly as the system matures. Even with the increase in the retirement age from 60 to 65 as planned, the number of recipients of old-age pensions is expected to rise by 15-fold to around 6.6 million over the next three decades.

The NPS and retirement allowances

11. **The replacement ratio for the NPS and RAS is relatively high.** Assuming a worker is covered under both the NPS and retirement allowances, the total replacement ratio for 35 years of services could generate a replacement ratio of 85 percent. As a result, there is an element of **intergeneration redistribution** because higher payroll taxes are called for to meet the demand of rising benefits over time as the system matures. In order to maintain the target funding levels, the tax rate would have to double over the next three decades. The younger generations entering into the NPS and the RAS will face a lower rate of return on their contributions.

12. **In addition, the mandated retirement income for workers covered under the NPS and the RAS varies by age cohort and type of worker.** The differences amongst workers within the same cohort are due to: (i) some workers, such as the self-employed are not covered by the retirement allowances; and (ii) the NPS builds in **intrageneration redistribution** through a progressive benefit formula, which generates a higher replacement ratio to workers with lower lifetime incomes. As a result of the progressivity in the system, the low-income group achieves a higher internal rate of return on their pension contribution.

13. **There is also considerable contractual risk associated with the RAS.** The RAS was originally set up to provide an old age pension when people retire and income support during unemployment. The RAS, however, is highly vulnerable because of it is unfunded. During the recession following the 1997-98 financial crisis, many firms were not in a position to make contributions to the scheme on behalf of their employees. Subsequently, the government reacted by establishing the Wage Guarantee Fund in July 1998 to cover for those firms that could not pay their obligations.[5]

14. **In addition, fund management under the RAS is poorly regulated.** Many firms record the liabilities associated with the retirement allowances on their balance sheet to take advantage of the tax deduction, since up to 50 percent of the total liability is deductible. The other half could also be deducted if the firm opens an insurance policy to cover the liability. In practice arrangements are often made with an outside financial institutions to lend the money back to the company.

15. **The need for a RAS has diminished in the current environment** which is markedly different from that when the system was first introduced. Key changes include a more mobile labor force and more frequent job changes, as well as the establishment of an unemployment system with broad coverage. More importantly, the recent financial crisis has highlighted the urgency to ensure funding of the scheme and to protect workers' right by segregating funds from companies' accounts.

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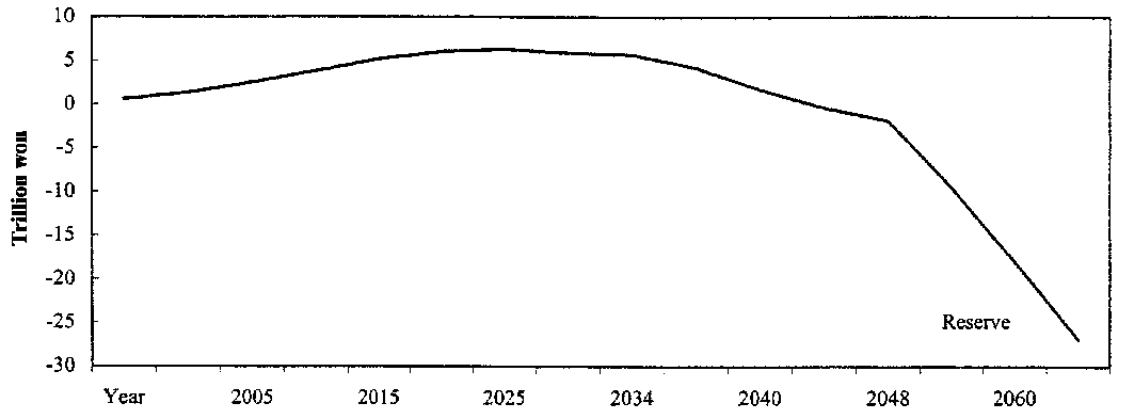
[5] The fund is financed in part by a 0.2 percent wage tax.

Fiscal implications

16. **The financial surplus of NPS is expected to be comfortable in the near to medium-term.** The surplus is currently about two percent of GDP because of expanded coverage (and hence contributions) and the system's immaturity, and this surplus is projected to peak in 2040 (see Figure V.1). Thereafter, however, deficits accumulate rapidly. In the short-run, the critical question is how to invest the surplus to generate enough cash flow when the system matures.

Figure V.1. The NPS Financial Projection
(9% contribution)

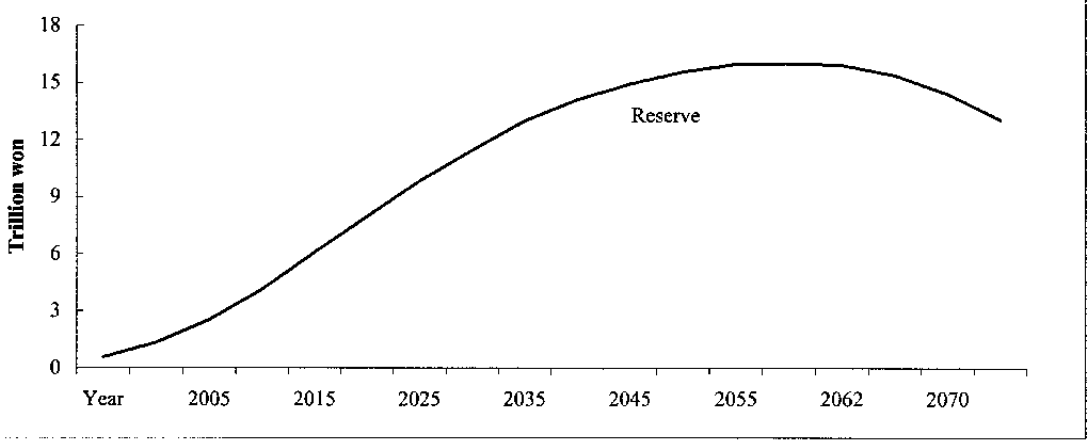


17. **The surplus from a partially funded public pension scheme could have implications for other budget decisions.** Starting in 2001, however, lending from the pension fund to the central government to cover its fiscal deficit in other areas will be disallowed, and old loans will not be rolled over, as dictated in the amended Public Funds Management Act (PFMA). Nonetheless, discretionary lending is not precluded. The current cash-based fiscal accounting, which does not take into account growing pension liabilities over time, could run the risk of spending too much on current programs than in the absence of the pension surpluses.

18. **The NPS will start to run cash flow deficits when today's labor market entrants retire.** By the time the system fully matures, the deficits will vary between 5 to 8 percent of GDP. Maintaining all the current parameters of the system, the NPS reserve will be depleted by 2043. To keep the system financially viable in the long run, either the contribution has to be raised or benefits have to be cut, or both. A recent proposal by the National Pension Corporation would avoid deficits until 2080 by raising the contribution rate gradually to 17.25 percent in 2033 (see Figure V.2). In addition, the debt owed by the central government to the NPS will have to be repaid long before that, which would require the government to

finance the debt repayment by borrowing in the market, or by cutting government spending, or by raising taxes, with adverse implications for growth and labor markets.

Figure V.2. The NPS Financial Projection
(Increase of contribution to 17.25%)



19. **The fiscal implication of financing the NPS and RAS is serious.** Financing the retirement allowances and paying long run NPS contributions to maintain its current target level of benefits would require raising government contribution to more than 25 percent of the covered wage bill or more than 10 percent of GDP.

Impact on capital markets

20. **Most of the pension assets in Korea are not invested in interest earning financial instruments.** It is estimated that only about ten percent of the retirement allowances is invested in assets held external to the companies, the rest is mostly lent back to the company as working capital. This significantly aggravates the risk concentration, precludes more efficient financial intermediation of resources, and distorts the debt and equity balance within companies. In particular, the absence of large contractual savings vehicles in the capital markets makes it difficult to develop longer term savings instruments and hinders the deepening of the financial market.

21. **A large chunk of the assets in the NPS is on-lent to the central government as direct loans.**[6] Out of the NPS portfolio, less than five percent is invested in private securities, about four percent is invested in social welfare projects, and there are no foreign assets. As a

[6] The NPS's assets are managed by a government agency that is subject to the influence of the Ministry of Finance and Economy and the Ministry of Health and Welfare.

result, the total return on the NPS portfolio is roughly the same on one-year treasury bills. The past practice of diverting these funds to finance other government operations has significantly reduced the internal rate of return on contributions. Observers have called for the National Pension Act to be further modified to preclude lending the reserves out as social investment, personal loans to members, and intragovernmental loans. Investment in listed instruments in the capital markets, and in high quality foreign securities would also be beneficial. In addition, an improved governance structure to eliminate bureaucratic discretion and impose a discipline on investment through the use of the benchmark portfolios with comparable risk profile will also be important.

Public occupational pension schemes

Civil service pension

22. **The government employee pension provides more generous benefits than the NPS and the RAS and allows for early retirement.** The benefit is equal to 50 percent of final salary for 20 years of service plus 2 percent of final salary per year of service up to a total of 33 years, resulting in a replacement ratio of 76 percent of final salary. In addition, a one-time retirement allowance benefit equivalent to 60 percent of monthly final salary per year of service is provided.

23. **The financial situation in the civil service pension has been steadily deteriorating, and has been in deficit since 1998.** The fund reserve could be depleted in 2001 despite the increase in contribution rate from 5½ percent for both the government and the employees to the current 7½ percent level. As a result, the GEPC has to borrow from the central government to finance its pension obligations. This has led to a higher fiscal deficit in the consolidated central government accounts. The civil service pension deficit is expected to widen further to about 3 percent of GDP around 2030 and stabilize at about that level thereafter.

24. **In addition to the generous benefits, two factors have contributed to the deficit in the civil service pension scheme.** One is the relatively early retirement age, which is encouraged because benefits stop accruing after 33 years of service. Further, even after the increase in minimum age of retirement to 60 for new employees, the system is still more generous than the NPS under which the minimum retirement age will eventually reach 65. The second factor is that the benefit formula is heavily back loaded. Benefits accrue more rapidly towards the end of the career, which discourages labor mobility. The lack of portability between public and private sector pension schemes further hampers the movement of labor.

Other public pension schemes

25. **Other public pension schemes are also facing financial problems because pension benefits are too high relative to the contribution rate.** The fund reserve of the

Military Pension was depleted in 1977 and the central government has financed its operation since then; the Private School Teachers Pension is projected to incur deficits from 2012 and its fund reserve is expected to be depleted by 2018. Some estimates suggest that, to maintain the current regime of pension benefits, the contribution rates have to increase to 30 to 35 percent, an unsustainable level.

26. **In the absence of reform, the impact on public debt dynamics of financing the various public pension schemes could be severe**. Rough estimates indicate that the present value of liabilities accrued to date minus existing assets is about 30 percent of GDP under the NPS. The present value of the stream of deficits in the government employees' scheme comes to another 25 percent of GDP, and the retirement allowances adds another 10 to 20 percent of GDP. Put differently, total implicit pension debt is larger than the total public debt.

Individual pension schemes

27. **Private pension schemes were introduced in 1994 and are at a nascent stage of development.** These schemes have a very limited role in providing retirement income with average balances in individual pension accounts of only W 3.7 million (about $3,000). Moreover, the reliability is low due to poor return on investment, unsound fund management and abuse of the fund as collateral for bank loans by the financial institutions.

D. The Policy Options

28. **The analysis in the previous section identified several main areas where changes are necessary**: overly generous benefits; varying levels of benefit for different groups of workers that are not justified by a public policy rationale; a large unfunded liability in all the publicly mandated pension schemes; and lack of portability of pensions for public and private sector employees.

29. **A range of policy options are available to the government to address these issues for both the near and medium term.** In the near term, publicly mandated pensions for private sector employees will not likely provide a substantial part of income for the elderly because of its limited coverage and low maturity ratio. Thus, it will remain important for the government to provide targeted spending on social welfare to alleviate poverty for the elderly poor. In the medium term, faced with insolvency in most of the public mandated pension schemes, the government needs to, at a minimum, tackle the increasing deficit in the civil service pension and improve the management of the retirement allowances and the NPS. This would represent an incremental approach to the needed reform. A more comprehensive approach would involve revamping the whole public pension system in a way that the major issues highlighted fin the previous section could be solved. There are several options within such a comprehensive approach.

30. **The recent report of the task force on pension reform has outlined the following directions for reforms:**

- Establish a multi-pillar pension system consisting of a mandatory public basic pension and a mandatory private pension, supplemented by a voluntary private pension.

- Introduce a defined contribution scheme.

- Convert the RAS into a corporate pension, a defined contribution scheme.

- Increase portability among different pension schemes and strengthen fund management and supervision of pension schemes.

- Combine the public occupational pensions into the multi-pillar system.

31. **The report proposes four options for reform along these lines.** Consistent with best practice, a common feature of these options is a multi-pillar system. Table V.1 provides a summary of the four options.

An incremental approach

32. **Option 1 proposed by the task force represents an incremental approach.** Three partial reforms could bring significant benefits to the public pension system. The first involves improving the regulatory framework for the retirement allowances scheme so that workers' rights can be protected, and also converting the RAS into a corporate pension gradually. The second involves improving the management of the NPS scheme. And the third involves reducing the benefits of the government employee pension at least to the level comparable to that under the NPS so that the scheme's deficit can be contained.

- *Converting retirement allowances into a private corporate pension.* The contribution would range between 3 and 8.3 percent, and the remaining part would be either converted to a voluntary corporate pension or a lump sum retirement compensation. In addition, pension portability would be introduced to facilitate labor mobility.

- *Improving the management of the NPS.* Changes would include introducing a formula to ensure that the retirement age is actuarially fair; granting a contribution period credit to the unemployed, poor, students, and military personnel; and adjusting the contribution rate gradually to about 15 percent to postpone a deficit until 2080.

- *Reforming the government employee pension scheme.* A critical objective is to control the ballooning of the cash flow deficit in the system. Options are to gradually reduce the benefits by raising the retirement age, eliminating the implicit work tax, shifting from wage indexation to price indexation, and using lifetime average earnings instead of final salary in the pension formula. The benefit would be lowered to comparable levels with other pensions, e.g., the NPS plus RAS.

Table V.1. Options for Pension Reform

		Option1	Option2	Option3	Option4
		Retain current system	Convert NPS as core	Create basic pension	Mandatory corporate pension
Employees	1st Pillar	NPS	NPS	Basic pension	Basic pension
	2nd Pillar	Corporate pension	Mandatory corp. pension	Earnings related pension	Mandatory corp. pension
	3rd Pillar	Individual private pensions			
Self-employed	1st Pillar	NPS	NPS	Basic pension	Basic pension
	2nd Pillar	--	Corp. pension	--	Mandatory corp. pension
	3rd Pillar	Individual private pensions			
Government	1st Pillar	Occupational pension	NPS	Basic pension	Basic pension
Employees	2nd Pillar		New Occup. Pension	New Occup. pension	New Occup. pension
	3rd Pillar	Individual private pensions			

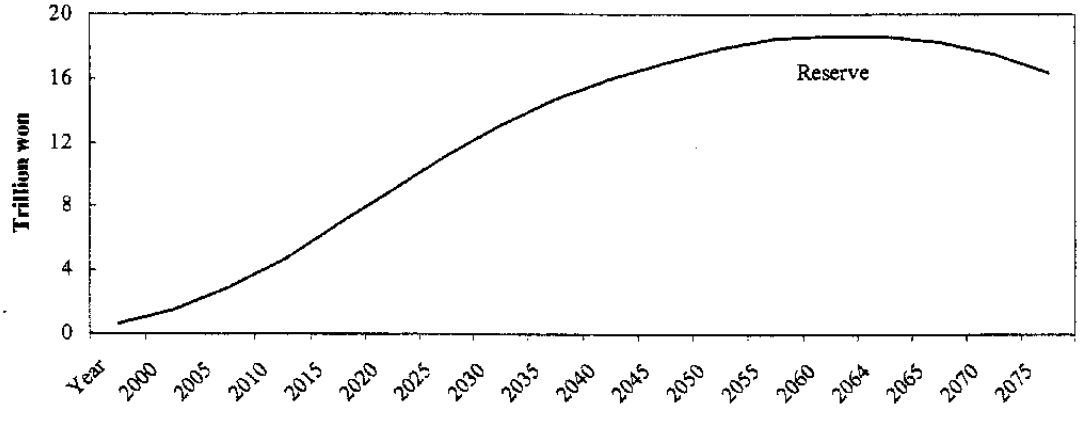
A comprehensive approach

33. **The other three options proposed by the task force involve a core pension system with broad coverage as the first pillar, a mandatory private pension as the second pillar, and a voluntary individual private pension as the third pillar**. However, important differences emerge as to the choice of the core pension system and the design of the second pillar pension. Nevertheless, the transition from the current mixture of partially-funded and unfunded schemes to the multi-pillar system would be a leap forward.

34. **Under Option 2, the NPS would become the core scheme for everyone** with a lower replacement rate between 45 and 50 percent for 40 years of contribution. The RAS would be converted to a mandatory corporate pension for employees, to operate as a defined contribution scheme with a contribution rate of 6 percent and a target replacement rate of 23 percent. A new corporate pension to be licensed by the state would provide comparable second pillar protection for the self-employed on a voluntary basis. The public occupational pension schemes would be split into two parts: one part would be merged into the NPS while the remaining would be converted into a new occupational pension scheme that has the same targeted replacement ratio as the corporate pension. The new occupational pension would be a national defined-contribution scheme funded solely by a 6 percent contribution from the government.

35. **Under the new multi-pillar system, the contribution rate under the NPS would need to be raised gradually to about 15 percent to ensure long-term financial viability.** The targeted combined replacement rate for NPS and the second pillar pension would be about 70 percent. The contribution period credit and premium discount would be given to the low-income earners and the underprivileged for the first pillar pension (see Figure V.3).

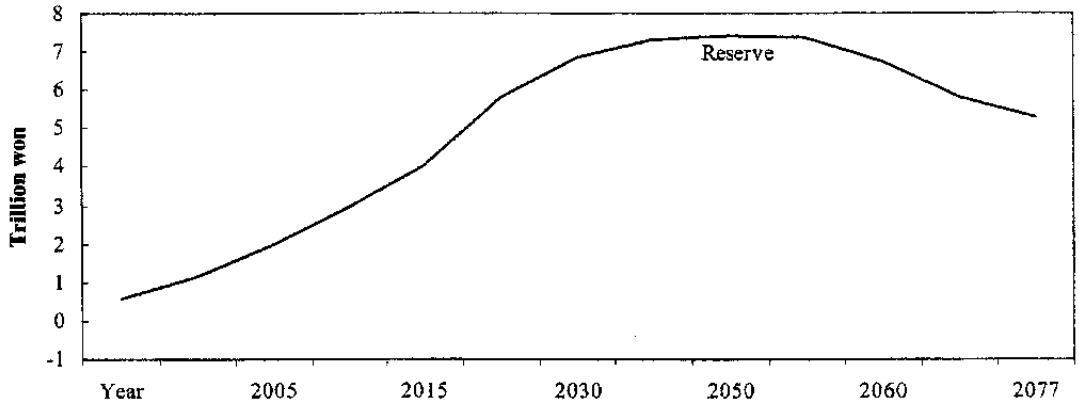
Figure V.3. The NPS Financial Projection
(Increase contribution to 15.24%)



36. **Under option 3, a universal basic pension for everyone over 18 years and older would become the first pillar pension.** The basic pension would be operated as a PAYG scheme with a target replacement ratio of 20 percent. The break-even contribution rate for the basic pension would steadily increase from about 2 percent in 2001 to 8½ percent in 2040, then level off at 10½ percent after 2050.

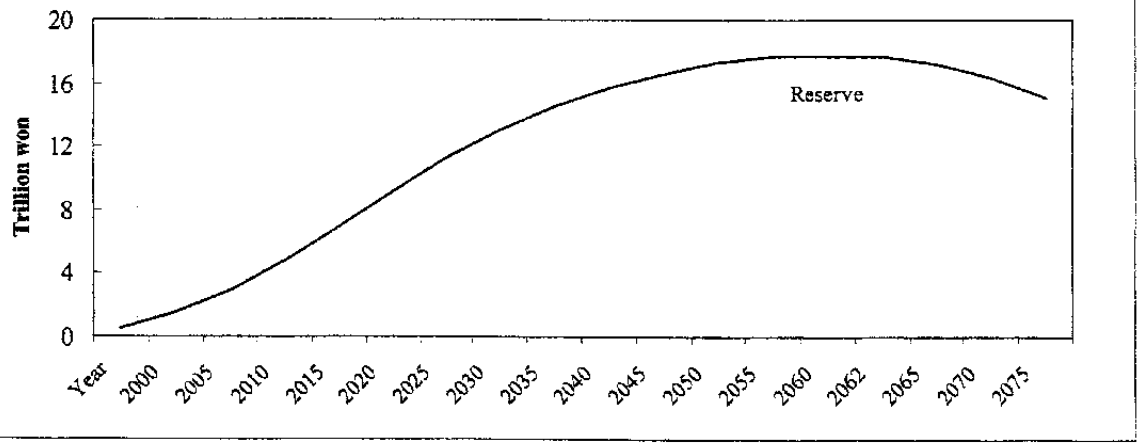
37. **The earnings related portion of the NPS would be converted into a National Pension for employees.** The National Pension would be operated as a fully funded scheme with a contribution rate of 6 percent and a replacement ratio of 20 percent. However, this contribution level may prove insufficient in the long term as a small cash flow deficit will occur after 2075 (see Figure V.4). The public occupational pension again would be split into two parts: the basic pension and the new defined benefit public occupational pension. The new public occupational pension would pay the difference between the original benefit before reform and that of the basic pension. The contribution rate for the public occupational pension would be raised to 21 percent to maintain financial viability. The conversion of the RAS to a corporate pension would be left to the discretion of each individual company while the management of the fund by outside financial institutions would be strongly encouraged with tax incentives.

Figure V.4. The National Pension Scheme Financial Projection
(Decrease contribution to 6%)



38. **Under option 4, the NPS would be transformed into a first pillar basic pension** with a replacement rate of about 35 percent and a strengthened intergeneration redistribution function. The contribution rate would be capped at 10 percent and any additional contribution requirements would be borne by the government. The financial projection shows that financial sustainability in the first pillar would be secured when the contribution rate is gradually increased from current 9 percent to 12.1 percent in 2035 (see Figure V.5).

Figure V.5. The NPS Financial Projection
(Increase contribution rate to 12.12%)



39. **The RAS would be converted to a mandatory corporate pension scheme (second pillar)** with expanded coverage to all firms and temporary workers. The contribution rate would be 8.33 percent, the same as under the current RAS, but could go up to a maximum of 16 percent. The corporate pension would operate as a fully-funded scheme with professional fund management. The public occupational pensions would be split into two parts: basic pension (first pillar) and the earnings related pension that corresponds to corporate pension for employees (second pillar). The earnings related occupational pension would have the same contribution rate of 8.33 percent paid by the government and the same level of replacement rate. As under option 2, the government would license a new corporate pension to provide second pillar pension for the self-employed and farmers who are excluded from the mandatory corporate pension, which will offer similar benefits and enjoy comparable tax concessions. This comprehensive reform involves several detailed steps to create incentives for current employees to switch to the new system, although a tradeoff would arise in terms of fast transition and larger deficit in the government employee pension scheme.

40. **Any of the four options would be an improvement relative to the current system, but they have different policy implications:**

- Although option 1 may receive the most favorable reaction from the public as it maintains the main features of the present framework, it does not offer a fundamental solution to the financial problems and imposes a very high economic burden on future generations.

- Option 2 would be a step forward from option 1 by setting up a multi-pillar pension system with harmonized public and private pension schemes and earnings related pensions. The ambitious target replacement rate, however, could create problems for the financial viability of the scheme.

- Option 3 offers a universal coverage basic pension to everyone over 18 years of age and serves an important function in preventing poverty in elderly poor. The proposed PAYG scheme for the basic pension may, however, be financially unsustainable, and the discretion allowed for converting the RAS to a mandatory corporate pension would essentially leave the RAS at its current unfunded and unregulated status.

- Finally, option 4 appears to be the most comprehensive reform proposal. It aims to set up the multi-pillar system with a basic pension for everyone that is converted from the NPS, and it also offers three earnings related schemes for the second pillar pension. More importantly, with lower target benefit levels and less demand on future generations, it is more financially sustainable. Nevertheless, this option may impose a higher burden on the government due to its capped contribution on the basic pension and the high contribution from the government for the earnings related occupational scheme.

E. Conclusions

41. **The pension system in Korea needs to be reformed.** The system is presently at an early stage of maturity and accumulated pension liabilities are still manageable. This allows room for maneuver and more flexibility to take critical decisions. A delay in implementing needed reforms, however, could place Korea in a much more difficult position.

42. **Successful pension reform requires careful planning, a supportive public, and a cooperative political environment.** It will be important for the government to educate the public about the status of the current pension system and the need for immediate actions. The options outlined by the *Pension Reform Task Force* provides a good basis for a public debate on the key issues and should be helpful in reaching a national consensus. The preferred reform should be the one that delivers the maximum long-term benefit with acceptable short-term transition costs.

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VI. The Profitability of the Banking Sector in Korea[1]

This chapter analyzes the profitability of Korean banks. Low interest margins and high provisioning costs due to low asset quality have resulted in poor performance. Despite an apparent increase in concentration, competition for market share remains fierce. There has been an effort to diversify portfolios and improve margins, and also contributed to improvements in risk management. Further consolidation in the sector through the merger of unsound banks with similar banking franchises is not likely to contribute to profitability unless significant reductions in overhead costs can be achieved.

A. Introduction

1. **The banking sector in Korea has undergone a significant transformation since the financial crisis of 1997-1998.** The changes have been most notable in relative market shares, ownership structure, financing sources, management, and attitudes toward risk. In the aftermath of the crisis the immediate reform efforts focused on an early restoration of the solvency of the financial system, and a correction of the major structural weaknesses revealed by the crisis. The resolution of troubled financial institutions has benefitted from significant improvements in prudential regulations and supervision, and overall governance. The restructuring of Korean banks entailed increased market concentration through closures and mergers, significant capital injections, one of the highest and fastest disposal rates of non-performing loans (NPL) in the region, and reductions in operational costs through retrenchment of branches and employees.[2]

2. **Throughout this transformation, Korean banks, plagued with low profitability even before the crisis, remained relatively poor performers.** In the 1992-96 period, the return on assets (ROA) of Korean commercial banks averaged around 0.4 percent, significantly below the OECD average. The onset of the crisis led to a considerable deterioration in profitability in 1997 (Tables VI.1 and VI.2). Despite the restructuring measures, weaknesses in the corporate sector, especially the unraveling of the Daewoo group in 1999, revealed the persistence of underlying vulnerabilities of the Korean banks that continue to affect their profitability adversely. Three years after the crisis, Korean banks in aggregate were still unable to remunerate their shareholders with a positive return on their equity.

3. **The Korean government launched a second stage restructuring process in June 2000 that focuses, among other things, on improving the profitability of the banking sector.** These reforms include; (i) a further clean-up of bank balance sheets by a realistic

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[1] This chapter was prepared by Meral Karasulu.

[2] The discussion of the restructuring process is beyond the scope of this paper. For a detailed discussion of restructuring measures in Asian economies, including in Korea, see Lindgren et al., 1999, Baliño and Ubide, 1999, and SM/99/285).

application of the forward looking asset classification (FLC) and provisioning rules to work-out companies and other restructured loans, (ii) additional capital injections into banks that are most affected by the recognition of these losses, and most recently (iii) an increased emphasis on encouraging consolidation in the sector through voluntary mergers and acquisitions, and also through the use of recently-allowed financial holding company structures. The government expects the consolidation in the sector to improve profitability through realization of scale economies. In the recapitalization process, the Korean government acquired control of a significant portion of banking sector assets and plans are underway to sell government holdings and recover the public funds injected into banks. The necessary precondition for reasonable recovery rates is a return to profitability by these banks.

Table VI.1. Korea: Bank Profitability: Selected Countries
(as of end-1997, in percent)

	Japan	Korea	OECD	UK	U.S.
NIM	1.8	0.0	2.8	2.6	4.1
ROA	-0.6	-0.9	0.5	0.8	1.2
ROE	-8.6	-14.2	8.1	11.6	12.7
	1992-1996 average, in percent				
ROA	0.04	0.40	0.53	0.95	0.95

Sources: World Bank database on Financial Development and Structure: Beck, Demirguc-Kunt, and Levine (1999): Bank Profitability--OECD financial statement of banks (1999).

Definitions:
Net interest margin (NIM) = Net interest revenue/total assets
ROA = Profit after tax /total assets
ROE = Profit after tax/total capital

TableVI. 2. Korea: Bank Profitability in Asian Countries Before and After the Crisis
(In percent)

	1997				2000			
	ROA	ROE	NIM	Number of banks	ROA	ROE	NIM	Number of banks
Indonesia 1/	1.025	15.45	2.21	222	-0.690	-17.80	1.49	153
Korea 2/	-0.930	-14.18	0.01	27	0.002	0.05	0.01	17
Malaysia 3/	1.000	10.20	2.74	59	-3.130	-23.10	...	4
Philippines 2/	1.700	13.60	2.89	52	0.100	1.90	...	51
Thailand 1/	-0.010	-0.07	0.03	35	-0.015	-0.32	0.01	13

Sources: FSC, various Staff Reports, Selected Issues papers, and Fund staff estimates.
1/ Data for 13 largest banks representing 78 percent of total bank liabilities,annualized for first half 2000.
2/ Commercial banks.
3/ End-1999, the numbers given correspond to the number of listed financial companies used in the calculation of ROA and ROE.

4. A thorough understanding of the underlying reasons behind the low profitability of the Korean banks is of paramount importance to guide the policy choices that are being considered. This paper will attempt to analyze the structure of the banking system in Korea, how its profitability has evolved since 1997, where the weaknesses remain and how they can be addressed. Section B describes the structure of the financial sector in Korea and summarizes its evolution since the 1997 crisis. Section C reviews the capital structure and asset quality of commercial banks. Section D analyzes the determinants of commercial bank profitability with the use of profitability indicators and regression analysis, and discusses the implications of these findings in the light of the restructuring efforts being pursued. Section E outlines two merger case studies to provide evidence of the impact of mergers on the profitability of the banks involved. Section F summarizes and concludes.

B. Evolution of the Financial Sector Since the Crisis

The changing structure of the financial sector

5. **Since 1997, the role of the banking sector in financial intermediation has increased significantly while that of the nonbank financial sector has declined** (Box VI.1). After closures and mergers, the share of the banking sector (including trust accounts) in total financial sector assets has increased from 66 percent at the end-1996 to

BOX VI.1. TYPES OF INSTITUTIONS

The Korean financial system includes three main types of institutions: commercial banks; the specialized and development (S&D) banks; and nonbank financial institutions (NBFIs).

Commercial banks

Commercial banks engage in traditional short-term financing of the corporate and the household sector. Since 1985 all commercial banks were also allowed to operate trust accounts which are maintained separately from their banking business, but managed as one entity. Although trust accounts were operated on client's own accounts, for all practical purposes, they were treated like deposits.[1] With the improvements in the regulatory framework, the management of trust accounts are now separated from the bank's core business. The application of the CAR ratio to all guaranteed trusts eliminated any remaining incentives to offer trust accounts to customers and reduced their role to pure fiduciary services. Commercial banks can engage in very limited securities business and are not allowed to engage in insurance business on their balance sheets, but they are allowed to own securities and insurance companies. Most banks have also leasing and credit card operations.

As of October 2000, the commercial banking system comprised 11 nationwide commercial banks, 6 regional banks, and 44 foreign bank branches. National banks are licensed to establish branches and conduct banking business in Korea, whereas regional banks are restricted to smaller geographic areas in their branch networks and their business is oriented to regional small and medium size enterprises (SMEs). Foreign banks are largely engaged in wholesale banking.

Specialized and development banks

S&D banks were established in the 1950s and 1960s to provide funds to specific strategic sectors. With subsequent changes in the financial environment, however, they were allowed to expand their business into commercial banking areas, but their balance sheets retain a longer term maturity structure. For their funding they rely heavily on the issue of domestic and foreign debentures and borrowing from the government in addition to deposits from the public.

There are four specialized banks and two development banks in Korea and they are partly or wholly owned by the government. Specialized banks include the Industrial Bank of Korea, which finances small and medium enterprises; and three cooperatives that specialize in agricultural, livestock and fisheries loans. The two development banks are the Korea Development Bank that finances key strategic industries and the Export-Import Bank of Korea specializing in financial support to export and import industries, and overseas investment projects.

Nonbank financial institutions

Nonbank financial institutions can be broadly classified into nonbank depository institutions and other specialized institutions. Nonbank depository institutions consist of merchant banking corporations, securities investment trust companies, mutual savings and finance companies, credit co-operatives, and a postal savings bank. Merchant banking corporations can engage in almost all financial business except securities brokerage and insurance business. The securities investment trust companies (ITCs) invest capital raised from retail and institutional investors in stocks, bonds and short term hybrid money market funds. Mutual savings and finance companies specialize in loans for small enterprises and households. Credit institutions such as credit unions, mutual credit facilities, and community credit cooperatives focus on mutual deposit and lending operations between members. Postal savings bank handled by the post offices, is a public financial institution.

The nonbank financial sector also includes a wide variety of nondepository financial institutions and specialized finance companies. These include securities companies, insurance companies, the Korea Securities Finance Corporation, mutual funds, futures companies, money broker companies, investment advisory companies, asset-backed securitization companies, and corporate restructuring companies.

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[1] These accounts were not counted in the calculation of the CAR ratio, but most of them offered a guarantee on the principal and the yield and were covered by the blanket deposit guarantee until end-2000.

71 percent at mid-2000 (Figure VI.1).The decline in the number of small saving institutions and other nonbank depository institutions has been the main driving force behind this change. These systemically insignificant institutions experienced the highest closure rates following the crisis losing more than 9 percent of their market share. The shrinking market share of smaller nonbank financial institutions (NBFI) benefited banks, investment trust and securities companies. Commercial banks experienced the largest gain of market share from this change. Their share in the financial sector increased by 4 percentage points although they experienced a significant decline in their trust business in the face of strengthening competition from investment trust companies (ITC) that specialize in comparable equity and stock investments, and as improved supervision diminished the attractiveness of bank trust accounts.

6. **The collapse of merchant banks has been a major reason for the growing importance of commercial banks in financial intermediation.** Over the past three years, merchant banks have seen a steady erosion of their core lending business, which was exacerbated by the recent collapse of the Daewoo Group. Between 1997 and 2000, total loans of merchant banks fell by 90 percent and total deposits declined by over 80 percent.

7. **Several factors contributed to the decline of the merchant banks.** First, the high share of merchant banks prior to the 1997 crisis was mainly due to artificial incentives, including weak supervision relative to that exerted on banks. The strengthening of the regulatory framework reduced these incentives. Second, after the government allowed banks and securities companies to discount commercial paper (CP), commercial banks rapidly encroached on the merchant banks' core business area. Third, and perhaps most importantly, a sharp increase in nonperforming loans related to the Daewoo Group and other workout companies led to the failure of the larger merchant banks and undermined investor confidence. As a result, merchant banks suffered steep losses following a mandated increase in loan loss reserves; further failures followed. Finally, in advance of the reduction in the coverage of deposit insurance from January 2001, merchant banks and smaller saving institutions suffered from a sharp rise in withdrawals of deposits by customers looking to place their money in commercial banks perceived as more secure institutions.

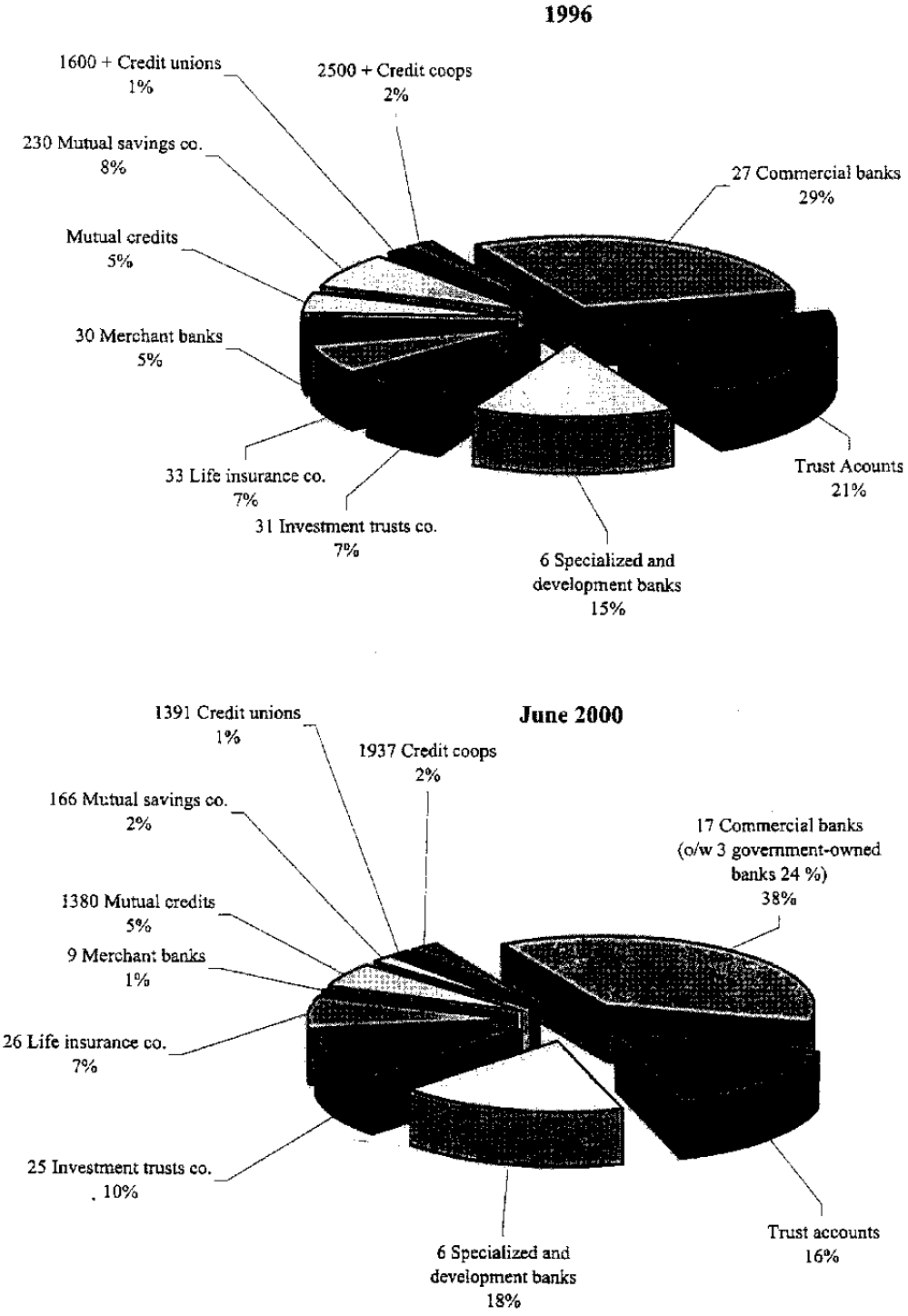
Table VI.3. Korea: Market Share in the Banking Sector
(In percent)

	1996			Jun-00		
	Assets	Deposits	Loans	Assets	Deposits	Loans
Commercial Banks	73.3	70.2	58.6	67.4	73.5	73.0
National Banks	56.7	58.4	45.0	57.2	65.7	63.2
Regional banks	11.3	11.6	8.6	5.2	6.8	5.9
Foreign Bank Branches	5.3	0.2	5.1	4.9	1.0	4.0
Specialized and Development banks	23.5	27.1	26.1	15.2	15.6	22.1
Development Institutions	3.2	2.6	15.3	17.5	10.9	4.9

Source: BOK Monthly Bulletin.

8. **Within the banking sector, nationwide commercial banks gained market share both in the deposit and loan markets.** Since 1997 four regional banks and nine foreign bank branches have been closed. In addition, consolidation in the banking sector and the downturn that affected small and medium sized enterprises disproportionately reduced the customer base for regional banks that specialize in this segment of the market. As a result the national commercial banks increased their market share both in deposit and loan markets (TableVI.3).

Figure VI.1. Korea: Financial Sector Developments, 1996 - June, 2000
(Share of Assets)



Source: Financial Supervisory Commission/Services.

Concentration and ownership in the commercial banking sector[3]

9. **The restructuring process led to a significant consolidation in the Korean banking sector.** At the end of 1997 there were 27 commercial banks in Korea. In the restructuring process, 5 banks have been closed and their businesses transferred, through purchase and assumption (P&A) transactions, to other banks. Two systemically important banks were nationalized soon after the crisis erupted. In four different sets of transactions, a total of 9 banks merged into 4 new banks, so reducing the number of commercial banks to 17 by the end of 1999 (Table VI.4).

Table VI.4. Korea: Total Assets of Commercial Banks

Bank	Amount (In trillion won)	Foreign ownership (Percent)	Government ownership (Percent)
National			
Kookmin	74.6	50.3	16.4
Hanvit	68.6	16.3	74.7
Korea Housing & Commercial	55.4	66.4	14.5
Cho Hung	47.6	0.4	80.1
Shinhan	45.3	43.4	19.2
Korea Exchange	44.2	31.4	32.2
Hana	36.5	26.2	46.2
Korea First	26.3	51.0	49.0
KorAm	24.0	30.7	34.8
Seoul	20.4	...	100.0
Peace	7.9	3.4	38.6
Regional			
Daegu	11.8	1.7	...
Pusan	11.3	9.8	...
Kyongnam	7.9	2.4	...
Kwangju	6.5	1.0	...
Jeonbuk	3.1	0.0	...
Cheju	1.3	6.7	...
Total:	**492.8**		

Source: FSC.

10. **Mergers have been a key factor in the consolidation of the banking sector.** Two of the mergers have involved relatively sound banks and were voluntary transactions. One of these involved two smaller-sized banks, Hana and Boram. The second involved Korea Long-Term Capital (KLTB)—a development bank—and Kookmin Bank, and created the largest bank in Korea. Two mergers were also undertaken to restructure unsound banks that had received conditional approval from the supervisory authority in the aftermath of the crisis. These transactions involved the purchase of NPLs of the merged banks by the government in exchange for equity ownership. The first was between Hanil Bank and Commercial Bank, creating Hanvit Bank, which became the second largest bank in Korea with 95 percent government ownership. The second involved the merger of three small banks with the fourth largest bank in Korea, Chohung Bank, resulting in 90 percent government ownership.

[3] Hereafter commercial banks and banks will be used interchangeably, unless specified otherwise.

11. **Concentration before the crisis was moderate, but increased considerably with the consolidation in the sector** (Table VI.5).[4] The Herfindahl-Hirshman index[5] increased from 0.08 to 0.1, a 25 percent jump, due to the impact of the restructuring process on the number and the size distribution of banks (Figure VI.2). At the end of 1998 there were 10 small banks comprising 13 percent of the banking sector assets. Through mergers and P&As the number of smaller and medium sized banks in the sector has declined in favor of larger sized banks, although the lower end of the market still contains 7 banks accounting for 10 percent of banking sector assets. The merger of Hanil Bank and Commercial Bank, which generated the second largest bank in Korea, diffused the concentration of medium-sized banks in the market, reducing their share from 55 percent with 8 banks to 31 percent with 5 banks. As a result, the share of large size banks in total sector assets increased from 32 percent with 3 banks to 59 percent in 2000 with 5 banks. The C3 and C5 concentration ratios (defined as the share of the three or five largest banks) increased accordingly.

Table VI.5. Korea:Concentration in the Korean Banking Sector 1/

	Dec-97	Dec-98	Jun-00
Number of banks	27	21	17
Number of bank branches per 1000 capita	7.7	9.2	9.8
HH Index in total:			
Assets	--	0.08	0.10
Loans		0.10	0.11
Deposits		0.08	0.10
Share of assets of 3 largest banks	26.7 2/	31.7	40.3
Share of assets of 5 largest banks	--	49.2	59.2
Memorandum item:			
Total Assets (in trillion won)	437.71	443.6	492.8
Total Assets/GDP	96.56	99.8	93.1

Sources: FSC and Fund staff calculations.
1/ Includes only commercial banks.
2/ Source: Beck, Demirguc-Kunt, and Levine (1999).

12. **Despite the increase in size concentration, the market structure in Korea remains very competitive both in the loan and deposit markets.** On the lending side, out of 11 national banks, 6 account for more than 70 percent of corporate lending with very similar market shares. Only two of the largest banks, Kookmin Bank and Housing and Commercial Bank have large market shares in retail and mortgage lending, but this is mostly

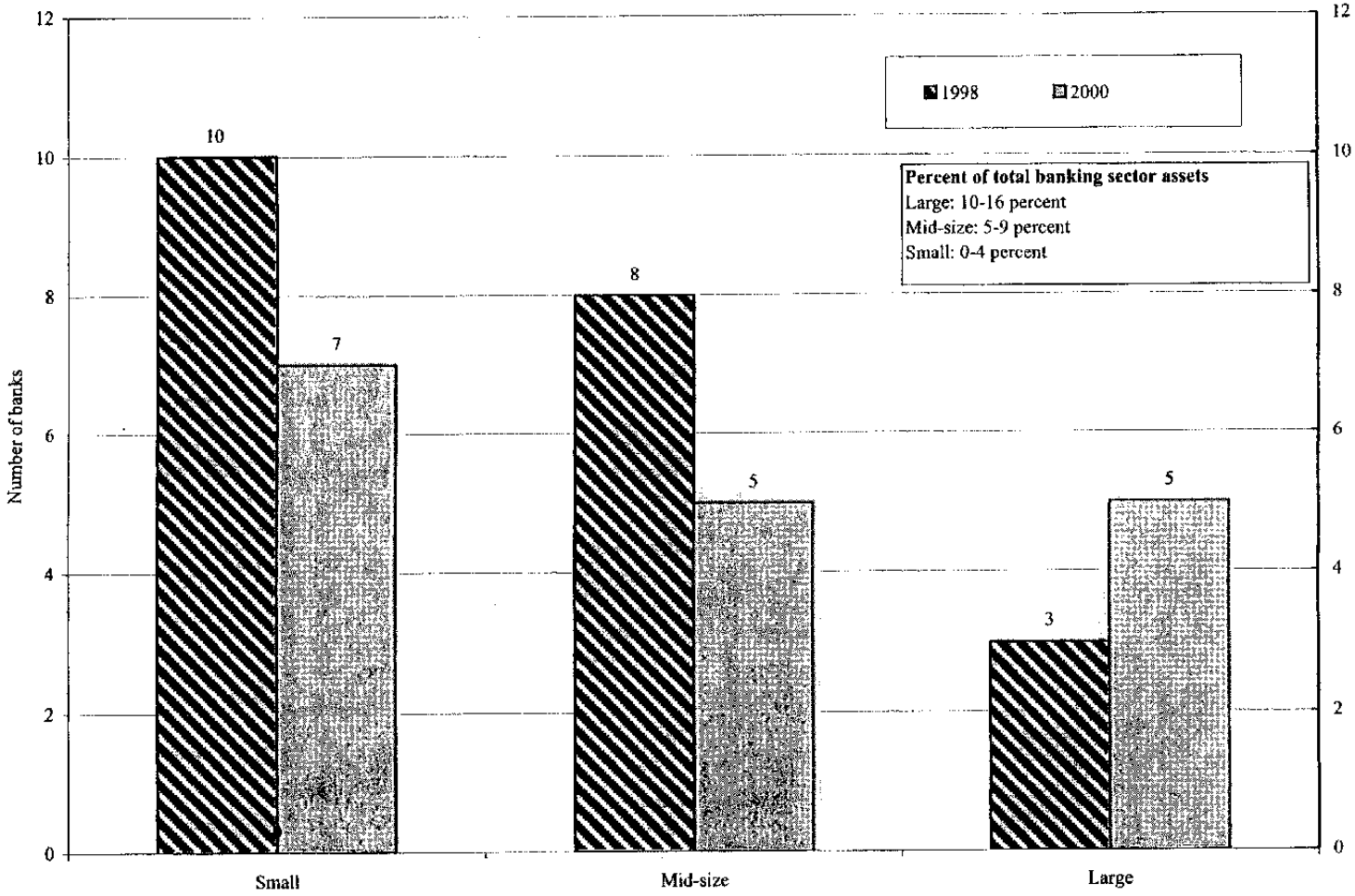
[4] These comparisons need to be interpreted with caution. Theory does not offer clear guidance for an appropriate indicator of market structure, nor for the optimal number and size distribution of banks. See Rhoades (1993) for a discussion of these issues, including the use of concentration ratio and other measures of concentration.

[5] The HH index is a measure of market concentration given by

$$H = \sum_i s_i^2$$

where s_i is the market share of the ith firm. The H-index takes into account both the number of firms in an industry and their size differences. The value of H will equal 1 when there is only a single firm in the industry and will tend towards 1 when there are fewer firms and/or greater degree of dispersion in market shares.

Figure VI.2. Korea: Size Distribution of Banks



Sources: FSC and Fund staff calculations.

due to historic reasons. These banks were established by the government in early 1960s with the purpose of providing credit to individuals and small and medium sized enterprises (SME), and for mortgage finance for low and medium income households. Both banks were privatized only in the mid-1990s and since then they have gradually diversified their portfolio, reducing their leadership in this segment of the market. This, along with the shift in the loan portfolio mix of other banks reduced the specialization in the loan market and has kept the level of competition high. For example, before the crisis the corporate lending market was dominated by six banks; now the ten largest banks are all seeking a broadly based corporate lending business, and most of them are also seeking to increase market share in the retail and consumer sector. On the deposit side, 6 banks account for 68 percent of total deposits but the market share of the three largest is significantly higher than before. Concerns over maintaining market share ahead of further consolidation in the sector have led banks to continue to compete for deposits in the face of declining good quality loan demand, keeping loan-deposit spreads low. In the months preceding the return to partial deposit insurance at the end of 2000, the larger banks saw a more rapid increase in their deposits as depositors shied away from ITCs and smaller NBFIs.

13. **An international comparison suggests that the concentration in Korea is not high relative to other OECD countries.** Although data deficiencies did not enable an up-to-date analysis for the commercial banking sector, the-three-bank concentration ratio for *all* deposit taking institutions in 1997 was low in Korea when compared to the OECD average and to other regional economies. Also, the number of bank branches per 1000 capita does not suggest that Korea is over banked relative to other OECD or Asian economies (Table VI.6).

14. **The restructuring process led to an increase in government ownership of commercial banks.** Before the crisis, the Korean government had equity shares in three banks for historic reasons, accounting for less than 18 percent of total banking sector capital. The recapitalization of commercial banks with public funds, however, resulted in a significant increase in government ownership in the sector. As of mid-2000, the Korean government owned 58 percent of commercial bank capital. Despite this increase, the government has controlling shares in only 3 large corporate lending banks accounting for 24 percent of commercial banking sector assets and 9 percent of total financial sector assets. The second stage restructuring process is likely to increase government ownership in the sector somewhat, as the proposed measures include the recapitalization of three smaller banks that previously did not have significant government ownership.

15. **The restructuring of banks has also entailed an increase in foreign ownership.** Until 1999 individual foreign ownership in commercial banks was limited to 50 percent of equity capital. This restrictions and the heavy government interference in the banking sector, limited foreign ownership in Korean banks to small portfolio investments with no management involvement. In the aftermath of the crisis, banks being restructured were exempted from these restrictions. The sale of 51 percent of Korea First Bank—one of the two banks nationalized early in the crisis—to Newbridge Capital, at the end of 1999, led to the first majority foreign interest in a large Korean bank that comprises 10 percent of banking sector assets. In the restructuring of the Korea Exchange Bank, another bank with historic

Table VI.6. Korea: Concentration in the Banking Sector: Selected Countries
(As of end-1997, in percent)

	Indonesia	Japan	Korea	Malaysia	OECD	Philippines	Thailand	UK	U.S.
DMB assets/total financial assets	--	43.0	44.8	66.3	67.5	82.1	71.2	--	31.7
DBM assets/GDP	56.6	127.9	64.5	101.1	83.6	62.6	108.8	122.3	72.7
Concentration ratio	65.2	24.8	26.7	44.2	62.1	52.1	50.2	52.9	20.0
Number of bank branches per 1,000 capita	--	11.4	10.8	--	55.9	10.1	--	24.1	22.5
Number of DMB 1/	--	13,600	7,900	--	1,266,900	998	--	46,800	917,600

Sources: World Bank database on Financial Development and Structure: Beck, Demirguc-Kunt, and Levine (1999), Bank Profitability--OECD Financial Statement of Banks (1999), and World Economic Outlook.

1/ Includes thrift banks, rural banks, and small saving institutions.

Deposit Money Bank Assets to Total Financial Assets = total claims on nonfinancial sectors by deposit money banks as share of total claims on nonfinancial sectors by central bank, deposit money banks and other financial institutions

Deposit Money Bank Bank Assets to GDP = total claims on nonfinancial sectors by deposit money banks as share of GDP

Concentration = share of the three largest banks' assets as share of total banking assets

public sector ownership, Commerzbank converted its credit exposure to equity, acquiring a 30 percent equity stake, and began to participate in the management of the bank. The International Finance Corporation invested in Hana Bank and in KLTCB before the respective mergers of these banks.

16. **Foreign investment contributed to the recapitalization of relatively more sound banks as well.** In 1999, ING Group and Goldman Sachs acquired 10 percent and 17 percent of Housing and Commercial Bank and Kookmin Bank respectively. Shinhan Bank raised capital in foreign markets through the issue of global depository receipts. Combined with other noncontrolling shares, total foreign ownership at end-1999 stood at 22 percent of outstanding bank shares, representing 30 percent of total banking sector assets. Recently, the Korean government exempted banks from the ownership restrictions, subject to approval by the Financial Supervisory Commission (FSC) on prudential grounds when ownership increases above certain predetermined levels.

C. Financial Structure of Commercial Banks

Capital structure

17. The full implementation of the Basel capital requirements and the recapitalization process, have led to a significant change in the capital structure of commercial banks. The average capital of commercial banks after mergers, closures, and recapitalization was 10.8 percent of risk-weighted assets at mid-2000 (Table VI.7).[6] The recapitalization of banks with public funds was implemented through cash injections, the exchange of government guaranteed bonds for equity, subscription for subordinated debt, and nonperforming asset purchases (Lindgren et al.,1999). Following the initial recapitalization drive by the government, viable commercial banks raised new capital, mostly through issuance of subordinated debt as equity financing proved difficult

Table VI.7. Korea : Microprudential Indicators of Commercial Banks
(In percent)

	1997 Dec.	2000 June
Capital Adequacy		
Average CAR	7.0 1/	10.8
Nationwide commercial banks	6.7	10.7
Regional commercial banks	9.6	11.2
Number of banks below 8 percent CAR	14 1/	5
Share of bank's assets below 8 percent CAR (as a percent total risk-weighted banking sector assets)	61.2	22.2
Leverage ratio (total assets/total equity capital)	33	27
Tier 1 Capital/Total Capital	71	62
Asset Quality		
Credit concentration		
Corporate loans/total loans	63.8	60.3
Household loans/total loans	20	25.9
Loans to public enterprises/total loans	0.9	1.7
Loans to housing/total loans	13.8	11.3
NPL/total loans 2/	5.3	11.6
NPL/total loans 3/	--	7
Provisions/NPL	41	45
Risk-weighted assets/total assets	8.4	6.4
Liquidity		
Total deposits/M2	97.4	99.1
Commercial bank deposits/M2	66.8	79.1
Total loans/total deposits	101.1	76.6
Commercial bank loans/deposits 4/	108.7	68.0
Memorandum items: (in trillions of won)		
Risk weighted assets	35.4	31.7
Total banking sector assets	420.9	492.8

Sources: FSC and Fund staff calculations.

1/ FSC definition.
2/ Old criteria.
3/ FLC criteria.
4/ Loans and discounts in won.

[6] The capital ratio at end-1997 was reported to be 7 percent of risk-weighted-assets, but given the weak accounting standards and supervisory requirements, this overstated the true amount of capital in the banking system.

due to the sluggish profitability of the banks. As a result, the share of Tier 1 capital in total capital, declined from a system-wide 71 percent in 1997 to 62 percent in mid-2000.[7]

18. **Despite the overall improvement in CAR ratios, the extension of FLC to work-out companies and other restructured loans has revealed additional capital deficiencies.** In 2000, three national and two regional banks reported CAR ratios below the mandated 8 percent. These banks represent 22 percent of banking sector assets. Following an evaluation of the self-rescue plans of these banks, the FSC announced that the banks were insolvent and introduced restructuring measures that include further injection of public funds and consolidation of the banks under a holding company, and subsequent operational restructuring.

Balance sheet structure and asset quality

19. **There has been a shift in the asset composition of Korean banks following the crisis and the subsequent changes in prudential regulations.** There is ample evidence in the literature that binding capital requirements affect the portfolio decisions of banks with implications for profitability. The implementation of the Basel capital adequacy requirements and better enforcement of supervisory regulations have been cited as likely triggers for significant shifts in asset composition of banks in the U.S., and elsewhere (Peek and Rosengreen (1995), and Shrieves and Dahl (1995)). In Korea, the recognition of large volumes of nonperforming loans and the consequent deterioration in capital adequacy ratios has been cited as one of the reasons for the decline in bank lending following the crisis (Ferri and Kang (1999), and Choi (2000)).

20. **Faced with capital constraints as a result of large loan losses, banks have shifted their portfolio to less risky assets that carry lower regulatory risk-weighting.** The Basel risk-weighted capital requirements were introduced before the crisis with a deadline for compliance at end-1997. As a result, most of the adjustment in asset compositions to reduce the capital charges had taken place prior to the crisis. Since 1997 there was an additional decline in the average risk-weight of bank assets. There were other significant shifts in the asset composition (Figures VI.3 and VI.4).

- The share of non-earning assets in total assets declined by 12 percentage points to 10 percent since 1998, whereas the share of earning assets increased by a similar amount.

- Within earning assets, the share of securities investment increased by five percentage points to 27 percent between 1998 and 2000. Within the investment portfolio, the share of government securities increased from 20 percent to 34 percent. The recapitalization of banks with public funds, and the acquisition of NPLs by the Korea Asset Management Corporation (KAMCO) contributed to the increase in government securities holdings.

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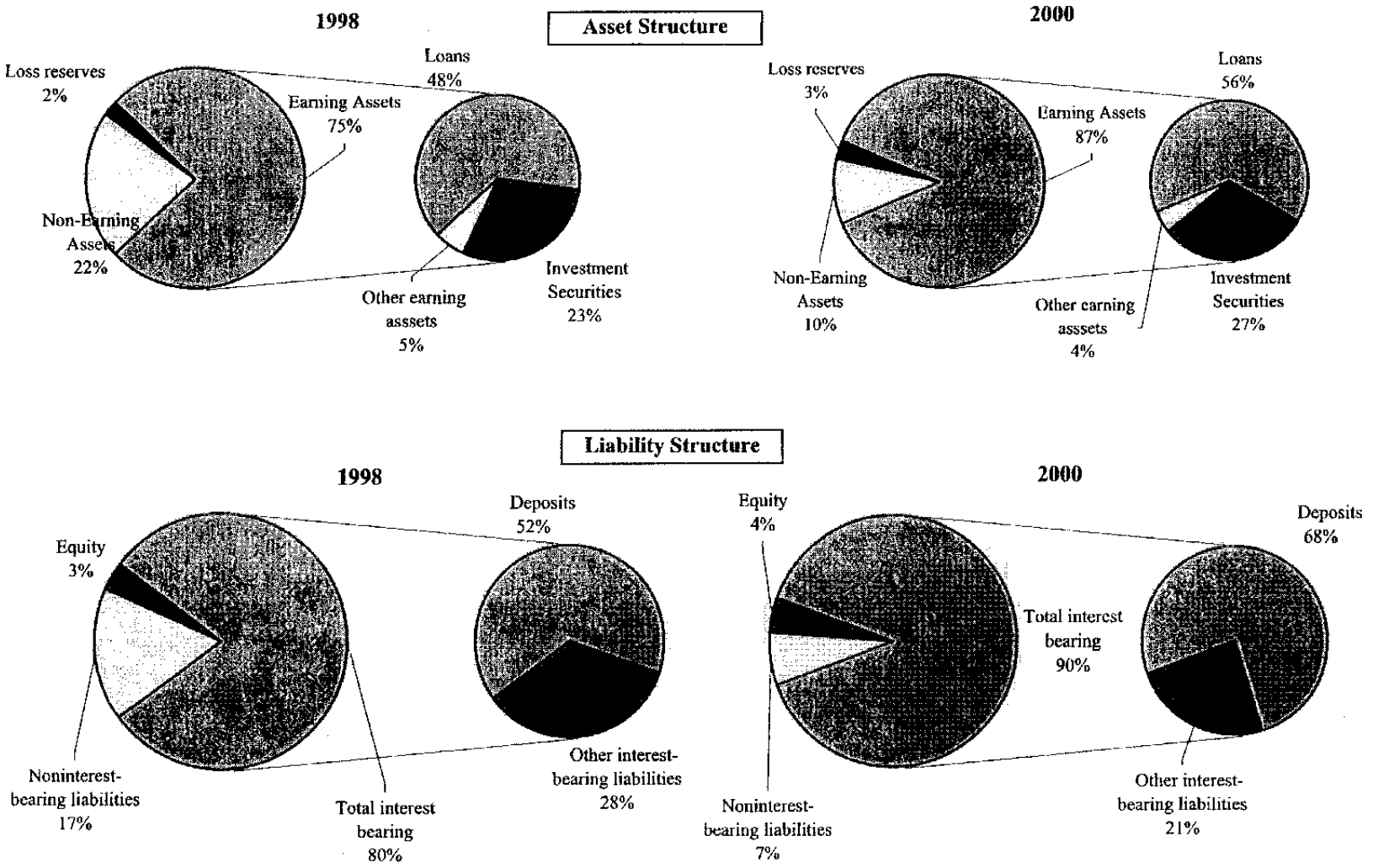
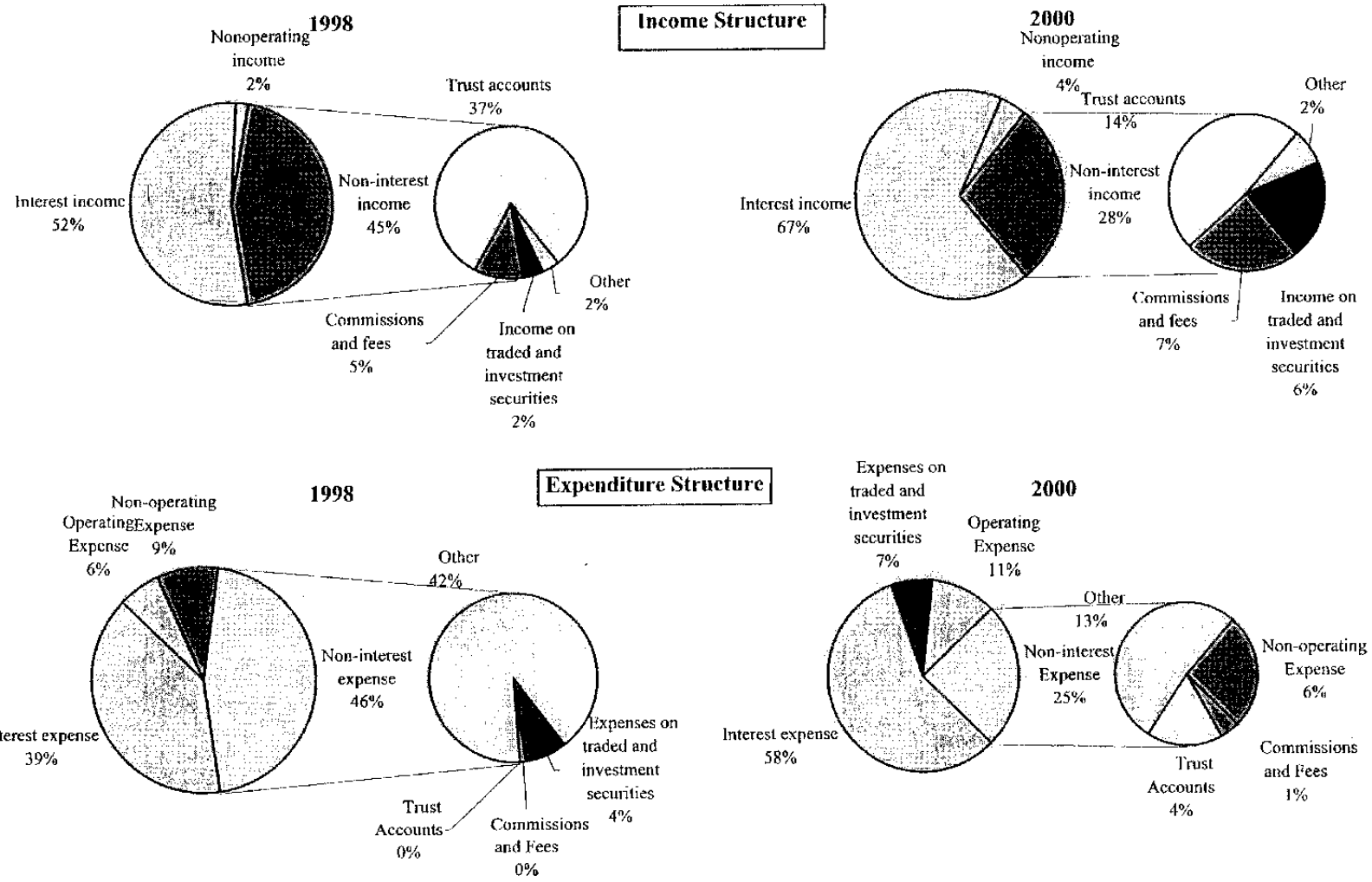
[7] Under the Basel Capital Accord, Tier II capital can not exceed 100 percent of Tier I capital, and subordinated debt is limited to 50 percent of Tier I capital.

Figure VI.3. Korea: Asset and Liability Structures



Sources: FSC and Fund staff calculations.

Figure VI.4. Korea: Income and Expenditure Structure



Sources: FSC and staff calculations.

Although the government guaranteed bonds acquired in these transactions were tradable, banks had ample incentive (in addition to the zero risk weighting for capital adequacy purposes) to hold on to their government securities portfolio as the decline in interest rates brought substantial gains.

- The size and composition of the loan portfolio changed as well. The share of the loan portfolio in total assets increased by eight percentage points to 56 percent and its composition shifted away from foreign currency loans towards won loans. The decline in foreign currency lending was due to the increasing funding costs in the aftermath of the crisis as well as stricter supervision of foreign currency liquidity.

21. **The main funding source of Korean banks, excluding trust accounts, is customer deposits.** This trend has not changed since 1997. The introduction of blanket guarantees at end-1997 helped maintain a stable deposit base in the aftermath of the crisis, while the flow of funds from ITCs and smaller saving institutions to commercial banks following the Daewoo crisis in 1999 increased the attractiveness of bank deposits. The continued fall out in the merchant banking sector and the failure of several small mutual savings and finance companies (MSFC) before the return to a partial deposit insurance at end-2000, exacerbated the flow of deposits into commercial banks. The increase in deposit funding was larger for regional banks who are closer substitutes for traditional MSFC customers, especially outside of Seoul.

Nonperforming loans

22. **The seemingly benign level of pre-crisis nonperforming loans was a reflection of the deficiency in prudential standards on asset quality.** In particular, the classification and provisioning rules were based on the loan's past servicing record, and on collateral availability, including third party guarantees, without much regard to the borrower's future capacity to repay. Also, loans were considered nonperforming only if they were in arrears for six or more months, and the published figures for nonperforming loans included only the "doubtful" and "loss" categories, and not the much larger volume of "sub-standard" loans. In this lax regulatory environment, banks did not develop strong credit risk management systems and under-provisioning was common practice.

23. **To address this deficiency, more stringent procedures for the valuation, classification, and provisioning of impaired assets have been introduced.** In 1998 the definition of a nonperforming loan was changed to include all loans overdue by more than 90 days and all such claims were classified as "sub-standard" or lower. The provisioning rate for "precautionary" assets was increased from 1 percent to 2 percent. The practice of including specific provisions within Tier 2 capital was abolished, except for those in respect of "precautionary" and "normal" assets. As a result, provisioning for nonperforming loans increased in line with the growth of NPLs, and the strengthening of loan classification and provisioning standards.

24. **The backward looking asset classification rules proved less than satisfactory in an underdeveloped lending culture.** The banks lacked credit risk management and credit analysis skills; banks could avoid classifying loans to weak companies by simply expanding lending sufficiently to allow the borrower to service its debt. Lending decisions tended to be centralized in senior management, credit reviews were scarce, limits on banks' risk concentration were loose. The improvements in the loan classification rules did not provide sufficient incentives to change this lending culture. The collapse of Daewoo group in 1999 provided a good example for the shortcomings of the system; prior to the collapse, most Daewoo debt was classified as normal or precautionary and severely under-provisioned.

25. **In order to encourage reform and progress in lending practices the FSC introduced the so-called "forward-looking criteria" (FLC) to classify assets with effect from end-1999.** Under the FLC, which require each bank to develop an individual loan grading system, to assess the capacity of borrowers based on expected cash flows with due regard to other risks, such as industrial, managerial, operational and financial risks. The introduction of the FLC led to a substantial increase in the amount of classified loans; NPLs more than doubled, reaching 12 percent of total loans by end-1999. However, this increase merely reflected the fact that the FLC have led to better identification and valuation of credit risk already on the books of the banks. While the new rules took effect from end-1999, the new approach will require considerable improvement in credit assessment by banks and new skills by examiners. Borrowers will also need to provide much more information, for example about their expected cash flows. Thus the full effect of the new arrangements will take several years to be fully reflected in asset valuations.

26. **In line with the new classification standard, the FSC has modified the definition of nonperforming loans** (NPLs) to include all loans overdue more than three months and "non-accrual" loans.[8] This modified definition is strictly for a comparable presentation of system-wide NPL ratios. According to the FLC, a borrower who is not in arrears or bankruptcy may be classified as substandard by one bank while an identical borrower may receive a different rating from another bank. According to the previous definition, the NPLs were defined as loans classified as substandard, doubtful and estimated loss. Due to this change in definition, the data for 1998 are not comparable to 1999 and 2000 figures. To circumvent this problem the old definition has been used in all tables and regression analyses.

27. **The extension of the FLC in 2000 to restructured loans increased required provisions of banks.** In recognition of the linkages between corporate and financial restructuring, the FSC instructed banks to reclassify their restructured loans, including those to work-out companies, using the FLC so as to reflect not only the weaknesses that gave rise to the need for restructuring, but also doubts that remain about the ability of the borrower to

[8] "Non-accrual" loans include (i) bankrupt loans, (ii) loans to borrowers whose capacity to repay have weakened, and (iii) nonperforming restructured loans.

repay.[9] This is expected to expedite the exit of non-viable companies, lead to faster restructuring of viable companies and greater recognition of the true losses of corporate restructuring to the financial sector. The banks are to book these provisions no later than December 31, 2000.

D. Profitability in the Banking Sector

28. **Despite a return to positive operational profits in 1999, the recognition of high NPLs continue to produce net losses (in aggregate) on a post-provision basis.** Following the large losses at the vortex of the crisis, Korean banks reported profits before provisions in 1999 and the first half of 2000 mainly due to a large decline in operational expenses and other noninterest expenses. Despite this improvement, the net income of Korean banks after taxes and provisions remained negative in 1999 as required provisions doubled following the implementation of the FLC.[10]

29. **Efforts to reduce NPLs, although necessary for an eventual return to profitability, are likely to erode profits in the near term.** Both healthy banks and those still under restructuring are making a significant effort to reduce their NPLs through asset sales to KAMCO and other buyers and by the issuance of asset-backed securities (ABS).[11] Although this would reduce the NPL overhang, the immediate impact on profits is likely to be negative. The sale of NPLs requires the recognition of the market value of the loans and involves the booking of credit losses to the extent that provisions are inadequate. Provisions may also be needed to cover potential losses on loans sold to KAMCO on a "with-recourse basis" (i.e. where banks have an obligation to repurchase loans from KAMCO under certain circumstances). Until now, banks' balance sheets did not always reflect the potential losses that might arise on buying back loans from KAMCO. The extension of the FLC to restructured loans and additional failures in the corporate sector are also likely to contribute to increased loan losses and to require higher provisions. A return to profitability does not appear likely before the full effect of the FLC and corporate restructuring is accounted for the in the books of the banks.

30. **Besides the NPL overhang, the underlying income and expenditure structure and the banking culture have also contributed to poor performance.** Although, the pace of return to profitability after a financial crisis is largely a function of how fast the NPL overhang can be eliminated, other significant determinants of this process include a change in

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[9] Previously, banks had been required to classify restructured loans as precautionary or substandard and provisioned them in the 2-20 percent range.

[10] Although net profits after taxes and provisions in mid-2000 are positive, they do not include all the additional provisions that will be booked at the end of the year due to the extension of the FLC to restructured loans.

[11] As of end-September 2000, KAMCO had purchased loans from the banks with a face value of W 47 trillion at an average discount of 59 percent.

the banking culture to improve the income and expenditure structures of a banking sector that historically focused on growth of assets as opposed to profitability. An analysis of these factors in conjunction with various profitability indicators reveals continuing weaknesses in the profit structure of Korean banks, but also some positive changes that will take time to be reflected in bank profitability.

Profitability indicators

31. **Korean banks recorded negative levels of ROA and ROE since the crisis, although a slight improvement has taken place since 1999.** Decomposition of these profitability measures into their constituent parts reveals the main reasons behind this poor performance (Table VI.8).

32. **The poor profit performance is mainly due to the low interest margins, and the high provisions necessitated by low asset quality.** Although operating revenues of Korean banks almost tripled since 1997, mainly due to a reduction in losses and a significant cut in operating expenses, the drastic increase in provisions reduced net profit margins.

Table VI.8. Korea: Profitability Ratios
(In percent)

Domestic commercial banks	1998	2000
ROE	-93.7	4.2
Net Profit Margin	-269.7	13.1
Asset Utilization ratio 1/	1.2	1.4
Equity Multiplier 2/	29.2	22.5
ROA	-3.2	0.2
+ Net Interest Margin	1.9	1.0
+ Non-interest Margin	-0.7	0.4
+Non-Operating Margin	-1.3	-0.1
-Financial Intermediation expense ratio 3/	3.1	1.2
Of which :		
Operation expense ratio 4/	1.1	0.5
Provisioning ratio 5/	2.0	0.6
NIM on loan and deposit portfolio	7.0	1.8
Earning Base	79.6	92.6
Earning spread	2.4	1.0
Provisions/Net Interest Revenue	105.3	54.7
Overhead/Operating Income	92.3	35.6
Employee Productivity Ratio 6/	5.4	62.0

Sources: FSC and Fund staff calculations.

1/ Operating revenue/ Total Assets
2/Total Assets/ Equity
3/ (Overhead+Provisions+Taxes)/T.Assets
4/Admin. Expenses/T.Assets
5/ Provisions/Total Assets
6/ Net Operating Income/Number of employees

33. **The low net interest margin on the loan portfolio is a reflection of deficiencies in pricing credit risk.** In the past, directed policy lending on the basis of implicit government guarantees biased banks to favor growth of assets over profitability. Lacking incentives to develop risk management systems to price credit risk appropriately, banks favored large corporate loans backed with chaebol guarantees and collateral. The competition for large corporate customers kept ex ante loan yields low. In the aftermath of the crisis, corporate failures led to high non-accrual rates and reduced the effective ex post yield on the loan portfolio of banks that had large exposures to chaebol and other large borrowers.[12]

34. **The net interest margin is also affected by related funding costs.** This is driven by two factors; (i) stickiness in deposit rates due to high competition in deposit markets to retain market share, and (ii) the change in the composition of deposits and the associated pricing structure. Due to financial innovation, the share of demand deposits in bank deposits since 1980s has been on a declining trend for almost all developed countries, including Korea. An additional contribution to the increase in time deposits in Korea has been the declining yield

[12] A decline in interest margins has been documented for other countries following a financial crisis (see Demirgüç-Kunt, et al., (2000)).

differentials with ITC products, especially since funds in ITCs have been marked-to-market. In a period of declining market interest rates, the lagged price setting structure on time deposits has contributed to the low net interest margins since time deposits bear higher rates than demand deposits.

35. **Despite a sharp reduction in operational expenses, financial intermediation expenses remain high mainly due to high provisioning costs.** The reduction in operational expenses has been achieved through rationalization of personnel and branches (Table VI.9). Since 1997, 22 percent of bank branches has been closed and 35 percent of the workforce in the banking sector has been cut, reducing operating expenses by more than one third. Mergers contributed significantly to the decline in operational expenses, but most of the operational savings from these mergers have been realized only in 2000.[13] A commonly used operational efficiency indicator–the ratio of operational costs to operational income—suggests a marked improvement in the efficiency of Korean banks since 1998. The employee productivity indicator seems to have stabilized at a high level as well. Despite these operational savings, the increase in provisioning costs, following the introduction of FLC, has kept financial intermediation expenses high, thus contributing significantly to the negative ROA performance.

Table VI.9. Korea: Number of Branches and Staff, and Operational Expenses

	1997			Jun-00			Percentage change		
	No.of Branches	No.of Staff	Operational Expense (in tr.won)	No.of Branches	No.of Staff	Operational Expense (in tr.won)	No.of Branches	No.of Staff	Operational Expense (in tr.won)
Domestic Commercial Banks	6,177	113,994	6.1	4,784	73,401	0.3	-22.6	-35.6	-95.3
Nationwide Commercial Banks	4,872	94,065	-	4,039	64,759	25	-17.1	-31.2	-
Regional Banks	1,305	19,929	-	745	8,642	22	-42.9	-56.6	-
Top 3 banks	1,010	25,710	-	1,828	31,019	11	81.0	20.6	-

Sources: FSC and Fund staff calculations.

36. **The post-crisis data reveal the painful adjustment process in income and balance sheet structures of banks that is still in progress.** The earning base of Korean banks has increased by more than 16 percent since 1998, while the earning spread declined by 57 percent. This suggests an inefficient intermediation function in borrowing and lending, considering the disproportionate decline in earning spread relative to the base. This appears to be related to a change in both the balance sheet and income structure of banks that led to an inefficient portfolio mix that is skewed towards income sources with lower profit margins.

37. **The decline in trust business has been one of the main driving forces of the change in the income structure of banks.** Until 1998, interest and noninterest income had similar shares in the revenues of the Korean banks. Fees generated by the trust business of

[13] An estimated 20 percent of the decline in bank branches is accounted for by the mergers. The P&A transactions do not appear to have contributed significantly to the decline in branch and personnel numbers as all the closed banks had limited branch networks.

the banks has been the main contributor to the high share of noninterest income in revenues, and more traditional sources of noninterest income such as commission and fees from banking services have been negligible. The assets in trust accounts accounted for 42 percent of the total assets in 1996, but by mid-2000 this ratio had dropped to 32 percent. Consistent with this decline, the share of trust fees in revenue dropped by 23 percentage points to 14 percent. By contrast, the portfolio share of loans increased by eight percentage points to 56 percent over the same period contributing to a 27 percent increase in the share of interest income in revenues. However, the changing structure of income sources is not commensurate with the margins in these operations. Between 1998 and mid-2000 the net interest margin declined significantly, while the noninterest margin more than doubled.

38. **Notwithstanding these weaknesses, profitability indicators have improved somewhat since 1999 mainly due to a pick-up in the noninterest and the nonoperating margins.** Banks have recently extended their efforts to increase their fee based income, including through diversification of their fee-based customer services and also by increasing merchant banking activities following the exit of several merchant banks. As a result, the share of commission and fee income in gross income has recorded a 2 percentage point increase since 1998. Although the full effect of this change is likely to take some time before its impact on the income structure and margins can be felt, it appears that the banks are increasingly appreciating this source of income as an important contributor to their profits. A cause for concern is the relatively high share of securities in the portfolio of banks that increased throughout 1990s and stabilized at 27 percent of their portfolio since the crisis. Although noninterest margins benefited from a positive contribution from securities gains in 1999, the high volatility of this source of income may erode noninterest income in the future.

39. **The restructuring of the financial sector shook the management culture and is changing the business structure of banks with positive implications for future profitability.** The government's recent restructuring measures include the consolidation of unsound government-owned banks under a holding company, which will create larger bank franchises with significant market shares. These measures are providing incentives for private banks to follow suit with voluntary mergers. The expectation of further consolidation in the sector, along with the introduction of FLC, improved supervision and strengthened accounting and disclosure standards, has kept competition strong as banks attempt to retain their market shares. In this environment bank managements are placing an increasing emphasis on rationalizing their income structure to improve profitability.

40. **Most banks now have a formal risk management system in place, although the entrenchment of these techniques into banking operations will take time.** Further, there does not appear to be a significant differentiation in loan pricing yet. However, a visible shift is underway in the composition of the loan portfolio. Recently, the banks seem to have adopted a more retail oriented marketing strategy, increasing the share of loans to households, and to smaller customers. As a result, the share of loans to enterprises declined from 75 percent in 1996 to 60 percent in mid-2000, whereas over the same period loans to households increased from 19.5 percent to 26 percent (Table VI.10). If the relative credit

risks are managed properly, this shift is likely to have a positive effect on profitability as margins in retail banking tend to be higher.

Table VI.10. Korea: Composition of Loan Portfolio
(As percent of total loans)

	1998				2000			
	Domestic Banks	National Banks	Regional Banks	Top 3 Banks	Domestic Banks	National Banks	Regional Banks	Top 3 Banks
Loans and Discounts in won	62.8	56.1	6.7	25.8	71.8	65.3	6.5	34.3
of which:								
Loans to Enterprises	39.9	34.6	5.4	11.9	43.3	38.3	5.0	16.7
Loans to Households	11.5	10.6	1.0	5.1	18.6	17.5	1.1	9.5
Loans to Housing	8.9	8.8	0.1	8.3	8.2	8.1	0.1	7.6
Interbank Loans	1.0	0.8	0.2	0.1	0.5	0.4	0.1	0.1
Other Loans in Won	13.8	13.4	18.3	11.9	15.5	13.6	2.0	5.7
Loans in Foreign Currency	23.3	24.9	8.0	17.7	12.7	12.4	0.2	4.8
Memorandum item								
Total Loans (in tr. won)	232.5	211.3	21.2	85.2	294.9	269.3	25.6	132.1

Sources: FSC and Fund staff calculations.

41. **The substantial cut in branches and staff suggests that room for cost savings through further cuts may have been exhausted.** Any additional contribution of cost cutting measures to net profits in the near term is not likely to be significant. Future improvement in profitability has to come from improved portfolio efficiency, by optimizing both net interest and net noninterest components of the portfolio in line with the yields they offer. Given the increasing share of loans in total assets, the improvement of lending margins will be critical in this respect. The increase in asset utilization ratios, derived from the ratio of operational revenues to assets suggests, a movement in the right direction in improving portfolio management policies in choosing the optimal yield and asset mix; a reflection of the changes discussed above.

Determinants of profitability

42. **This section reports regression estimates for the determinants of profitability for commercial banks in Korea.** The data is based on balance sheet and income statements of 17 commercial banks between 1998 and mid-2000. During this period there were significant changes in the regulatory environment and the financial structure of banks that are still in progress. These changes are likely to have reduced the ability of panel data in such a short span to pin down the underlying determinants of profitability. Due to these deficiencies the results of the regressions reported in this section should be considered as only indicative. Only pooled regression result are reported. As determinants of profitability the following variables were considered.

Equity capital/total assets (EQR):

43. **The regression includes the equity ratio to capture the impact of leveraging on banking activity.** Ceteris paribus, a bank with a higher equity ratio should have a higher return on assets and a lower return on equity, necessitating the use of equity ratio as a conditioning variable.

Ownership (OWN):

44. **To capture differences in managerial efficiency under different ownership structures, the regression includes a dummy for government ownership.** Although foreign ownership has also been cited as a significant determinant of profitability, a foreign ownership dummy has not been included as the data lack sufficient variation in this variable to identify its effect.[14] In Korea, the increase in foreign ownership led to a management change in only one bank, Korea First Bank, which was acquired by a foreign investor, and which has signed a special agreement with government that includes put-back options of NPLs until end-2002. This agreement expedited the removal of NPLs from the balance sheet and might have contributed to an improvement in profitability. Although this is directly related to the sale of the bank, it is not really an indicator of foreign managerial efficiency. This single observation is insufficient to identify the effect of foreign ownership in the sample. Although the two largest banks in Korea have significant foreign participation, these are of a portfolio nature and the banks are operated under Korean management.

Loans/total assets (TLTA) and deposits/total assets (TDTA) :

45. **To capture the impact of portfolio shifts on profitability, TLTA and TDTA have been included in the regression analysis.** Loans are the largest segment of interest earning assets with a direct impact on bank profitability. Assuming perfect competition in loan markets, loan prices will be market determined, leaving the quantity and type of loans as the choice variable for asset management. Deposits represent the largest source of funding for Korean banks with straightforward implications for profitability.

Nonperforming loans (NPLR):

46. **Asset quality has a significant affect on net profit margins and hence profitability.** As loans represent the highest portion of earning assets, the nonperforming loans ratio was included in the analysis as a proxy for asset quality.

Operational efficiency (OPEXBR):

47. **The effect of operational efficiency on profitability is investigated by using operational expenses per branch as one of the independent variables.** Branches and employee wages constitute the largest portion of noninterest expenses for Korean banks.

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[14] Among others, see Beck et al. (1999)

Since 1997, there has been significant retrenchment in branch networks and the number of employees due to mergers and restructuring. These improvements are expected to have made a positive contribution to profitability.

Tax management (TAT):

48. **Although the tax rate on corporate profits is not a choice variable for banks, the differences in tax management may be an important factor affecting profitability.** The ability of the bank management to allocate its portfolio to minimize its taxes can be captured by the ratio of taxes to before-tax profits. This ratio represents the effective tax rate faced by the bank.

Interest rate policy (CALL):

49. It has been proposed in the banking literature that the profitability of banks may be restricted during periods of rising interest rates. This is associated with concerns for the soundness of smaller banks, which are commonly thought to hold a large portion of their portfolios in longer term fixed-rate loans and thus face a considerable interest rate risk. According to this hypothesis, the higher the interest-paying liabilities relative to interest earning assets, the lower will be the net interest margin and hence the return on assets, when interest rates rise. This effect is accentuated if the interest spreads do not adjust following a rise in interest rates. The empirical evidence is mixed. Demirgüç-Kunt and Huizinga (1999) present empirical evidence to the contrary suggesting a positive relationship between interest rates and profitability. Hanweck and Kilcollin (1984) report a positive relationship between interest rates and profitability for small banks, whereas for larger banks no significant effect is reported (Flannery, 1981). Hancock (1985) provides evidence for U.S. banks that interest rate increases tend to increase profits, irrespective of their effect on the spread.

50. **To investigate the validity of this hypothesis in the case of Korea, the overnight call rate is included in the regression analysis.** With the decline of interest rates following the crisis, the loan-deposit spread declined significantly. However, this does not take into account the effect of NPLs which reduce the effective spread on the loan side as the share of non-accrual loans increase as NPLs rise. In addition, the high level of competition in the deposit market led to the sluggish adjustment of deposit rates squeezing margins further. Hence the effect of interest rate decline may not have contributed significantly to profits.

Concentration and Market Share (CON and MS):

51. **High market concentration has been identified as a factor that may affect bank profitability through price setting behavior and above normal profits** (see Molyneaux, 1994, among others). This hypothesis posits a positive relationship between a proxy of market concentration (such as the three bank-concentration ratio) and the performance measure. Proponents of the efficient structure hypothesis, on the other hand, maintain that the observed high profitability in high concentration markets may be a reflection of the more efficient management that led to an increase in the market share. These two hypotheses can be tested by including both the three-bank concentration ratio and the market share of each

bank in the analysis. If the coefficient of the concentration variable is positive and that of the market share variable is insignificant this would suggest that concentration in the sector is a determining factor of profitability.

Regression results

52. **Regression results reveal the following tendencies** (Table VI.11):

- As expected, the share of NPLs, along with government ownership, operational and tax management efficiency, and capital asset ratio are statistically significant determinants of profitability.
- The interest rate does not seem to exert a significant effect on the ROA.
- The increasing concentration in the sector does not appear to have affected profitability.
- After controlling for concentration, a higher market share has a positive effect on profitability, validating the efficient structure hypothesis. This is consistent with the circumstances in the Korean banking sector. First, the increase in concentration has been mainly due to mergers among unsound banks. These are the least profitable banks and they are not best suited to exert market power. Second, despite the increase in concentration, competition in the sector remained high as banks attempted to retain their market share before further consolidation in the sector. In this environment the banks that have managed to increase their market share are likely to be those that have better management practices with positive implications on their profitability. Hence, the increase in concentration did not contribute to profitability of the sector, and the positive relationship between market share and profits is a reflection of the more efficient structure of those banks that were able to increase their market share.

Table VI.11. Korea: Regression Results

Dependent variable ROA -		Estimation by least squares	
Usable observations:	50	Degrees of freedom:	39
Centered R**2 :	0.72		
R Bar **2 :	0.65		
Standard error of dependent variable		0.03	
Standard error of estimate		0.02	
Sum of squared residuals		0.01	
Durbin-Watson statistic		2.26	

Variable	Coefficient	Std. error	T-Stat	Significant
Constant	0.41	0.50	0.82	0.41
NPLR	-0.07	0.03	-1.91	0.06
EQR	0.29	0.15	1.87	0.06
OPEXBR	0.00	0.00	-1.65	0.10
TBTP	-0.08	0.04	-2.24	0.02
CON	-0.85	1.08	-0.79	0.43
MS	0.38	0.13	3.04	0.00
CALL	-0.01	0.01	-1.15	0.25
TLTA	-0.02	0.04	-0.50	0.62
TDTA	0.00	0.04	0.12	0.90
OWN	-0.04	0.01	-2.41	0.02

Source: Fund staff calculations.

E. Can Mergers be a Solution for Low Profitability?

53. **The second stage restructuring measures of the government have encouraged consolidation in the banking sector as a means of improving profitability**. This premise assumes that there are economies of scale in the banking sector that can be realized with mergers that spread the overhead costs and provide better diversification. The literature provides mixed evidence for scale economies in U.S. banks, and the effects of consolidation

on profitability in financial service companies.[15] The regression results above also suggest that concentration in the sector did not have a significant effect on profitability. However, these results may be confounded by the effects of the crisis and the many regulatory changes that took effect over the same period.

54. **Two merger cases are examined to shed light on the possible benefits that may emerge in future consolidations.** In 1998 there were four mergers in Korea, of which two were not voluntary and were engineered by the government to restructure relatively unsound banks. To gain a better understanding of the effect of mergers, this section will focus on the involuntary merger of Commercial Bank and Hanil Bank and the voluntary merger between Hana Bank and Boram Bank.

55. **The validity of several merger motives listed in the literature are discussed in light of the pre- and post-merger performance of the banks.** These motives include the following:[16]

- The acquirers may be motivated by the potential to diversify their funding sources and earnings. Those that rely on purchased funds may be especially interested in banks that have core deposit funding bases. Shareholders may also gain from diversification of the loan portfolio.

- If merged banks share similar franchises and service similar markets, consolidation of these services, especially the branch network, would reduce overhead costs and may improve operating efficiency;

- A third reason may be that acquirers perceive gains from an increased size and market share, and associated economies of scale.

- Finally acquirers may have better management than the target bank and one reason for the merger may simply be to improve the target bank's financial performance.

Hana-Boram merger

56. **In the Hana-Boram merger, the target was the Boram Bank.** In terms of size, Hana and Boram were the two smallest banks among national banks with market shares of 4 and 2 percent of total commercial banking sector assets, respectively. More recently, the enlarged Hana Bank accounted for 7½ percent of banking sector assets.

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[15] See Hughes, et al., (1999), and Berger, et al., (1999).

[16] Among others, see Hunter and Wall (1989).

57. **The balance sheet composition of both banks was very similar** (Table VI.12). On the funding side, both banks relied on core deposits, but Boram Bank had a slightly higher share of purchased funds in its portfolio. The diversification of loan portfolio was similar, as well. Both banks allocated more than 80 percent of their loan book to enterprises and the remainder to household loans (Figure VI.5).

58. **The balance sheet structure of the merged bank suggests that the increase in size was used as a means to increase diversification and market share.** After the merger, Hana Bank expanded its loan portfolio significantly and reduced the share of nonearning assets in its portfolio, gaining market share in the loan market. In the process it reduced its exposure to corporate loans and increased the share of household loans in its portfolio. Compared with the trend in the industry, the loan portfolio shift of Hana Bank was more pronounced. As a result, the bank's share in the household loan market increased by 3 percentage points in 2000 over the combined share of the two banks in 1998 (Table VI.13). The funding sources of the merged bank exhibited an increasing reliance on deposits and a decline in the share of noninterest bearing liabilities. This also led to an increased market share in the deposit market.

Table VI.13. Korea : Evolution of Market Share in Hana-Boram Merger
(As percent of total banking sector)

Market share in:	1998 Hana	1998 Boram	1999 Hana	2000 Hana
Total assets	4.2	2.1	7.2	7.4
Deposits	4.7	1.9	8.0	7.4
Deposits in won	4.0	1.9	7.9	7.4
Negotiable certificates of deposits	18.4	2.9	16.2	15.6
Deposits in foreign currency	4.6	1.7	3.9	3.7
Loans	3.7	2.0	6.3	6.5
Loans and discounts in won	3.5	2.2	6.7	8.0
Loans to enterprises	4.6	2.8	7.8	9.7
Loans to households	2.6	1.8	7.4	7.9
Loans to public sector and others	2.8	1.0	3.5	3.7
Loans for housing	0.1	0.2	0.4	0.6
Interbank loans	4.0	0.0	2.2	16.3

Sources: FSC and Fund staff calculations.

59. **Hana Bank's desire to expand its branch network was achieved with the merger.** The branch network of both banks were the smallest in the industry even when compared with most regional banks (Table VI.14). However, Hana bank was increasing its branch network aggressively in the two years prior to the merger. In this period Hana increased its number of branches by 75 percent and its staff by 28 percent. Both banks' branch size (measured in terms of assets and staff per branch) was similar to the industry average, but Hana Bank had better operational efficiency in its branch network with lower overhead costs despite a larger

Table VI.14. Korea: Evolution of Branch Network and Staff Expenditures in Merger Cases

Bank	1998 No. of branches (1 person, 1 branch)	1998 No. of staff (1 person, 1 branch)	1998 Total assets per branch (100 million Won)	1998 Operational expenses per staff (100 million Won)	mid-2000 No. of branches (1 person, 1 branch)	mid-2000 No. of staff (1 person, 1 branch)	mid-2000 Total assets per branch (100 million Won)	mid-2000 Operational expenses per staff (100 million Won)
Hana Bank	173	2,071	1,086	0.6	281	3,305	1,301	0.4
Boram Bank	106	1,218	898	0.8				
Commercial Bank	446	5,785	798	0.7				
Hanil Bank	421	5,781	929	0.7				
Hanvit Bank					684	10,933	1,003	0.3
Nationwide Commercial Banks	4,164	64,830	962	0.6	4,039	64,759	1,116	0.3
Domestic commercial Banks	5,056	75,677	877	0.6	4,784	73,401	1,030	0.3

Sources: FSC and Fund staff calculations.

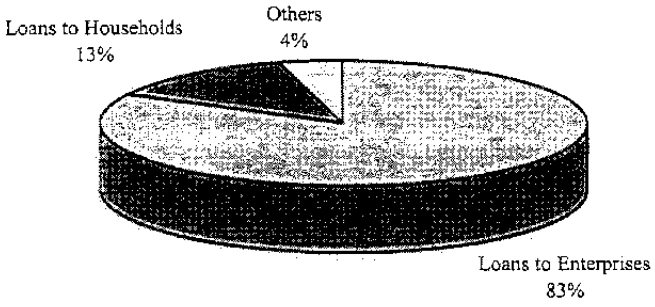
Table VI.12. Korea: Evolution of Asset and Income Structure in Hana-Boram Merger

	1998		2000
	Hana	Boram	Hana
		(In percent)	
Structure of Assets and Liabilities			
Total earning assets	83.3	74.8	94.7
Loans	45.0	47.6	52.3
Of which: Loans and discounts in won	27.5	33.0	42.2
Investment securities	35.2	23.1	38.0
Other earning asssets	3.1	4.1	4.3
	18.0	27.5	7.0
Loss reserves	-1.3	-2.2	-1.6
Total interest-bearing laibilities	77.5	76.6	90.2
Deposits	57.7	46.4	67.4
Of which: Deposits in won	42.9	40.0	62.1
Other interest-bearing liabilities	19.9	30.2	22.8
Non-interest-bearing liabilities	17.9	22.7	4.8
Equity	4.6	0.8	5.0
Memorandum items:			
Total assets (in trillion won)	18.8	9.5	36.5
		(In percent of gross income)	
Structure of Income and Expenditure			
Interest Income	80.9	62.1	82.3
Non-interest income	18.9	37.7	15.6
Of which: Trust accounts	9.7	30.7	3.4
Non-operating income	0.1	0.2	2.1
		(In percent of gross expenditure)	
Interest expense	69.6	41.4	72.5
Non-interest income	21.1	45.1	16.3
Of which: Other	17.4	42.2	7.8
Operating Expense	6.9	4.8	9.0
Non-operating Expense	2.5	8.7	2.2
		(In trillion won)	
Memorandum items:			
Gross income	2.1	1.8	1.7
Gross expenditure	1.9	2.0	1.4
Profit before provision and taxes	0.3	-0.2	0.3
Provisions	0.1	0.2	0.1
Taxes	0.0	0.0	0.0
Net income after provisions and taxes	0.1	-0.4	0.1

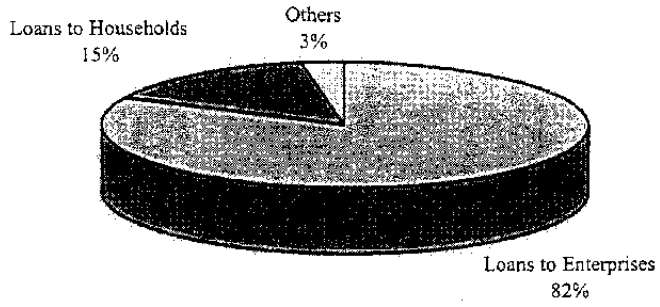
Source: FSC and staff estimates.

Figure VI.5. Korea: Loan Portfolios

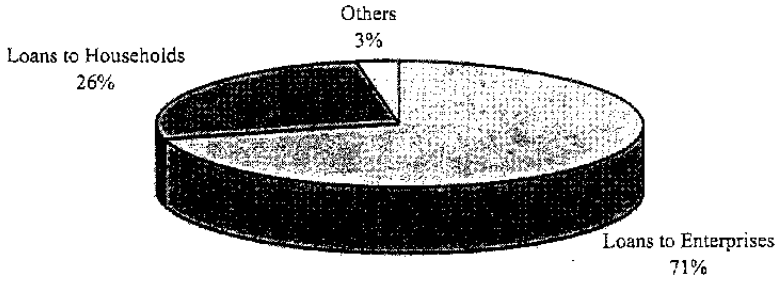
Hana Bank (1998)



Boram Bank (1998)



Hana, after the merger (2000)



Sources: FSC and Fund staff calculations

branch size. After the merger, Hana bank extended its branch network and increased staff relative to the respective combined figures of the two banks in 1998. The average branch size in terms of total assets per branch increased by more than the two combined banks and the industry average. The overhead costs per staff also rose significantly in 1999 but this increase is not significantly above the increase in the combined statements of the two banks and possibly reflects the costs of the merger. In 2000 there was a 45 percent decline in overhead per staff, similar to the trend in the rest of the sector. This substantial cut in expenses did not come from further branch and staff reductions, and possibly reflects the gains from centralization of some operations, such as accounting, information technology, and account processing.

60. **After the merger the bank's profit performance deteriorated but it is still the second most profitable bank in the sector**. Prior to the merger, Hana Bank outperformed most industry peers with positive profits and a high ROE and ROA (TableVI.15). In fact, Hana Bank was the most profitable bank among national banks. By contrast, among the banks that were deemed relatively sound based on their CAR ratios at the end of 1997, Boram Bank had the highest losses in the sector relative to its assets and equity. A formal analysis of scale economies that employs widely used concepts in the literature, such as ray scale and expansion scale economies could not be conducted due to lack of detailed data for the merged banks. However, a simple comparison of the operational expenses relative to net operating income before and after the merger suggests that scale economies were present in this case. This ratio declined by 29 percent in 1999 over the combined ratio of the merged banks in 1998. The relative efficiency of Hana Bank in reducing operational expenses despite the expansion of the branch network seems to be the main reason for this gain. The strikingly different performances of the two banks before the merger, and the relatively high profitability of the bank after the merger, also suggests that the acquiring Hana Bank saw the potential for realizing superior managerial efficiency through a merger with Boram Bank.

Table VI.15. Korea: Evolution of Profitability Indicators in Hana-Boram Merger
(In percent)

	1998		2000
	Hana	Boram	Hana
ROE	12.8	-542.4	5.0
Net profit margin	25.0	-890.9	24.2
Asset utilization ratio	2.4	0.5	1.0
Equity multiplier	21.8	132.0	20.0
ROA	0.6	-4.1	0.2
+ Net interest margin	2.3	2.9	1.0
+ Non-interest margin	0.1	-2.4	0.1
+Non-operating margin	-0.2	-1.8	0.0
-Financial intermediation expense ratio	1.5	2.8	0.8
Of which:			
Operation expense ratio	0.7	1.0	0.4
Provisioning ratio	0.8	1.8	1.3
Earning base	83.3	74.8	94.7
Earning spread	2.1	4.1	0.9
Provisions/net interest revenue	32.7	61.1	34.3
Overhead/operating income	29.0	217.1	34.5
Employee productivity	151.9	-42.2	0.7

Sources: FSC and staff calculations.

Hanil-Commercial merger

61. **The merger of Hanil Bank and Commercial Bank of Korea created Hanvit Bank, the second largest bank in Korea, with 14 percent of banking sector assets.** Before the merger at end-July 1998, both Commercial Bank and Hanil Bank had sizable market shares, comprising 8 and 12 percent of total banking sector assets, respectively (Table VI.16).

Table VI.16. Korea: Evolution of Market Share in Hanil-Commercial Merger
(As percent of total banking sector)

Market share in:	1998 Commercial	1998 Hanil	2000 Hanvit
Total assets	8.0	8.8	13.9
Deposits	7.5	7.6	14.0
Deposits in won	7.7	7.6	14.2
Negotiable certificates of deposits	1.9	2.4	4.1
Deposits in foreign currency	8.2	11.6	16.0
Loans	7.2	8.6	14.8
Loans and discounts in won	6.4	6.4	13.2
Loans to enterprises	7.4	8.2	15.8
Loans to households	6.1	4.8	11.4
Loans to public sector and others	13.7	12.1	27.2
Loans for housing	1.0	0.4	1.9
Interbank loans	6.2	0.0	8.0

Sources: FSC and Fund staff calculations.

62. **The merger did not produce gains in portfolio diversification, nor in market share.** The balance sheet composition of these banks was very similar, as in the case of the Hana-Boram merger. Both banks relied on core deposits in their funding, and half of their loan portfolio was allocated to corporate loans (Table VI.17, Figure VI.6). Hanvit Bank expanded its loans to enterprises and reduced the share of household loans in its portfolio.

63. **The reduction in operational costs appears to be the main gain realized through this merger.** The branch network of both banks were the second and third largest in the industry before the merger, with almost identical number of branches and staff. Their operational costs per staff were similar as well, and were 11 percent above the industry average. After the merger, Hanvit Bank reduced its branch network by 17 percent over the combined branch network of the two banks before the merger. However, the combined staff of the two banks was reduced by only 4 percent in 1999, reflecting operational difficulties in a merger process that take time to be resolved. Hanvit Bank managed to cut operational costs by 52 percent in 2000, as the number of branches and staff were reduced by an additional 5 and 2 percent, respectively. Despite these cuts, Hanvit Bank still has the largest branch network.

64. After the merger the Hanvit Bank recorded some improvement in operating profits, mainly due to the reduction in operating expenses and in noninterest losses. Before the merger, both banks recorded almost identical negative ROA and ROE figures in 1998 (Table VI.18). Like their industry peers,

Table VI.18. Korea: Evolution of Profitability Indicators in Commercial-Hanil Merger
(In percent)

	1998 Commercial	1998 Hanil	2000 Hanvit
ROE	-87.5	-87.3	-3.8
Net profit margin	-5.5	-15.3	-0.1
Asset utilization ratio	0.8	0.3	1.8
Equity multiplier	19.0	19.9	28.0
ROA	-4.6	-4.4	-0.1
+ Net-Interest Margin	1.4	1.6	1.0
+ Non-interest Margin	-0.5	-1.4	0.8
+Non-Operating Margin	-2.7	-1.3	-0.2
-Financial Intermediation expense ratio 1/	2.8	3.3	1.7
Of which:			
Operation expense ratio	1.1	1.1	0.5
Provisioning ratio	1.7	2.3	1.2
Earning base	15.1	18.5	13.0
Earning spread	2.1	2.2	1.0
Provisions/net interest revenue	122.7	137.9	119.4
Overhead/operating income	134.3	367.9	29.1
Employee productivity	-17.8	-52.0	78.6

Sources: FSC and Fund staff calculations.

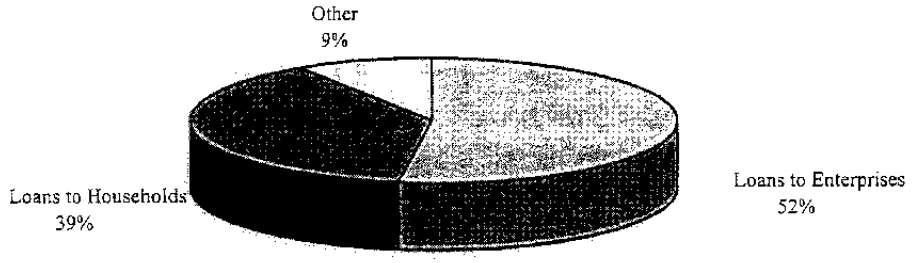
Table VI.17. Korea : Evolution of Asset and Income Structure in Hanil-Commercial Merger

	1998		2000
	Commercial	Hanil	Hanvit
	(As a percentage of total assets)		
Structure of Assets and Liabilities			
Total earning assets	76.0	76.9	93.4
Loans	45.5	49.5	63.6
Of which: Loans and discounts in won	26.2	24.0	40.8
Investment securities	24.8	19.9	24.0
Other earning asssets	5.6	7.4	5.8
Non-earning assets	25.6	25.3	10.4
Loss reserves	-1.6	-2.1	-3.8
Total interest-bearing laibilities	78.8	77.1	90.7
Deposits	48.6	45.0	67.8
Of which: Deposits in won	44.0	39.2	63.6
Other interest-bearing liabilities	30.2	32.0	22.8
Non-interest-bearing liabilities	16.0	17.9	5.7
Equity	5.3	5.0	3.6
Memorandum items			
Total assets (in trillion won)	35.6	39.1	68.6
	(In percent of gross income)		
Structure of Income and Expenditure			
Interest income	53.4	50.5	59.3
Non-interest income	43.3	46.2	36.7
Of which: Trust accounts	35.9	39.1	20.0
Non-operating income	3.2	3.4	4.0
	(In percent of gross expenditure)		
Interest expense	38.6	37.0	52.2
Non-interest expense	39.5	48.1	29.8
Of which: Other	35.0	43.9	13.5
Operating expense	5.7	5.2	9.8
Non-operating expense	16.2	9.7	8.2
		(In trillion won)	
Memorandum items			
Gross income	6.0	7.0	4.3
Gross expenditure	7.0	7.9	3.6
Profit before provision and taxes	-1.0	-0.8	0.7
Provisions	0.6	0.9	0.8
Taxes	0.0	0.0	0.0
Net income after provisions and taxes	-1.6	-1.7	-0.1

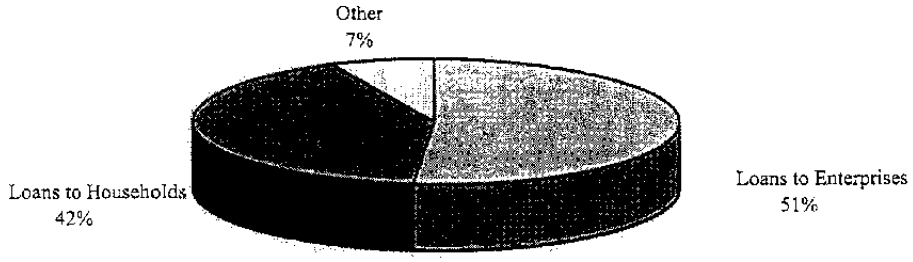
.Sources: FSC and Fund staff calculations.

Figure VI.6. Korea: Loan Portfolios

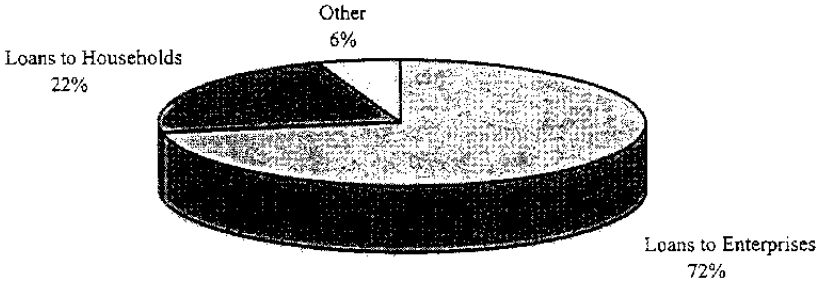
Commercial Bank-Loan Portfolio 1998



Hanil Bank- Loan Portfolio 1998



Hanvit Bank- Loan Portfolio 2000



Sources: FSC and Fund staff calculations.

Hanil and Commercial suffered from low interest margins and high losses on their noninterest and nonoperating business. Following the merger, both profitability measures improved in 1999, as cost cutting measures raised the operating margins. The ratio of operational expenses to net operating income declined by 77 percent. Hanvit also benefited from a significant reduction in nonoperating costs. However, this turn around in nonoperating losses appears to be cosmetic, since the earlier losses in 1998 reflected the write-off of large loan losses before equity injections by the government in the merger process.

65. **The analysis of two merger cases sheds light on the possible benefits that may emerge in future consolidations.** In the Hana-Boram merger, which involved two relatively sound banks, the increase in market share and the associated diversification in the balance sheet appears to have been a key motive for the merger. The merged bank appears to have realized economies of scale by rationalizing its operations rather than its branch network and staff. The second merger case involved two government-owned banks that were under restructuring. These banks had similar asset compositions, branch networks, and similarly low profitability. The merger of these banks appears to have generated a significant reduction in overhead costs, mostly due to the rationalization of branch network and staff. However, profitability of the merged bank remains elusive.

F. Conclusions

66. **The poor performance of Korean banks is mainly due to low interest margins, high losses on noninterest earning accounts, and high provisioning costs.** Past reliance on chaebol guarantees and collateral, did not encourage banks to focus on pricing credit risk appropriately or to develop fee-based services to improve their noninterest income. With the crisis, the ex-post yields on loans declined as the rate of nonperforming loans increased thus squeezing interest margins. The strengthening of loan classification and provisioning standards revealed the deficiencies in asset quality leading to substantial increases in required provisions.

67. **In an environment where the focus is shifting to profitability from asset growth, bank balance sheets in Korea are undergoing a process of rationalization.** Banks are reducing non-earning assets and shifting their loan portfolio away from corporate lending toward household loans. Most banks now have a formal risk management system in place, although the impact of these techniques on profitability will take time to materialize. Despite these changes, interest margins have not yet improved. This is a reflection of deficiencies in pricing credit risk and the high share of nonperforming loans in the portfolio which reduces effective loan yields. Furthermore, heavy competition in the deposit market, and attempts to preserve market share before further consolidation in the sector, has tempered downward pressure on deposit rates and contributed to low interest margins.

68. **A pooled regression analysis confirms the importance of asset quality in explaining the poor performance of Korean banks.** The results also suggest that concentration in the market does not appear to be a determining factor in explaining the change in the return of assets. Increasing market share of banks, however, does explain the

variation of returns across banks. Other significant determinants of bank profitability are operational expenses and tax management efficiency. The level of interest rates does not appear to exert a significant effect on return on assets in the short sample period specified.

69. **The government is placing an increasing emphasis on consolidation in the sector to improve the profitability of Korean banks through realization of economies of scale.** Although this study did not include elaborate techniques to estimate economies of scale in the sector, this policy emphasis may need to be reviewed based on available evidence. First, mergers tend to produce economies of scale when they involve banks that operate in different market niches. However, most commercial banks in Korea compete in the corporate loan market with similar market shares. Hence realization of scale economies through loan and funding diversification appears to be less likely, especially if it involves similar-sized banks. Given the similar branch networks of banks, the largest scale economies can be obtained by rationalization of branch networks and staff of merged banks, and centralization of some functions, such as accounting, information technology and account processing. The merger of two-government owned banks also demonstrates that mergers are not a sufficient condition for improved profitability if the underlying banks are unsound.

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VII. Health of the Corporate Sector in Korea[1]

The corporate sector has made progress in improving its capital structure and profitability since the crisis. Debt ratios have come down and corporate cash flow has improved owing in part to the economic recovery. However, the corporate sector continues to suffer from poor profitability and remains highly leveraged by international standards. The return to profitability has been constrained by the large debt service burden. An analysis of the interest coverage ratio for the top-64 chaebol affiliates in 1999 show that about one in four companies were still unable to generate enough cash flow to meet their interest payments. Further, a sensitivity analysis of the corporate sector to changes in the interest rate and to debt levels indicates that the corporate sector remains vulnerable to a sharp rise in interest rates and that there are still significant gains from further deleveraging and operational restructuring in terms of improving profitability and reducing corporate vulnerability.

A. Introduction

1. **Since the crisis, resolving the problems in the corporate sector has been at the forefront of Korea's reform drive.** The objective has been to address the underlying structural weaknesses that left Korea vulnerable to an external crisis, and to create a more competitive and vibrant corporate sector. Over the past three years, progress has been made in restructuring the corporate sector. Debt-equity ratios have fallen from their excessively high levels; financial disclosure and corporate governance have improved; and the strong economic recovery has helped to improve cash flows and created new financing. However, Korea's corporate sector still remains highly leveraged and continues to suffer from low profitability, indicating that much more restructuring needs to be done.

2. **The purpose of this chapter is to assess the health of the corporate sector since the crisis.** The paper examines various financial indicators to describe the progress made by the corporate sector in improving its capital structure and raising profitability. In addition, the paper uses firm-level financial data for the affiliates of the top-64 *chaebol* to calculate interest coverage ratios—a measure of a firm's capacity to service its debt—as way of providing a more complete picture of corporate health. A sensitivity analysis was also done to assess the vulnerability of the corporate sector to increases in interest rates and to gauge the potential gains from further deleveraging.

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[1] This chapter was prepared by Kenneth H. Kang.

B. Corporate Sector Developments in 1999

Capital structure

3. **Although progress has been made in reducing debt-equity ratios, the corporate sector remains highly leveraged by international standards.** The average debt-to-equity ratio for the nonfinancial corporate sector declined from a high of 425 percent in 1997 to 235 percent in 1999. For the manufacturing sector, whose assets make up over half of the nonfinancial corporate sector, the average debt-to-equity ratio fell from 396 percent in 1997 to 215 percent at end-1999; as of end-June 2000, it stood at 193 percent. Despite the decline, the debt-to-equity ratio in the manufacturing sector still remains high compared to a sample of other advanced countries (Table VII.1 and Chart VII.1). Other financial indicators, such as the ratio of total borrowings and bonds payable to assets and borrowings to sales, indicate that the manufacturing sector is still heavily dependent upon debt financing.

Table VII.1. Korea: Indicators of Financial Stability and Dependence on Borrowed Funds in Manufacturing, 1997-99
(In percent)

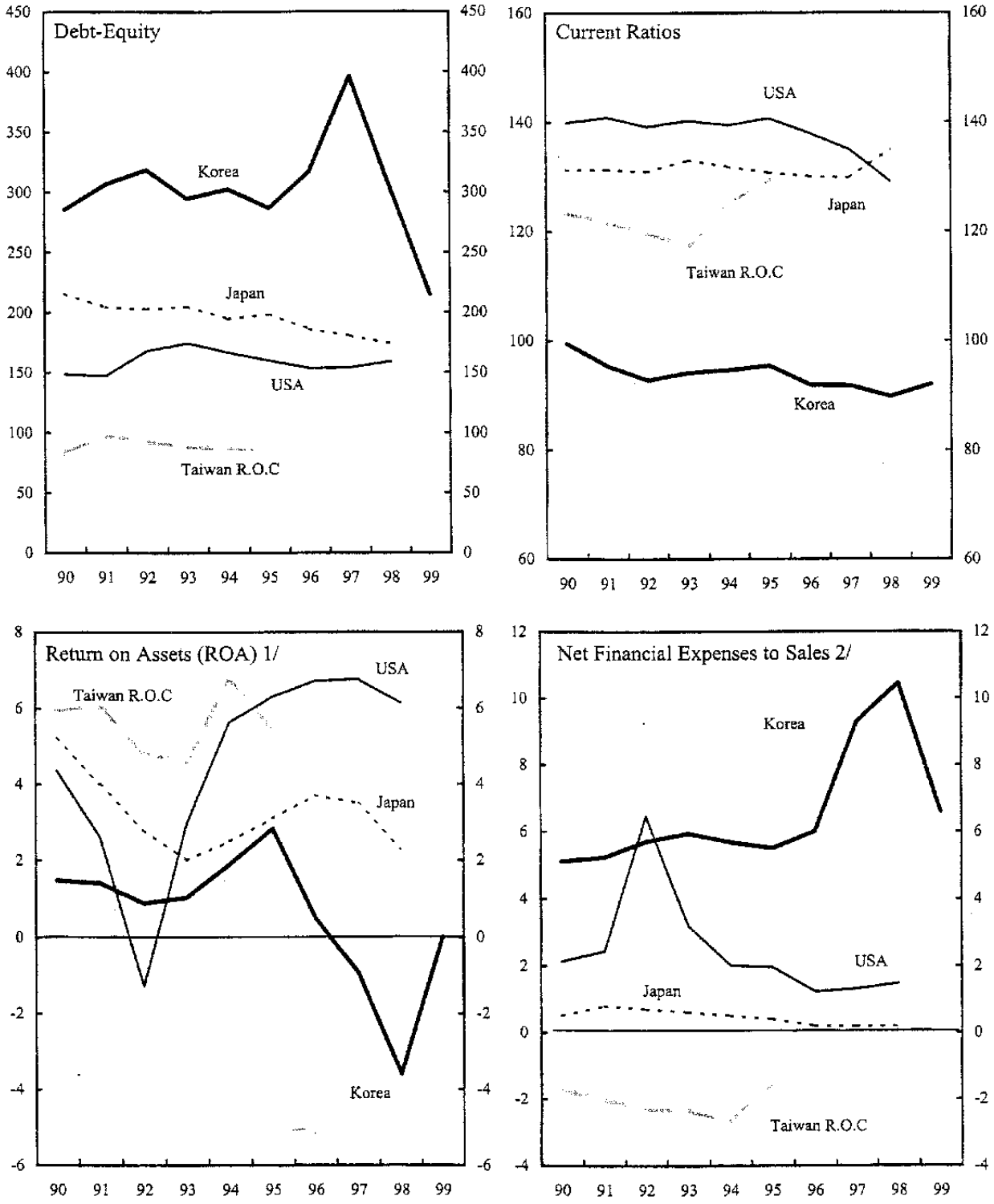
	Korea			U.S.	Japan	Taiwan,	Germany	Hong Kong,	U.K.
	1997	1998	1999	1998	1998	P.O.C., 1995	1996	S.A.R., 1996	1996
Debt-equity ratio	396.3	303.0	214.7	158.9	173.6	85.7	163.0	186.0	111.0
Total borrowings and bonds payable to total assets	54.2	50.8	42.8	26.5	33.7	25.3	...	...	...
Borrowings to sales	66.4	62.7	52.8	26.1	33.5	32.6	...	...	...

Sources: BOK, Financial Statement Analysis for 1999 and national sources.

4. **Debt ratios improved in most sectors in 1999**, except for wholesale and retail trade which experienced a large jump in 1999 on account of losses by a few large enterprises (Table VII.2). Both small and large sized manufacturing firms managed to undertake significant deleveraging since the crisis. Although the construction sector lowered its debt ratio substantially in 1999, it still remains one of the most leveraged sectors. On the other hand, the information technology industry, which traditionally relies more upon equity and venture capital financing, had one of the lowest debt ratios.

5. **The corporate sector has also improved its debt structure since the crisis**. The share of short-term debt in total debt fell from 25½ percent in 1997 to 18½ percent in 1999, and the average interest rate on debt declined to around its pre-crisis level of 10½ percent. However, the current ratio (current assets/current liabilities), a measure of a firm's liquidity, was 94½ percent in 1999, basically unchanged from 1997 and indicating that current assets could not meet current liabilities in the event of a credit cut-off.

Chart VII.1. Korea: Profitability and Liquidity Ratios in Manufacturing, 1990-99



Source: BOK, Financial Statement Analysis for 1999; national sources.

1/ Defined as net income as a percent of total assets.

2/ Includes interest income / expenses and losses and gains from foreign currency transactions and disposals of investments and tangible assets.

Table VII.2. Korea: Debt-Equity Ratios, by Sector, 1997-99
(In percent)

Sector:	1997	1998	1999
Total, nonfinancial	**425**	**336**	**235**
Construction	656	659	406
Manufacturing	396	303	215
Large enterprises	390	295	209
Small- & medium-sized enterprises	418	334	232
Transport, storage & communications	483	324	146
Wholesale & retail trade	613	400	841
Memorandum item:			
Information technology industry	...	...	136

Source: BOK, Financial Statement Analysis for 1999.

Table VII.3. Korea: Trends in the Structure of Corporate Finance, 1997-2000
(Non-financial enterprises; flow data; in trillions of won)

	1997	1998	1999	2000 H1
Indirect financing	43.4	-15.9	2.1	11.7
Deposit money banks	15.2	0.7	15.1	18.6
Nonbanks	28.2	-16.6	-13.0	-6.9
Direct financing	44.1	49.5	26.8	10.0
Stocks	11.6	14.7	41.6	11.2
Bonds	28.0	46.5	1.7	-1.0
CP	4.4	-11.7	-16.5	-0.2
Overseas financing	6.6	-9.8	10.0	13.7
Total:	**94.0**	**23.8**	**38.9**	**35.3**
Memorandum item:				
Financing to nonbanks and through CP	32.6	-28.2	-29.5	-7.1

Source: BOK.

6. **However, much of the improvement was due to issuances of new equity rather than debt reduction.** Total liabilities for the nonfinancial corporate sector fell by only W 6.5 trillion in 1999 to W 725 trillion (137 percent of GDP) while the stock of total equity (book value) increased by W 91 trillion. Taking advantage of the rising stock market, the flow of equity financing jumped from W 15 trillion in 1998 to W 42 trillion in 1999, replacing bond issuances as the primary source of financing (Table VII.3). Bond financing fell sharply in 1999 following the collapse of the Daewoo Group and the difficulties faced by investment trust companies (ITCs) which have traditionally been large buyers of corporate bonds. This pattern continued in the first half of 2000, though equity financing has declined in line with the slumping stock market.

7. **Since 1997, equity issuance and bank borrowing have replaced new bonds as the main source of corporate financing and have been used to retire debt owed to the nonbank sector**, primarily ITCs and merchant banks, through loan repayments and redemption of commercial paper. These repayments amounted to W 58 trillion during 1998-99. Banks, on the other hand, have re-emerged as major lenders to the corporate sector in 1999, and with the slowdown in equity financing were the largest source of financing in the first half of 2000.

Indicators of profitability

8. **Manufacturing profitability has improved over the last three years, owing in part to the economic recovery.** Revenue from sales grew by 8 percent in 1999 up from 0.7 percent in 1998, and the ratio of operating income to sales (i.e. profit margin) increased slightly in 1999, largely due to lower costs associated with bad debts and material purchases and a pickup in revenue (Table VII.4). Ordinary income to sales, which takes into account financial expenses, foreign currency transactions, and disposals of assets, also turned positive for the first time in two years, mainly as a result of lower interest rates and net gains on asset sales. Other indicators, such as return on assets (ROA), also rebounded somewhat in 1999, but still remained low compared to Japan, Taiwan, P.O.C., and the U.S. (Chart VII.1).[2]

9. **However, manufacturing profitability remains weak and is constrained by the large debt service burden.** Table VII.4 shows that operating income to sales compares favorably with a small sample of other countries, but that after accounting for nonoperating income and expenses, Korean corporate performance suffers markedly. The large gap

[2] A report by the LG Economic Research Institute (LGERI), which examined financial data from 164 nonfinancial companies of the top 60 business groups listed on the Korea Stock Exchange, found that profitability and sales continued to improve in the first half of 2000 ("The Validity of Interest Coverage Ratio," LGERI, October 19, 2000).

Table VII.4. Korea: Indicators of Profitability in Manufacturing, 1997-99
(In percent)

	Korea			U.S.	Japan	Taiwan,
	1997	1998	1999	1998	1998	P.O.C., 1995
1. Operating income to sales 1/	8.3	6.1	6.6	7.5	2.5	7.3
plus nonoperating income & expenses to sales	-8.6	-7.9	-4.9	0.6	-0.2	-2.2
2. Ordinary income to sales 2/	-0.3	-1.8	1.7	8.1	2.3	5.1
Memorandum item:						
of which: interest expense to sales	-6.4	-9.0	-6.9	...	-0.9	-2.2

Sources: BOK, Financial Statement Analysis for 1999 and national sources.
1/ Operating income is the difference between the revenue of a business and its related costs and expenses, excluding income derived from sources outside its regular activities.
2/ Ordinary income is operating income after losses or gains from interest expenses/income, foreign currency transactions, and disposals of investments and tangible assets.

Table VII.5. Korea: Profitability Indicators, by Sector, 1999
(In percent)

Sector:	Operating income to sales	Ordinary income to sales	Difference
Total, nonfinancial	**3.9**	**-0.3**	**-4.2**
Construction	2.4	-3.1	-5.5
Manufacturing	6.6	1.7	-4.9
Large enterprises	7.4	1.0	-6.4
Small- & medium-sized enterprises	5.2	2.9	-2.3
Transport, storage & communications	5.4	4.2	-1.2
Wholesale & retail trade	-1.7	-4.9	-3.2
Memorandum item:			
Information technology industry	9.0	7.8	-1.2

Source: BOK, Financial Statement Analysis for 1999.

between operating income and ordinary income to sales in Korea is due mainly to interest expenses which cut heavily into profits. The interest burden on accumulated debt accounts for almost all of nonoperating expenses in Korea and is much higher relative to sales than in Japan, the U.S., and Taiwan, P.O.C.

10. **The nonmanufacturing sectors also showed a similar pattern of heavy interest expenses cutting into stronger earnings.** For example, ordinary income to sales in the construction sector improved slightly in 1999 but remained negative (-3.1) as result of its large interest burden (Table VII.5). The interest burden was also greater for the large enterprises than for the small and medium-sized ones. Not surprisingly, sectors with low debt ratios, such as information technology and transport, storage and communication, recorded higher net profits, helped in part by their low interest expenses.

Results of the 1999 combined financial statements (CFS)

11. **On August 1, 2000, the Financial Supervisory Services (FSS) released for the first time a report on the combined financial statements (CFS) for sixteen large Korean *chaebol* for fiscal year 1999.** The release of the CFS represents an important step in the Korean government's drive to improve financial disclosure and transparency and to bring Korean accounting standards up to the level of international best practices. "Combined" statements apply the principle of consolidated accounting to companies that do not necessarily have any shareholding links but are under common control. This is a common form of organization of Korean *chaebol* where control is exerted through family shareholdings in individual companies rather than through a parent holding company. The CFS nets out the effects of intra-group transactions in presenting one financial statement for each *chaebol* group and treats all its affiliated companies, regardless of voting interest, as one economic entity.

12. **Not surprisingly, the CFS revealed higher debt-to-equity ratios than what had been reported under the consolidated framework.** The average debt-to-equity ratio for the conglomerates, excluding financial institutions, was 225 percent at the end of fiscal year 1999 (Table VII.6). Hyundai, LG, and SK all had debt ratios that exceeded the government mandated threshold of 200 percent. The higher debt ratios for the top-4 *chaebol* reflected both higher reported debt (by $14 billion) and lower equity (by $10 billion). For the remaining *chaebol*, the debt ratios varied from a low of 82 percent for Lotte to a high of 1,789 percent for Ssangyong.

Table VII.6. Korea: Key Financial Indicators under CFS, 1999

	Debt-to-Equity Ratio			Interest Coverage Ratio	Current Assets / Current Liabilities 1/
	end-1998	*end-1999*			
	Original	Original	New CFS	New CFS, end-1999	New CFS, end-1999
	(in percent)				
Hyundai	449.3	181.0	229.7	0.91	0.81
Samsung	275.9	166.3	194.0	3.15	0.96
LG	341.0	184.2	273.2	1.42	0.75
SK	354.9	161.0	227.6	1.47	0.76
Top-4	**352.0**	**173.9**	**225.4**	**1.71**	**0.83**
Total (16)	...	...	**225.5**	**1.42**	**0.81**

Source: FSS.
Note: 1/ "Current" refers to assets which can be converted within one year or liabilties with a maturity of one year.

13. **The CFS also showed that *chaebol* were still suffering from poor operating performance.** Nine of the sixteen *chaebol* reported an interest-coverage ratio (operating income divided by interest expense) of less than one, indicating that operating income was insufficient to cover their interest payments, let alone their principal obligations. Of the top-4, Hyundai was the worst performer with a ratio of 0.91 while Samsung was the best at 3.1. In addition, the average ratio of current assets to current liabilities was 0.81, implying that in the event of a cutoff in credit lines, many *chaebol* would not be able to cover their short-term debts with current assets that can be liquidated within one year. These figures imply that a majority of the 16 companies still remain highly leveraged and vulnerable to a rise in interest rates, a cutoff in bank lending, or a slowdown in the economy.

Interest coverage ratios for top-64 *chaebol*

14. **The focus of corporate restructuring in Korea has been on reducing debt-equity ratios, but this presents an incomplete picture of corporate health.** For example, although the Hyundai group (along with LG, Samsung and SK) managed to reduce its debt-to-equity ratio to below 200 percent by end-1999 (on a consolidated statement basis), several of its affiliates continued to experience financial difficulties.

15. **The interest coverage ratio (ICR) is defined as earnings before interest, tax, depreciation, and amortization (EBITDA) over interest expense** and is a measure of a firm's capacity to cover its interest payments on its outstanding loans.[3] If a firm has an ICR of below 1, it is unable to meet its interest payments, let alone its principal obligations, using its current earnings. In the U.S., the average ICR in 1996 was around 8, and in order to earn an A-rating based upon Standard & Poor's rating requirements, a U.S. company typically must have a ratio of operating cash flow to interest of more than 8.

16. **Despite the improvement in operating performance in 1999, about one in four companies were still unable to generate enough cash flow to meet their interest payments.**[4]

- In 1999, the average ICR for the companies in the sample was 2.3, up from 1.4 in 1998. However, 23 percent of the top-64 chaebol affiliates had an ICR below one,

[3] Other firm-level analyses have used EBIT (earnings before interest and taxes) which excludes depreciation and therefore usually shows a lower value for earnings (and therefore a lower ICR) than does EBITDA. However, EBITDA which includes depreciation, is regarded as a more accurate measure of a firm's cash flow position and short-term ability to finance its loan obligations. EBIT is used more often because of the ease in collecting the data and in drawing comparisons with other countries.

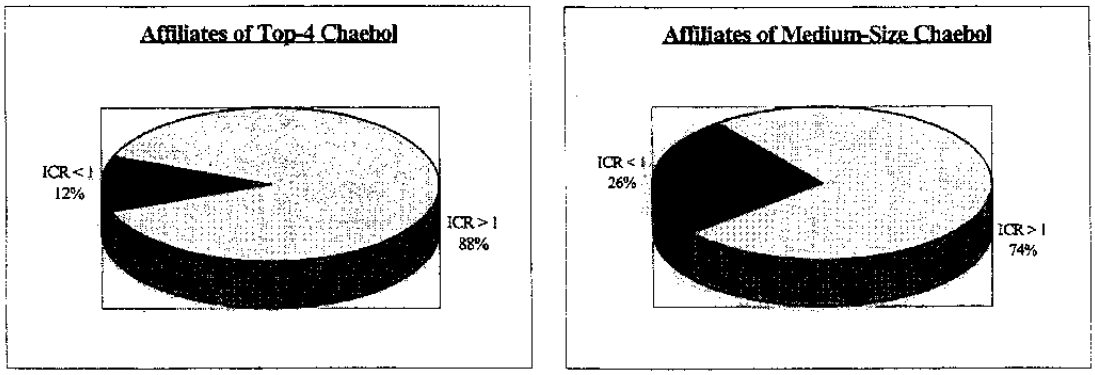
[4] The analysis here uses firm level financial data for 496 companies of the top-64 chaebol groups in 1999 (excluding Daewoo) compiled by IFC using data from the Korea Investor Services.

including 13 percent which recorded negative EBITDA (Table VII.7).[5] This result is consistent with BOK's analysis of 3,703 companies in the manufacturing industry which showed that in 1999, roughly 1 in 4 manufacturers were unable to pay their financial costs with their cash income.[6]

- Further, a more recent BOK study of 1,807 manufacturing companies in the first half of 2000 found that about 27 percent still had an ICR of less than one.

17. **A further examination showed that financial position of the medium-size *chaebol* affiliates was much weaker than for the top-4 affiliates.** The average ICR for the medium-size *chaebol* was 1.6 compared to 2.9 for the top-4 affiliates. The medium-size *chaebol* also had a larger share of companies with an ICR of below one and a larger share of "precautionary" debt (Chart VII.2).

Chart VII.2. Korea: Share of Companies with ICR Below and Equal to 1, 1999 (EBITDA / Interest Expense)



18. **The average interest rate for all affiliates was around 14 percent and did not vary much by size of *chaebol*.** Korean firms issued W 28 trillion of corporate bonds in 1997 and W 46½ trillion in 1998, much of it with a 3-year maturity and at high rates. The average 3 year corporate bond rate has come down substantially from 20 percent in early 1998 to around 8.5–9.0 percent as of end-2000. Consequently, the average interest rate payable on accumulated debt is expected to come down further, as this debt is refinanced or rolled-over at the lower rate.

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[5] Many of the worst performers represented companies in workout programs or in court receivership. Here, distressed debt of companies with an ICR of below 1 (so called "precautionary" debt) made up roughly 20 percent of the total interest-bearing debt.

[6] "Manufacturing Industries: Analysis of Cash Flow during 1999," Bank of Korea, August, 2000.

Table VII.7. Summary of Interest Coverage Ratios for Top-64 Chaebol

In 1999, the average interest coverage ratio (ICR) for the 496 companies (excluding Daewoo affiliates) in the sample was 2.30, with roughly one in four companies with an ICR of below 1. Medium-size chaebol were in a much weaker financial position than the top-4.

	Number of Companies	Share in Total	Interest-Bearing Debt (W trill.)	Share In Total	Interest Coverage Ratio 1/
All (excl. Daewoo)					
Total	**496**	**100%**	**169.1**	**100%**	**2.30**
ICR below 0	64	13%	16.4	10%	-1.13
ICR between 0 and 1	48	10%	17.5	10%	0.58
ICR between 1 and 1.5	44	9%	23.8	14%	1.26
ICR between 1.5 and 2	53	11%	27.6	16%	1.70
ICR above 2	287	58%	83.7	49%	3.95
ICR below 1	112	23%	33.9	20%	-0.29
ICR equal or above 1	384	77%	135.2	80%	2.97
Top-4					
Total	**104**	**100%**	**88.8**	**100%**	**2.88**
ICR below 0	4	4%	4.5	5%	-0.95
ICR between 0 and 1	8	8%	8.5	10%	0.84
ICR between 1 and 1.5	15	14%	14.4	16%	1.27
ICR between 1.5 and 2	11	11%	6.8	8%	1.74
ICR above 2	66	63%	54.5	61%	4.22
ICR below 1	12	12%	13.1	15%	0.09
ICR equal or above 1	92	88%	75.7	85%	3.38
Medium-size (6-64)					
Total	**392**	**100%**	**80.3**	**100%**	**1.64**
ICR below 0	60	15%	11.8	15%	-1.21
ICR between 0 and 1	40	10%	9.0	11%	0.37
ICR between 1 and 1.5	29	7%	9.5	12%	1.24
ICR between 1.5 and 2	42	11%	20.8	26%	1.68
ICR above 2	221	56%	29.2	36%	3.44
ICR below 1	100	26%	20.9	26%	-0.53
ICR equal or above 1	292	74%	59.5	74%	2.45

Source: Data provided by IFC and compiled by Korea Investor Service from 1999 financial statements.

1/ Interest coverage ratio is measured as EBITDA/interest expense.

C. Sensitivity Analysis

19. **A sensitivity analysis reveals that although a modest increase in interest rates would have only a minimal impact, a sharp rise could lead to further corporate distress.**

- For example, a 100 basis point increase in the effective borrowing rate over a one-year period would have raised the number of companies with an ICR of below one by only 6 and lowered slightly the average interest coverage ratio for the sector from 2.30 to 2.14.

- However, a significantly larger increase in interest rates, say by 5 percentage points over a one-year period, would have reduced the interest coverage ratio to 1.69 and raised the number of companies with an ICR of below one by 33.

- A 5 percentage point increase in interest rates would have created an additional W 18½ trillion in "precautionary" debt representing 31 percent of all interest-bearing debt.

20. **A further examination shows that because of their weaker financial position, medium-size *chaebol* are much more vulnerable to a rise in interest rates than the top-4.** For example, a 5 percentage point increase in interest rates would have lowered the ICR for the top-4 from 2.9 to 2.1 compared to 1.6 to 1.2 for medium-size firms. The share of "precautionary" debt would have risen from 15 percent to 27 percent for the top-4 compared 26 percent to 35 percent for the medium-size chaebol (Chart VII.3).

21. **A broader analysis which included also principal payments falling due (i.e. a debt service coverage ratio) would likely show that many more firms would be unable to meet their principal obligations with current income.** W 61 trillion of corporate bonds is expected to mature in 2001, representing some 45 percent of the outstanding amount (Table VII. 8).[7] While some of this is likely to be refinanced and at a lower rate, firms with a poor cash flow position would likely face difficulties in rolling over this debt and remain vulnerable to a cutoff in credit lines.

Table VII.8. Korea: Maturing Corporate Bonds, 1999-01
(in trillions of won; as of end-September 2000)

	1999	2000	2001
Amount	29.3	42.3	61.1
(in percent of total bonds outstanding)	24%	35%	45%

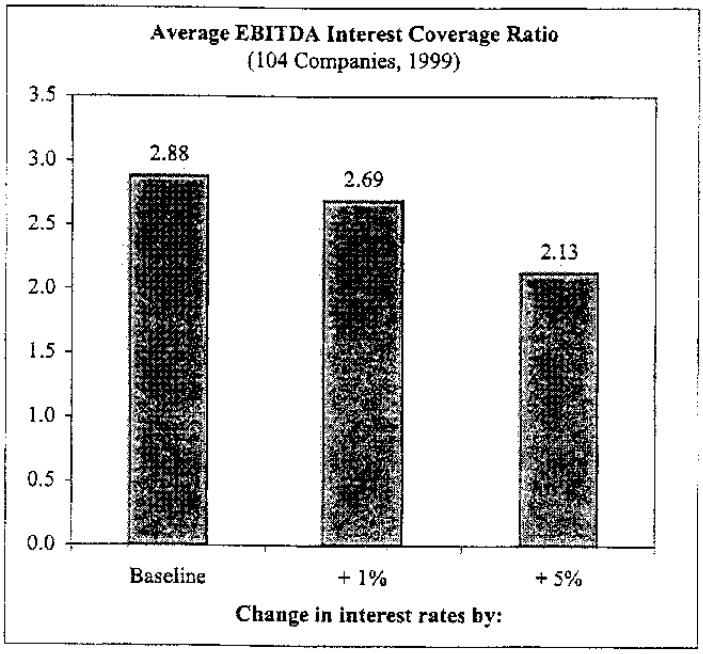
Source: BOK.

[7] As mentioned earlier, much of this was issued shortly after the crisis in early 1998 with a standard 3-year maturity.

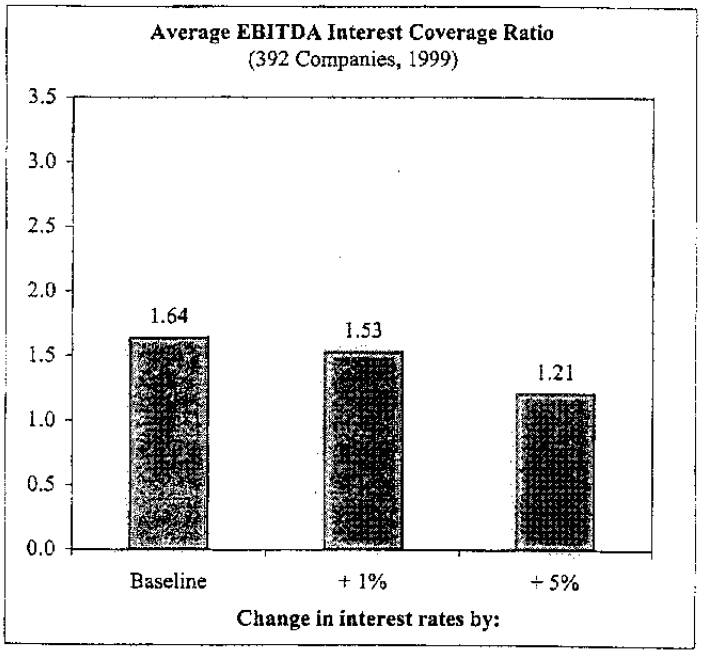
Chart VII.3. Korea: Interest Rate Sensitivity Analysis of Interest Coverage Ratio Top-4 vs. Medium-Size Chaebol Affiliates, 1999

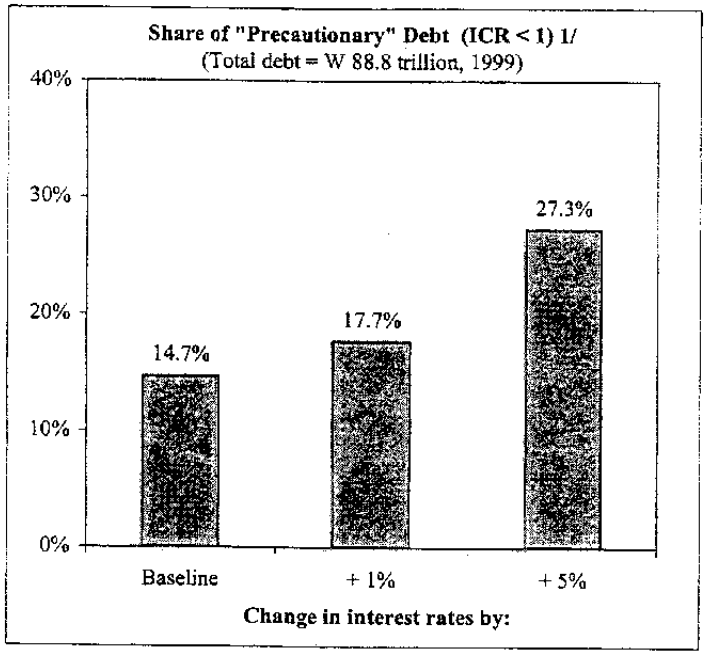
In 1999, medium-size chaebol affiliates started from a weaker financial position and were more vulnerable to a rise in interest rates than the top-4.

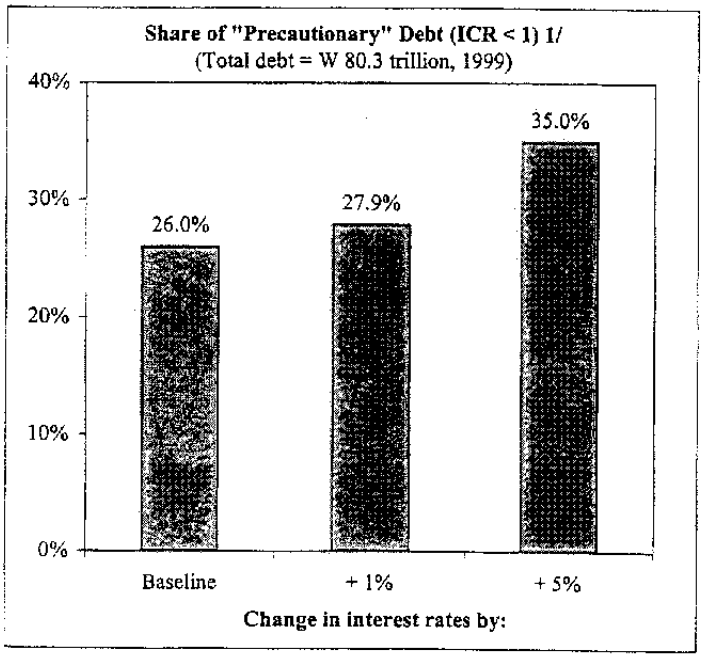
Top-4 *Chaebol*



Medium-Size *Chaebol*







1/ "Precautionary" here is defined as interest bearing debt for companies with an interest coverage ratio of below 1 in 1999.

22. **Further deleveraging and operational restructuring is needed to improve the profitability and cash flow position of Korean corporations.** A second sensitivity analysis shows that further debt reduction would have significantly improved interest coverage ratios and lowered the amount of "precautionary" loans for both the top-4 and medium-size *chaebol*.

- For example, a reduction of interest-bearing debt by 10 percent in 1999 would have raised the average ICR from 2.33 to 2.55 and reduced the amount of "precautionary" debt by W 4½ trillion. The improvement would have been greater for the medium-size *chaebol* than for the top-4 (Chart VII.4).

- A significantly larger reduction of debt, say by 20 percent, in 1999 would have raised the average ICR to 2.87 and reduced the amount of "precautionary" debt by W 14 trillion.[8] In particular, the share of "precautionary" debt for the top-4 would have fallen from 15 percent of the total to around 6½ percent.

D. Conclusion

23. **Despite the progress made so far, the corporate sector still remains highly leveraged and continues to suffer from low profitability.** The average debt-equity ratio remains high by international standards. Although cash flows have improved owing in part to the economic recovery, profitability continues to suffer, mainly due to the large interest payments needed to finance the debt. An analysis of the interest coverage ratios for the top-64 *chaebol* affiliates reveals that about one in four companies were unable to generate enough cash flow to meet their interest payments in 1999. Other studies have confirmed that this trend continued into 2000. A weak corporate sector will continue to be a source of instability and drag on the rest of the economy.

24. **Further deleveraging and operational restructuring is needed to improve the profitability and resilience of the Korean corporate sector to adverse shocks.** Sectors that have managed to reduce significantly their debt-equity ratios have in general shown better operating performance while those that remain saddled with large debts have fared much worse. The large debt burden also leaves the corporate sector vulnerable to financing difficulties and an economic downturn. For example, a sensitivity analysis shows that although a modest increase in interest rates would have only a minimal impact, a sharp rise or a cutoff in credit lines could lead to further corporate distress and raise significantly the amount of nonperforming loans. Because of their weaker financial position, medium-size *chaebol* affiliates in particular remain vulnerable to adverse shocks.

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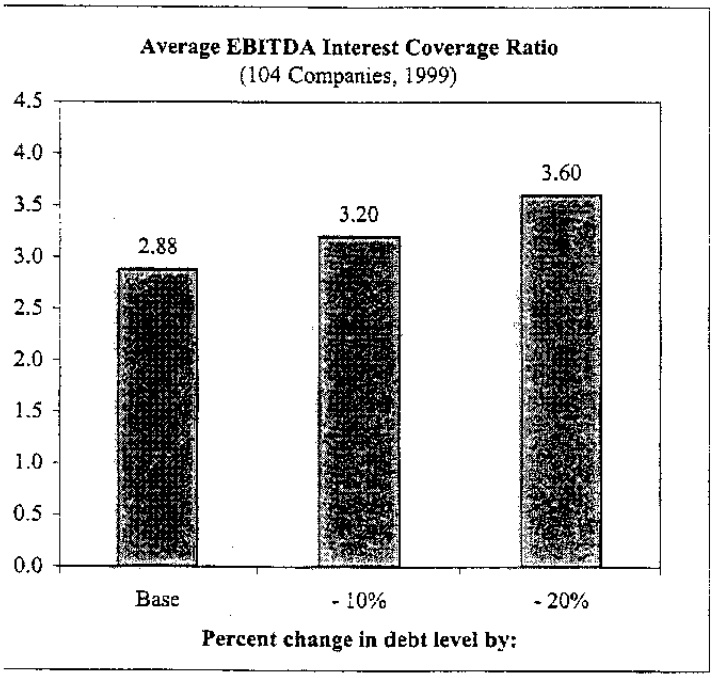
[8] To have a sense of its impact on its leverage ratio, a 10 percent reduction in debt for the top-4 *chaebol* would have lowered their debt-equity ratios in 1999 from 255 percent to 203 percent (according to their combined financial statements). A 20 percent debt reduction would have lowered their debt-equity ratios to 180 percent.

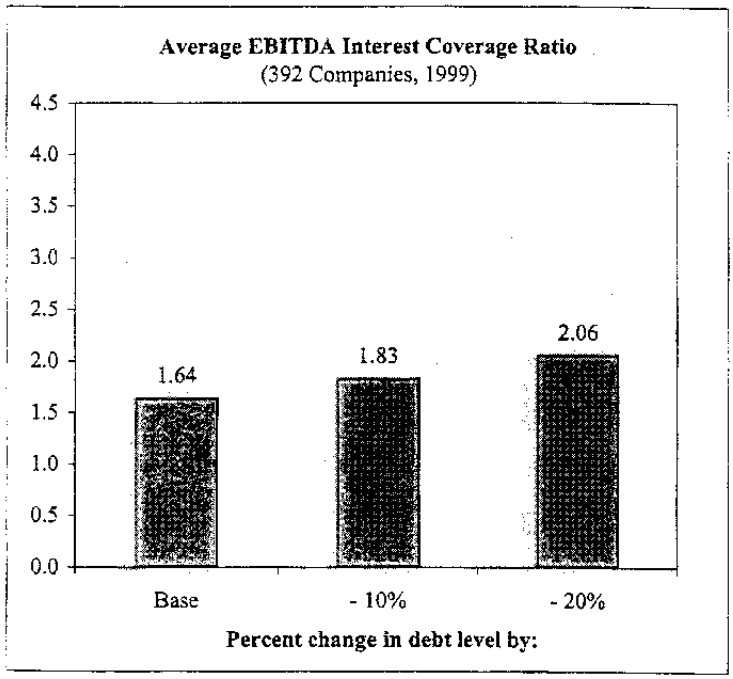
Chart VII.4. Korea: Sensitivity Analysis of Interest Coverage Ratio to Debt Reduction Top-4 vs. Medium-Size Chaebol Affiliates, 1999

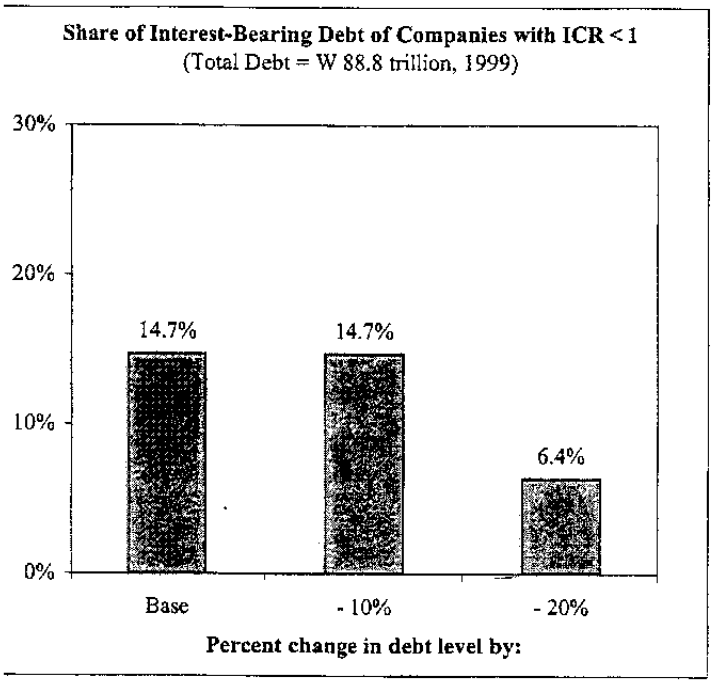
Reducing the overall level of debt in 1999 would have significantly improved the interest coverage ratios and reduced the share of "precautionary" loans for both the top-4 and the medium-size chaebol affiliates. 1/

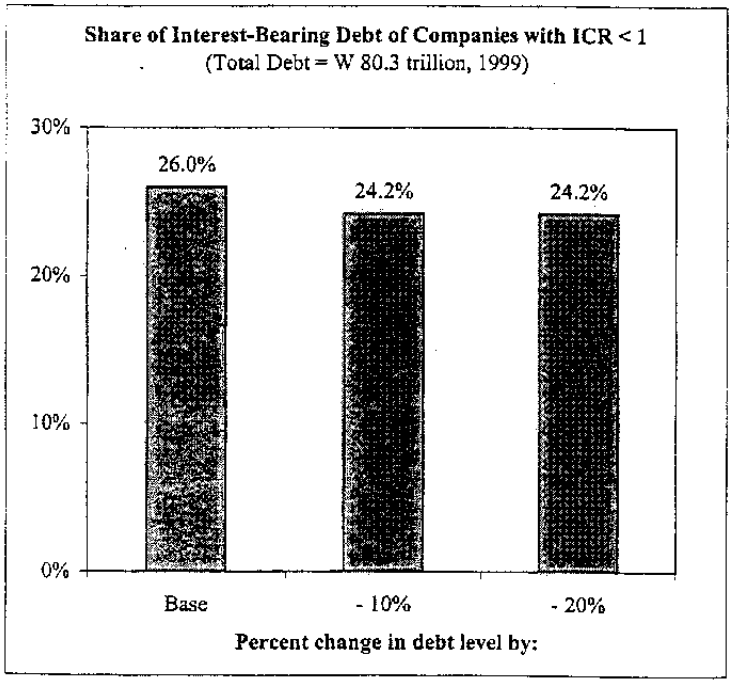
Top-4 *Chaebol*



Medium-Size *Chaebol*







1/ "Precautionary" here is defined as interest bearing debt for companies with an interest coverage ratio of below 1 in 1999.

25. **The analysis could be updated and expanded in several ways.** For example, it would be useful to update the sensitivity analysis using data through end-June 2000, though financial data is released usually with a six month lag. It would also be useful to separate workout (informal and court-supervised) versus non-workout firms in the sample to assess their performance and vulnerability. Finally, it would useful to include information on capital structure (e.g. debt-equity, short-term vs. long-term assets and liabilities, weighted-average cost of capital) and operational performance (return on assets, return on invested capital) to see whether there is a correlation between capital structure and profitability and to examine whether companies with sound fundamentals are still suffering from excessive debt service burdens as a result of their high leverage.

VIII. Foreign Exchange Crises, the Demand for Money, and International Reserves[1]

This chapter presents a summary of recent theoretical work linking money demand to perceptions about the risk that domestic currency may become inconvertible. An empirical investigation of the size of this effect is carried out using monthly data for Korea to estimate an augmented demand for money equation. It is found that the fear of inconvertibility arising from the 1997 currency crisis may have caused broad money demand to fall by 3 ½-4 ½ percentage points, equivalent to the loss of reserves of $5 ½-7 billion (or about 30 percent of reserves as measured at end-November 1997). The results are used to assess Korea's current level of reserves, which appear to be adequate to meet plausible shocks to money demand. The chapter also draws implications for certain external vulnerability indicators.

A. Introduction

1. **The understanding of the nature of foreign exchange crises has deepened significantly following several such episodes affecting emerging markets during the second half of the 1990s.** Countries vulnerable to external shocks are now identified using well established vulnerability indicators, such as a large current account deficit, sustained loss of competitiveness, and low external reserves (measured for example relative to imports, to short-term external debt measured by residual maturity, and to money). Work on Early Warning Systems (EWS) has produced further econometric evidence regarding the usefulness of such indicators in predicting foreign exchange crises.[2]

2. **However, the understanding of the specific channels through which a crisis can propagate remains less complete, weakening the ability to design appropriate preventive policies.** In particular, it is often difficult to judge which set of vulnerability indicators is the most relevant for a particular country, and the work on EWS, although useful, is based much more on statistical correlations than on a well understood theoretical framework. Hence, even *ex post*, it is often difficult to assign a quantitative weight on the importance of various factors in explaining the incidence and severity of a crisis.

3. **This chapter utilizes recent theoretical work to investigate a specific channel of vulnerability, the drop in the demand for money that arises from a fear of a crisis-induced inconvertibility of domestic currency.** After providing a short summary of the theoretical framework, the chapter estimates a conventional money demand equation for Korea, which is modified to include variables that are observable and that are linked to the

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[1] This chapter was prepared by Charalambos Christofides.

[2] Andrew Berg *et al*, *Anticipating Balance of Payments Crises: The Role of Early Warning Systems*, International Monetary Fund, Occasional Paper No. 186, 1999.

probability that domestic currency becomes inconvertible following a crisis. The paper finds that such variables are helpful in explaining money demand, and especially the large drop around the time when the foreign exchange crisis afflicted Korea toward the end of 1997. A counterfactual simulation is conducted to measure the impact of these "crisis" variables on money demand. These results are then contrasted with empirical findings from a different study which used a cross-sectional data based approach. Finally, conclusions are drawn regarding the quantitative importance of inconvertibility in crises, as well as more tentative conclusions on how to design policies to minimize external vulnerability given the findings in this chapter.

B. An Outline of a Theoretical Model of Currency Inconvertibility[3]

4. **The key insight of the new theoretical framework is that demand for (domestic) money will fall as the likelihood that domestic currency becomes inconvertible rises.** In this sense, there is a precautionary element to money demand which is always present, but whose importance rises in line with the risks. A simple optimizing two-period model can deliver this insight using fairly general utility functions and is outlined below:

- It is assumed that there are two regimes, one where domestic currency is convertible and one where it is not. In each period t, there is a probability α_{t+1} that convertibility will be suspended during period t+1.

- There are two conceptually distinct periods in the model: in the "first" period, agents decide how to allocate their financial assets between domestic and foreign currency, and in the "second" period they decide how to allocate their consumption bundle between domestically and foreign produced goods (to be respectively purchased using domestic and foreign currency).

- At time t+1, and if convertibility is available, the consumption allocation decision is only restricted by the usual budget constraint, and can be optimized as usual; if convertibility is suspended, however, consumption of the foreign good is constrained by the availability of foreign exchange as fixed at time t.

- Economic agents are assumed to have conventional utility functions defined over the bundle of domestic and foreign goods, and to maximize next period expected utility over the two regimes.

5. **With this setup, the key equations of the model become:**[4]

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[3] This section summarizes work by Stanley Black (*Convertibility*, Mimeo, December 2000), further elaborated in work by Alex Mourmouras (Mimeo, January 2001).

[4] This version of the model is taken from Mourmouras (*op. cit.*).

$$\frac{h_t}{p_t} + f_t = W; \tag{1}$$

At date t+1, with probability 1-α_{t+1},

$$x_{t+1}^1 \le \frac{h_t(1+i_t)}{p_{t+1}} - b_{t+1} \tag{2}$$

$$y_{t+1}^1 \le f_t + b_{t+1} \tag{3}$$

At date t+1, with probability α_{t+1},

$$x_{t+1}^2 \le \frac{h_t(1+i_t)}{p_{t+1}} \tag{4}$$

$$y_{t+1}^2 \le f_t \tag{5}$$

Here h_t>0 and f_t>0 represent the quantities of domestic and foreign currency, respectively, that the household purchases in the domestic market at t and hoards until period t+1, and x and y denote the home and foreign goods respectively. Also, $\pi_t \equiv \frac{p_{t+1} - p_t}{p_t}$ the home-country's rate of inflation, and $R_t \equiv \frac{1+i_t}{1+\pi_t}$ the gross return of domestic currency, where i_t is the net nominal net rate of interest on domestic currency holdings. The quantity b_t is the net sales (purchases if negative) of foreign currency in period t+1 if convertibility is maintained. Finally, using the budget constraints, the objective function can then be written in terms of the asset demands as follows.

$$(1-\alpha_{t+1})u\left[(W-f_t)R_t - b_{t+1}, f_t + b_{t+1}\right] + \alpha_{t+1}u\left[(W-f_t)R_t, f_t\right] \tag{6}$$

6. **After solving the maximization problem, the key finding is that the optimal demand for foreign currency rises as the probability of inconvertibility rises ($\frac{df}{d\alpha} > 0$).** Since the sum of domestic and foreign currency is constrained by the time t endowment, this finding implies that the optimal demand for domestic currency falls as the probability of inconvertibility rises ($\frac{dh}{d\alpha} < 0$). This insight will be used in the empirical implementation below.

7. **The main focus of this chapter is money demand as the channel through which the fear of inconvertibility influences reserves, although other channels could also be operative.** The other channels—e.g., fears of a devaluation (as opposed to inconvertibility),

banking crises, unsustainable fiscal positions—are not addressed in order to keep the analysis tractable.

C. Demand for Money Allowing for Inconvertibility

8. **The estimation strategy is to extend the usual equation for money demand to encompass variables that are linked to the likelihood of crisis.** The modern approach to the estimation of money demand functions is to use cointegration methods, which take into account the stationarity properties of the variables and which separate out the long-run from the short-run effects. For the purposes of this paper, this strategy has the important additional advantage that the effect of crises is most likely to be quantitatively important over the short-run, since a country (at least, a country like Korea, which has enjoyed relatively good macroeconomic performance over the past 30 years) will generally not be in a crisis or close to a crisis. Hence, the estimation strategy needs to focus separately over the short-run if it is to have any chance to separate out the impact of the crisis on money demand. Equation (7) below focuses on the long-run relationship, as it estimates the link between the *levels* of money demand and the *levels* of the explanatory variables. In this setup, the coefficients give the estimated long-run impact of a change in the explanatory variables on money demand. Equation (8) focuses on the short-run relationship, as it estimates the link between the *changes* of money demand and the *changes* of the explanatory variables. In this setup, the coefficients give the estimated short-run impact. The link between the short-run and the long-run is captured by the inclusion of the "cointegration" variable in the short-run equation, which allows for a feedback between a disequilibrium today on short-run money demand.

9. **The starting point of the empirical investigation is to select the candidate explanatory variables and to subject them to stationarity tests.** The variable to be explained is real money demand, and the potential explanatory variables comprise real output, interest rates and inflation (these variables are standard), plus the exchange rate and reserves (the new variables that are thought to be linked to the probability that domestic currency will become inconvertible).[5] [6] Standard augmented Dickey-Fuller (ADF) tests are

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[5] From the theoretical framework, it is not entirely clear which monetary aggregate would be the appropriate one to use. Clearly, the fear of inconvertibility could in principle spill over to longer-maturity components of money, if they were liquid enough, which would argue for using a broad monetary aggregate. The regressions to be described below were run both on narrow and broad definitions of money. It was found that both definitions were influenced by the "crisis" variables, but that the residuals for narrow money were larger, presumably because that equation was not able to account satisfactorily for shifts between components of money. As these shifts are not the main objective of this chapter, the analysis is focused on broad money (the sum of money and quasi money, as defined in the IFS database).

[6] One important qualification is the interpretation of the exchange rate as an indicator of possible inconvertibility. Of course, another interpretation might be that the exchange rate is capturing return considerations (akin to the interest rate). The theoretical model in Black does

(continued)

performed, confirming that the variables are non-stationary, and that they are integrated of order one (their differences are stationary).[7] Hence, a cointegration framework is the statistically appropriate way to estimate the money demand equation. The Annex at the end of this chapter presents more detail on the variable definitions and on the stationarity tests.

10. **Given the focus of the study on the short-run, a two-step estimation procedure is selected, although the longest possible sample is included in the estimation (monthly data starting in February 1970 and ending in September 2000).** The two-step Engle-Granger estimation procedure is followed here, as it allows us to focus on the short-run, and because of its simplicity.[8] One important complication that needs to be dealt with is the possible endogeneity of exchange rates (they would in general be affected by money demand) and the link of reserves to money through the central bank balance sheet identity (the sum of reserves and net domestic assets equals money). To ameliorate the impact of endogeneity on the estimated coefficients, an instrumental variables estimation technique was used (2SLS), using as instruments for the exchange rate and for reserves lagged exchange rate and lagged reserves.[9]

11. **After some experimentation, the following long-run and short-run specifications were respectively selected**:

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not clearly distinguish these two possibilities. Inconvertibility does have a clear interpretation in a fixed exchange regime framework, where it means that households no longer have access to foreign exchange (at the prevailing fixed rate of exchange). As Korea's exchange rate was allowed to move only within a very narrow band prior to the crisis, the interpretation of the exchange rate as a signal of possible inconvertibility emphasized here seems an appropriate one. It remains an open question, however, how one should think about inconvertibility for the floating exchange rate regime case.

[7] Noting that the fact that inflation is found to be integrated of order one (a result also sometimes found for other countries) implies that the CPI price index is integrated of order two. To keep the estimated equations balanced in terms of the order of integration between the left-hand and the right-hand sides implies that we use inflation in the long-run equation, and the change in inflation in the short run equation.

[8] Subsequent research could investigate more sophisticated estimation methods, such as the Johansen methodology.

[9] Of course, this solution also has costs, mainly that one uses proxies that by necessity are not as informative as the actual variables themselves. To see how significant this loss of information is, the regressions were run both with and without the use of instruments. It was found that the regression coefficients for the exchange rate and reserve variables were fairly close between the two sets of regressions, and that the main results from the counterfactual simulation were not significantly affected.

$$\log(\frac{h_t}{p_t}) = 7.17 + 0.85\log(y_t) - 0.01i_t + 0.01\pi_t + 0.08\log(e_t) + 0.11\frac{R_t}{M_t} + u_t \qquad (7)$$

$$\Delta\log(\frac{h_t}{p_t}) = 0.02 + seasonals - 0.015u_{t-1} + 0.1\Delta\log(\frac{h_{t-1}}{p_{t-1}}) + 0.09\Delta\log(y_t) - 0.0004\Delta i_t - 0.004\Delta\pi_t - 0.09\Delta\log(e_t) + 0.01\Delta(\frac{R_t}{M_t}) + v_t \qquad (8)$$

where in addition to symbols already defined, y_t denotes real output, i_t the interest rate, e_t the (average period) exchange rate in won per dollar, $\frac{R_t}{M_t}$ reserves divided by imports, u_t the estimated residuals from the long-run equation, Δ the difference operator, and *seasonals* a set of monthly seasonal dummies (not shown here to conserve space). In terms of statistical significance, all variables except inflation are found to be statistically significant at the 5 percent level in the long-run equation, and all variables except interest rates are found to be statistically significant at the 5 percent level in the short-run equation.[10]

12. **The estimated equations perform reasonably well when examined against standard benchmarks, which is striking considering that no allowance was made for possible breaks in the relationship and that different components of money are not modeled separately.**[11] The long-run equation has an $\overline{R^2}$ close to 0.99, and the short-run equation has an $\overline{R^2}$ 0.42, with a D.W. statistic of 2.05. Perhaps more impressive is the ability of the estimated equation to produce forecasts of real money that track actual real money even during December 1997, the month when the crisis hit in earnest (Figure VIII.1). Finally, the "cointegration" residual u_t is found using the ADF test to be stationary, which further validates the use of the cointegration framework.[12]

13. The estimated coefficients generally seem in accord with the hypothesized framework, including for the new theoretical framework that incorporates the effect of

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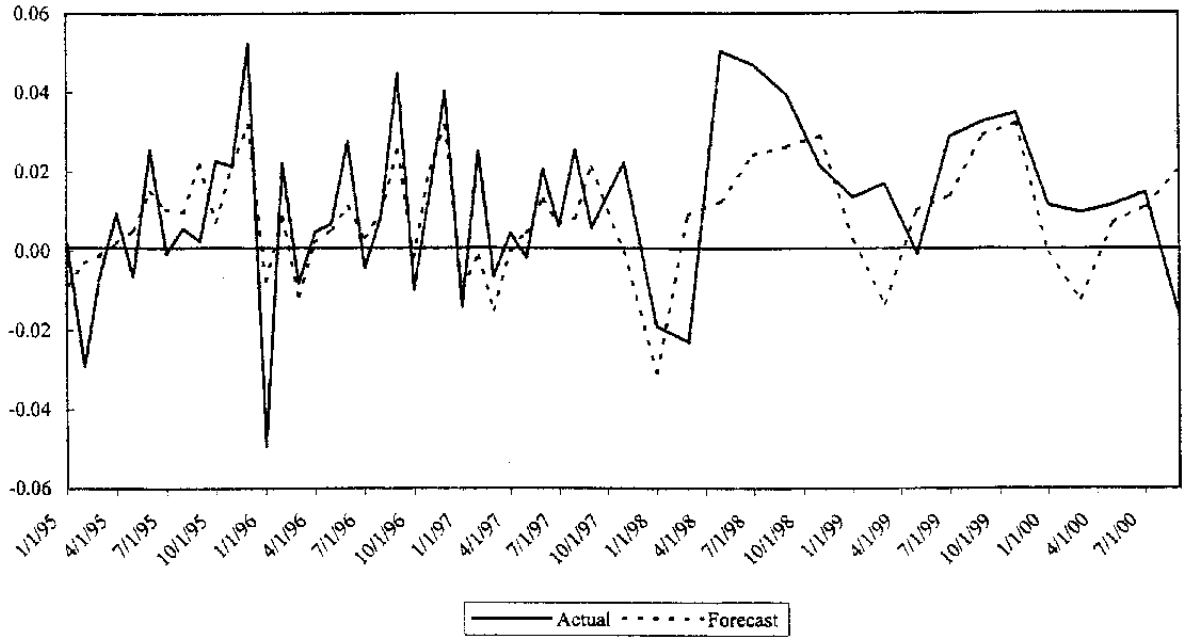
[10] The residual u_t is significant at just below the 5 percent level, with a t-statistic of –1.89.

[11] E.g., the macroeconomic model used by the Bank of Korea has several different equations separately explaining various disaggregated components of broad money (Yang Woo Kim *et al*, *A Macroeconometric Model of the Korean Economy*, The BOK Economic Research Institute, January 1998).

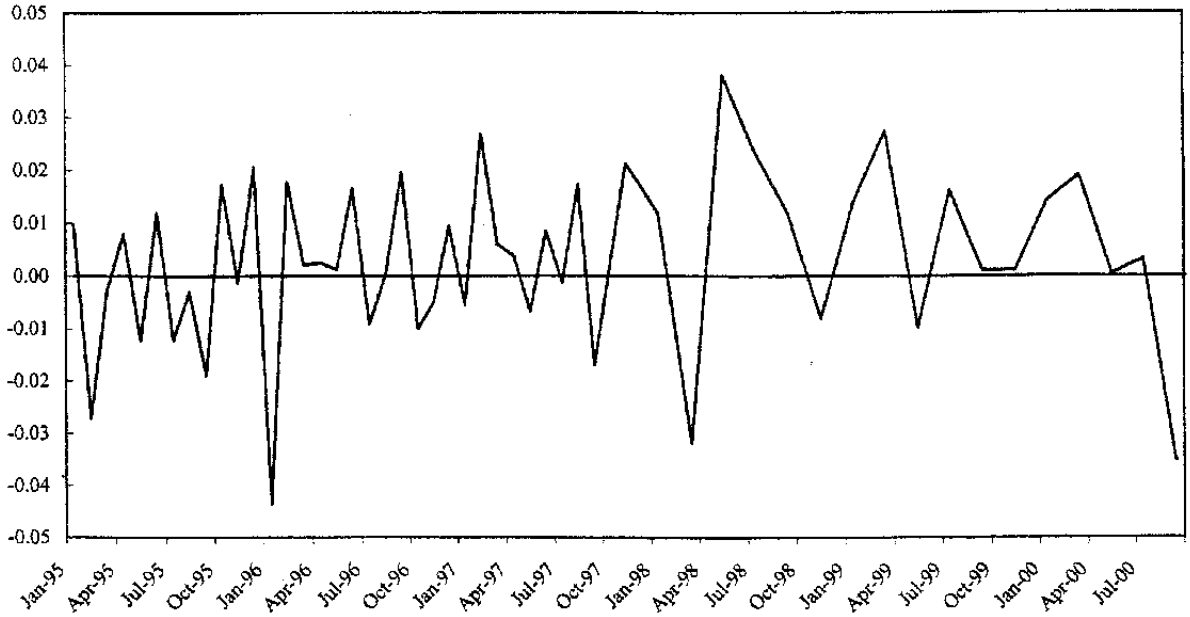
[12] The ADF statistic (using the same assumptions as described in the Annex for the other variables) is found to be –3.14, with a critical value for a test at a 5 percent significance level of –2.88.

Figure VIII.1. Money Demand Equation
(logarithmic scale)

Actual vs. Forecast Money Demand



Residuals from the Estimated Demand Equation



Sources: IFS database, and Fund staff estimates.

inconvertibility. Over the long-run, the demand for real money is driven positively by real output and negatively by nominal interest rates, while inflation turns out to be insignificant. Since the inconvertibility framework does not provide clear predictions over the long-run relationship between risk variables (here, proxied by exchange rate and reserves) and real money, we do not attempt to interpret their coefficients in the long-run equation.

14. **Over the short run, real money demand adjusts sluggishly toward its long-run equilibrium.** The coefficient on the u_{t-1} term in equation (8) shows that money demand adjusts by 1.5 percent per month in response to a disequilibrium (about 20 percent of the disequilibrium disappears over the course of one year, and 50 percent after 28 months). From the point of view of this chapter, the key implication is that one can focus mainly on the short-run impact multipliers from the exchange rate and reserve variables onto money demand (which is very helpful for the counterfactual simulations), as any long-run disequilibrium effects would be negligibly small at the one-month frequency.

15. **The main finding is that the "crisis" variables have the predicted impact on real money demand.** As the short-run equation shows, a depreciation of the exchange rate and a loss of reserves both act to depress the demand for money, and the result is statistically significant. The next section examines the quantitative significance of this effect more closely, and provides a comparison with an alternative study which was based on cross-sectional data.

D. A Counterfactual Simulation of the Impact of Inconvertibility on the Demand for Money and Reserves

16. **Armed with the estimated money demand equations, it is possible to produce an *ex post* estimate of the impact of the crisis.** The money stock fell by about 3 percent in December 1997 and a further 2 percent in January 1998. The model predicted a fall of 1.7 and 2.3 percent respectively, a good prediction for what was an unusual period. One implication is that the model did not explain about 1 percentage point of the decline in money demand (this could have happened for various reasons, including the possibility that the proxy variables used to capture the risk of inconvertibility were less than perfectly correlated with the information set available to households at that time). Nevertheless, the key question is how much of what the model explains is due to the "crisis" variables.

17. **A counterfactual simulation reveals that the "crisis" variables (exchange rates and interest rates) helped explain an important part of the reduction in money demand during December 1997.** As already mentioned, the key question is how much of the model-predicted fall in demand can be explained by the "crisis" variables. This calculation can be done by (counterfactually) setting the change in the exchange rate and in reserves to zero during December 1997, and recomputing the model forecasts. The difference between these new, conditional, forecasts and the earlier forecasts is the model's estimated impact of the crisis variables onto money demand. It is found that the model counterfactually forecasts that the demand for money would actually have **increased** (which is reasonable, as this would have been expected in line with the usual seasonal pattern) by 1.9 percent, a difference of

3.5 percentage points versus the model's unconditional forecast (and 4.5 percentage points versus the growth in the actual money stock during December 1997).

18. **Using real money at end-November 1997 as a base, the counterfactual simulation implies that the inconvertibility channel from the crisis to the demand for money translated into a loss of reserves of between $5.6-7.1 billion.**[13] The calculation is performed by using the end-of-period November 1997 exchange rate (1,163.8 won per dollar) to calculate broad money in dollars ($158.8 billion). Then, one applies the estimated effect (3.5-4.5 percent) of the crisis variables on money demand to this number. To put the estimated impact on reserves in perspective, it represented almost 30 percent of foreign exchange reserves (excluding gold) measured as of end-November 1997 ($24.4 billion).

19. **One important problem discovered after the initial impact of the crisis is that reserves were mismeasured, with truly useable reserves being much lower than those reported publicly at that time.** This has two distinct sets of implications for the analysis in this chapter. One is whether the mismeasurement would influence the estimated coefficients, and the other is in assessing the importance of the inconvertibility effect on money demand. As to the former, it is in all likelihood not an important problem, because people would be reacting to the data that they had available at the time of the crisis. It therefore makes sense to use data that is closest to what would have been observable at the time. As to the latter implication, however, it is important to have an understanding of the true extent of the deterioration in reserves.

20. **Given that useable reserves, excluding the emergency Fund assistance, declined to practically zero at end-1997, it is concluded that the impact of the possible loss of convertibility on reserves was a significant, but not the most important factor.** Estimating the decline in reserves in the last few months of 1997 to be approximately $24 billion, of which 30 percent was due to the inconvertibility effect on money demand, it is concluded that 70 percent of the loss of reserves was due to other factors. Without performing a detailed analysis of those other factors, it is not possible to conclude with precision how important these other factors might be. This could be a topic of future research endeavoring to isolate further the other channels by which crises influence reserves. However, it is known that much of the outflow from Korea during the crisis was linked to the inability to roll over short term debt, as creditors became unwilling to refinance their exposure. Tentatively, therefore, one can conclude that the short-term debt vulnerability indicator may have been of more significance than the inconvertibility channel.

21. **In terms of the external vulnerability indicators, the analysis in this chapter implies that reserves are now at levels that are adequate to cover plausible shocks to**

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[13] The effect could be somewhat larger if the value of real money then were translated into today's money (between end-November 1997 and the end of the sample period in September 2000 the CPI index rose by about 10 percent).

money demand. Assuming that the shock from the 1997 crisis to money demand was at the high end (representing a kind of natural "stress test"), reserves should cover at least 4.5 percent of broad money. In fact, the reserve level of $96 billion at end-2000 covers 11 percent. This should be contrasted with the inadequate level at end-1997, when useable reserves, inclusive of the emergency support from the Fund, were at 2.2 percent of broad money.

22. **An alternative approach using cross-sectional data found a larger impact on money demand and reserves from a potential lack of convertibility.**[14] That study collected data on a large number of countries, estimating the impact of inconvertibility on money demand through a cross-country regression. The methodology was to construct simple measures of money velocity and to regress them against inflation and on a dummy variable capturing whether that country's currency was convertible (using the Fund's AREER handbook as a guide to determining convertibility). The main finding was that money demand was 15½ percent lower for countries with inconvertible currencies. This effect is between 3.5-4.5 times larger than what was estimated using the Korean-specific money demand function. If the finding in the Black study were correct, it would have meant that reserves would have fallen to zero (or to below zero) on the strength of the inconvertibility channel alone.

23. **It seems unlikely that the higher estimate for the impact on reserves is applicable in the majority of the cases.** Given the method of estimation, it seems that only full and present inconvertibility would result in a reduction in money demand of the full 15.6 percent (so that amount can be viewed, in general, as an overestimate). More likely, households ascribe some probability to the possibility of inconvertibility that is less than 100 percent. Even given the severity of the crisis in Korea, it is not plausible that households came to expect full (not to mention permanent) inconvertibility. Under these circumstances, the estimate that money demand fell by between 3.5-4.5 percentage points seems a more reasonable one.

E. Conclusion

24. **This study offers some insights for policies designed to contain external vulnerability and particularly for reserves.** Some of the conclusions, however, are tentative pending further research.

- At times of crisis, money demand will generally fall as agents perceive the risk of domestic currency becoming inconvertible as rising. This intuitive theoretical prediction is born out by the empirical analysis carried out for the case of Korea in this chapter.

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[14] Stanley Black (*Convertibility*, Mimeo, December 2000).

- The negative impact of a crisis on money demand, and the attendant negative spillovers to international reserve holdings, can be significant but, for countries whose problems are perceived to be temporary, and that have a reasonable amount of initial reserves, manageable. Korea's current reserves, when compared with broad money, would more than cover a shock to money demand equivalent to that sustained during the 1997 crisis.

- From the usual indicators of external vulnerability, the analysis in this chapter finds that the reserves-to-broad money ratio is an important indicator. At least for the case of Korea, one can tentatively say that the reserves-to-short term debt (measured by residual maturity) variable may have been quantitatively more important. Further theoretical and empirical work needs to be done, however, to conclusively rank the importance of alternative indicators of vulnerability.

Data Sources and Definitions

The data used are all collected from the Fund's International Financial Statistics (IFS) database, and are monthly series for the period February 1970 to September 2000.

The key definitions used include:

- Real broad money is the end of period sum of money and quasi money deflated by the CPI index, seasonally unadjusted.
- Real output is the industrial production index, seasonally adjusted.
- The interest rate is the monthly yield on deposits longer than 1 year.
- Reserves is end of period foreign exchange reserves excluding gold measured in dollars, divided by imports also measured in dollars.
- The exchange rate is the monthly average market rate, measured in won per US dollar. For converting money stocks to dollars the end of period rate is used instead.

To extend the sample back to 1970, it was necessary to use the aforementioned interest rate (some alternative series started much later). This entailed some loss of information as there were periods over which that rate did not change (there were periods over which it apparently was changed only infrequently). There was no definition of quasi money in the IFS database that was seasonally adjusted, and there was no definition of industrial production that was seasonally unadjusted. To account for this discrepancy, the short-run regression equation includes seasonal dummies.

The tests of variable stationarity yielded the following results:

Table VIII.1. ADF Tests

(Performed assuming 12 lags and including a constant and no trend, and assuming that the constant equals zero under the null hypothesis)

Variable	Levels	Difference	Conclusion
Broad money divided by CPI	0.34	-3.62	The variable is integrated of order 1
Output	-1.62	-4.18	The variable is integrated of order 1
Interest Rate	-2.73	-4.86	The variable is integrated of order 1
Inflation Rate	-2.68	-7.34	The variable is integrated of order 1
Exchange Rate	-1.65	-5.13	The variable is integrated of order 1
Reserves-to-imports ratio	-0.75	-3.87	The variable is integrated of order 1

Note: The 5 percent critical value for the ADF test is –2.88 (James Hamilton **Time Series Econometrics**, 1994, Table B.6, case 2).

One notable result, often found also in other country cases, is that inflation is integrated of order one (hence, the difference of inflation is stationary). This implies that the CPI is integrated of order two. This explains why in the long run equation it is inflation that is used (to keep the orders of integration commensurate between the left-hand and the right-hand sides of the equation) and why it is that in the short-run equation it is the difference in inflation that is used.