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THE KOREAN SYSTEM OF LEADING INDICATORS†

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Since BSI was first compiled in 1964, a series of cyclical indicators have been developed by various organizations and growth cycle has been utilized extensively in identifying and predicting turning points for Korean economy. In this paper, we investigate characteristics of Korean leading indicators, especially CI and BSI. At present, seven organizations are producing BSI's every month or quarter. It, however, is advised to interpret BSI's with care reluctant to answer the questionaries. CI has been playing the most important role in describing Korean business cycle since its first development in 1981. While CI has been revised four times to reflect latest economic situation by introducing new component series or evaluation of compilation method, there, still remain many difficulties in obtaining accurate picture of Korea economy through CI only.

Currently, NSO is developing new qualitative indicator which is expected to provide supplementary information on economic dynamics.

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I .INTRODUCTION

It was not until early 1960's when Korea had experienced economic downturn and was interested in measuring the economic fluctuation by business indicators. Since the Korea Productivity Center (KPC) had compiled Business Survey Index (BSI) in 1964, a series of cyclical indicators such as BSI, WI (Warning Indicators), DI (Diffusion Index), CI(Composite Index), econometric models have been developed by various organizations for economic analysis and forecasting.

BSI has been considered as one of the most popular business indicators in Korea since KPC produced its first BSI. At present, seven organizations are BSI's every month or quarter. The surveys cover only limited sectors of the economy : manufacturing, construction, and some non-manufacturing. And they require the active participation of executives of enterprises who are reluctant to answer the surveys. As a consequence, it is advised to interpret the BSI with care.

Since their first development in 1981, the National Statistical Office of Korea (NSO) has been publishing each month a set of three composite indexes through the Composite Indexes of Business Indicators. And CI has been playing the most important role for short-term economic analyses such as determining reference turning dates or measuring growth rates of Korean economy. The methodology of compiling CI is very similar to what is being used by the US Department of Commerce except weighting and trend adjustment.

The composite indexes have been revised four times. Every revision consists of introduction of new components to reflect the latest economic situation in Korea and evaluations of compilation methods to enhance the quality of composite indexes. In spite of these efforts, there

still remain many difficulties in obtaining an accurate picture of Korean economy via business cycle due to the ever-changing economic conditions.

In recent years, this dilemma has been so overwhelmed that the NSO have decided to utilize qualitative information as a supplementary for economic analysis and forecasting. A new qualitative indicator is expected to be developed by the end of this year.

This paper is structured as follows. The economic development of Korean over the last 30 years is reviewed in section Ⅱ. In section Ⅲ, a brief history of Korean cyclical indicators is presented and behaviors of key macroeconomic variables over business is cycles are studied. In section Ⅳ, the characteristics of Composite Indexes for Korean business indicators are discussed in terms of their component series, methodology, revision, etc. In section V, the characteristics of Korean BSI's are discussed along with their forecastability. Concluding remarks are in the last section, which summaries the usefulness and limitations of Korean business indicators.

Ⅱ. ECONOMIC DEVELOPMENT OF KOREA : OVERVIEW

Until the early 1960's Korean economy exhibited the typical pathology of developing countries: high rates of unemployment and inflation, severe poverty, low capital stock, chronic deficit in trade balances, stagnating GDP growth.

The government took steps to finance the necessary funds required for economic development - the enhancement of tax collection capacity; the rationalization of budget system; the enhancement of tax collection

capacity; the rationalization of budget also devalued the Korean Won an reduced the tariffs on imports used for manufacturing exports, and provided the export subsidies to promote her exports of labor-intensive goods. As a result, Korean economy was expanding.

In the 1970's Korean government turned her policy to the promotion of heavy and chemical industries. Government's intervention of resource allocation through taxation and restriction of imports brought about inefficiency in the development of financial sector and concentration of economic power. Excessive expansion of government support brought a drastic expansion of the money supply. The oil crisis also caused economic difficulties, accelerating inflation, weakening competitiveness and growth potential and expanding the current account deficit.

During the worldwide recession in the early 1980's the Korean government focused her policy on stabilizing factor prices such as interest rates and prices. Since 1982, inflation has been tamed drastically to about 5% per annum from its previous level of over 10%. Rationalization of taxation and the financial sector with the initiation of an industry incentive system followed in timely fashion. The success of the government in stabilizing prices had a positive effect on exports: Korea's trade and current account balances recorded surplus from 1986 to 1989, however, the balance of trade has returned to annual deficits because of a number of internal conditions, including stagnation of exports induced by pressures to open the domestic market, the appreciation of the won and rises in wage levels.

Since 1962, seven five-year Economic Development Plans have been implemented and the Korean economy have moved forward in remarkable fashion. In, 1953, the Korea's economy stood at over US$450.5 billion in terms of GNI and over US$200.0 billion in trade volume, which is similar to the level of Netherlands, the tenth largest among OECD-member

countries. The aggregate savings rate and the aggregate investment rate reached 35.2% and 36.1% respectively, which compares to one of the highest of OECD countries.

In 1995, the Korean economy grew by 9.0% with about 4.5% inflation rate, far exceeding the average growth rate of OECD countries of 2.9% with 4.3%. The unemployment rate was about 2.0%, in contrast with the 7.9% average of OECD countries. Despite the rapid growth in exports, an even more rapid growth in imports resulted the current account deficit of about US$8.2 billion in 1995.

In 1996, Korean economy is expected to grow at moderate rate of about 7.0% and inflation rate will be around 4.5%. Capital account liberalization will induce a revaluation of the won and will slow economic growth and inflation.

Ⅲ.KOREAN BUSINESS CYCLES

Ⅲ.1. Brief History of Cyclical Indicators in Korea

In the early 1960's while the Korea's first Economic Development Plan was successfully being executed, Korea experienced the first economic downturn since Korean War. Korean government, which had never been prepared for such economic sluggishness, realized the necessity of means to measure the economic fluctuation.

In 1964, the KPC compiled BSI which was the first cyclical indicator of business activity in Korea. I 1965, the Korea Development Bank(KDB) also produced its own BSI, the oldest BSI currently being produced in Korea, for the manufacturing sector. Since then, many public

and private organizations have produced a series of cyclical indicators such as BSI, Warning Indicators (WI), Diffusion Index (DI), etc.

The Korea Development Institute (KDI) released the first result of the yearly forecast for Korean economy through its own econometric model in the early 1970's. It provided pretty accurate picture of different organizations. And now, econometric model is one of the most popular tools to conduct econometric model is one of the most popular tools to conduct economic forecasting for the medium or long horizon in Korea. Currently, more than ten organizations are producing prespects for Korean economy through their own econometric models.

Korea had severely been struck by the worldwide recession due to the second oil embargo in the late 1970's. And there was increasing need for better and more accurate business indicator which could measure not only turning points but also amplitudes of business cycles. The team of NSO and KDI, therefore, launched a program to develop composite indexes for Korean business indicators which believed to provide the best information on short-term economic dynamics.

In March of 1981, a set of three composite indexes was compiled: leading composite index; coincident composite index; lagging composite index. The first set of composite indexes consisted of 19 component series: 9 for leading, 5 for coincident, 5 for lagging. Since then, they have acted as official indicators for domestic economic activity.

The actual economy, however, is far more complicated than what can be projected by a couple of business indicators. Therefore, NSO has been utilizing not only quantitative information such as individual data, CI, econometric model but also qualitative one as BSI to describe Korean economy.

Ⅲ.2. Characteristics of Korean Business Cycle

1. Business Cycle v.s. Growth Cycle

Business cycles are recurrent sequences of alternating phases of expansion and contraction. A business cycle is identified by the aggregate economic activity which is measured by a wide variety of series including output, sales, employment, etc. Economic aggregates tend to be more active during expansions and less during contractions . The peaks and troughs are marked by the clusters of the end of each expansion and contraction, respectively.

Expansions and contractions are defined as sustained movements in economic activity : at least two consecutive quarterly movement of real GDP in the same direction. Figure 1 plots the pattern of Korean CI's from January of 1970 to Mary of 1996, a period that includes entire business cycles from trough to though.

The coincident CI indicates only one contraction for Korean economy since 1970, between 1979 and 1980. Since the 1960s, Korean economy has been growing so rapidly, near 10% per annum, that trend component is dominating in business cycle. And the cyclical declines often cause the economic growth to slow down rather than to absolutely decline.

Growth cycle approach, popularized during the 1960s when many industrialized economics experienced several years of positive growth without a contraction, can be more useful for the analysis of Korean business cycle. These growth cycles are defined in terms of the growth of the real GDP relative to long-term trend growth. Growth cycles are fluctuating around the trend level: peaks when business cycle is the highest above the trend and

troughs when the lowest below the trend.
During expansions, it is not unusual for the growth rate of real GDP to fluctuate above and below the trend rate. Thus, growth cycle expansions and contractions are much more common than business cycle expansions and contractions.

Long-term trends, however, vary over time and are hard to measure. NSO has extensively been utilizing the Phase Average Trend (PAT) method to eliminate trend component and to find the cyclical component of coincident CI, a growth cycle. Using this growth cycle, the NSO described the Korean economy with six cycles from the early 1970s. Table Ⅲ.1 shows the reference turning dates and durations of cycles since the 1970s.

Table Ⅲ.1 : Business Cycle Chronologies

Cycles	Reference Turning Dates			Cycle Duration(Months)		
	Trough	Peak	Trough	Expansion	Contraction	Full Cycle (T to T)
Cycle 1	'72.3	'74.2	'75.6	23	16	39
Cycle 2	'75.6	'79.2	'80.9	44	19	63
Cycle 3	'80.9	'84.2	'85.9	41	19	60
Cycle 4	'85.9	'88.1	'89.7	28	18	46
Cycle 5	'89.7	'91.1	'93.1	18	24	42
Cycle 6	'93.1	-	-	-	-	-
Average (SD)	_	_	_	31 (10.8)	19 (3.0)	50 (11.3)

Note: SD stands for a standard deviation

2. Behaviors of Key Macroeconomic Variables over the Business Cycles

This section investigates the characteristics of Korean business cycles in terms of typical behaviors of key macroeconomic variables over the cycles. A common method used to characterize the behavior of economic variables is in terms of their cyclical natures during business cycles. A variable is said to be procyclical if it typically moves in the same direction as aggregate economic activity. A countercyclical variable usually moves in the opposite direction of aggregate activity. A variable can be acyclical - showing no consistent pattern in terms of its movement over business cycles.

We compare growth rates of variables in expansion or contraction phase with average growth rates of the cycles. Table Ⅲ.2 presents the annualized percent changes in real GNP, consumption, investment, export, money supply, Consumer Price Index, and inventory during the expansions and contractions that occurred from 1970 to 1995.

Consumption spending measures purchases of goods and services by private sector and is the largest component of aggregate demand, accounting for almost one half of GNP in 1995. Table Ⅲ.2 shows that consumption spending is acyclical, rising slower than average during expansions for Cycles 3 and 4, while faster for other cycle. Investment, which accounts for 35 percent of GNP, is more volatile than consumption and is the only perfectly, consistently procyclical variable. It rises faster than average during expansions and slower during contractions.

Money supply (M2) and export exhibit procyclical behaviors except one cycle. Price level, however, shows countercyclical behavior which contradicts to the demand theory. And inventory is acyclical.

TableⅢ.2 : Changes in Key Macroeconomic Variables in Cycles

(%)

		GNP	CON	IVST	EX	M2	CPI	INV
CY1	AVG	8.5	6.6	19.1	38.2	30.9	12.2	23.0
	EXPN	10.3(5.3)	7.0(2.4)	19.7(20.5)	59.2(18.7)	33.8(6.5)	8.6(6.3)	10.8(12.1)
	COTN	5.9(2.6)	6.1(2.0)	18.3(18.1)	6.7(33.3)	26.6(2.5)	25.1(2.5)	41.0(16.6)
CY2	AVG	8.3	6.7	61.5	13.5	31.3	17.8	16.5
	EXPN	11.0(4.0)	7.8(2.0)	24.2(32.5)	20.4(17.0)	33.4(5.4)	15.4(5.9)	6.6(8.3)
	COTN	2.1(5.2)	4.0(4.3)	-1.6(33.7)	-2.6(8.5)	26.4(1.3)	23.5(4.7)	36.6(9.7)
CY3	AVG	7.6	6.3	6.9	3.4	19.5	8.7	10.9
	EXPN	7.7(6.2)	6.1(3.6)	7.0(9.8)	4.0(9.3)	23.8(5.5)	11.6(9.9)	10.9(8.9)
	COTN	7.5(1.9)	6.8(1.1)	6.7(12.6)	4.0(9.3)	10.2(3.2)	2.4(0.3)	9.4(2.6)
CY4	AVG	11.3	9.1	13.8	18.5	18.0	4.6	11.9
	EXPN	12.9(3.3)	8.3(0.9)	14.0(4.4)	21.3(12.4)	17.6(1.7)	3.4(1.9)	9.4(2.8)
	COTN	8.8(2.8)	10.3(0.8)	13.6(6.5)	14.2(9.5)	18.4(2.0)	6.3(0.8)	15.7(5.9)
CY5	AVG	7.3	8.6	11.0	3.8	20.0	7.6	15.4
	EXPN	9.0(1.9)	10.1(1.3)	22.9(1.8)	1.6(2.4)	20.9(2.3)	8.3(1.4)	16.6(5.9)
	COTN	6.0(2.6)	7.5(2.0)	1.6(10.0)	5.5(6.0)	18.3(2.2)	7.1(1.9)	5.4(4.3)
CY6	EXPN	7.0(1.6)	6.5(0.9)	8.4(8.4)	14.0(3.7)	17.2(3.8)	5.4(0.9)	4.3(0.8)

Note 1: Entries are year-to-year changes or annualized growth rates.
Note 2: Standard deviations are in parentheses.
Note 3:
- CY1:'72.Ⅰ-'74.Ⅱ; CY2: '75.Ⅱ-'80.Ⅲ; CY3: '80.Ⅲ-'85.Ⅲ; CY4:'85.Ⅲ-'89.Ⅲ; CY5: '89.Ⅲ-'93.1; CY6: '93. Ⅰ-'95.Ⅳ
- AVG: Average; EXPN: Expansion Phase; COTN: Contraction Phase
- GNP: Real GNP (quarterly); CON: Real Private Consumption (quarterly); IVST: Real GNP (quarterly); CPI: Consumer Price Index (monthly); EX: Export(quarterly);M2: Money Supply(monthly); INV: Inventory(monthly)

Note 4: The shaded area denote the countercylical behavior of a variable

3. Characteristics of Korean Business Cycles

Korean business cycles can be characterized as cyclical asymmetry and variability.

<Cyclical Period>

The expansion phase has been longer than the contraction except the fifth cycle:31 months for expansion phase; 19 for contraction on average. The length of expansions has varied greatly, with a standard deviation of 11 months: the shortest is 18 months; the longest is 44 months. The length of contractions are much stable with a standard deviation of 3 months.

Average duration of business cycles in Korea is about 50 months, with a corresponding standard deviation of 11.3 months which still indicates a high degree of variability of expansion length. Currently, Korean economy is in expansion phase of the sixth cycle which has been continuing since Jan. 1993.

<Cyclical Asymmetry>

Private consumption grows steadily over the cycles. However, investment, export have been growing much faster in expansion phases than in contractions since cycle 1. Money supply has been growing faster in expansions due to increasing demand from industries which need more fund to increase production. CPI, however, increased more rapidly in contractions and has been more stabilized since cycle 4.

<Cyclical Variability>

The growth rates of macroeconomic variables are more volatile in contractions than in expansions. The higher the growth rates of components of GNP (GNP, Private consumption, Investment), the smaller the standard deviations. Variabilities of export and inventory are getting smaller. This movement is consistent to the movement of aggregate demand.

CPI varies more in expansions than in contractions which shows the rigidity of price level to lower bound. The variabilities of Key macroeconomic variables has been getting smaller since the early 1970s. This reflects the fact that impact of external shock on Korean economy is getting smaller as volume of Korean economy becomes larger. And the impact lasts shorter as liberalization and globalization of Korean economy becomes wider.

Ⅳ. COMPOSITE INDEXES OF KOREA

Ⅳ.1.Overview

The composite index (CI) of business indicators is desingned to approximate movements in aggregate economic activity. The Statistical Analysis Division of NSO has been compiling a set of three main and two supplementary CI's every month since March of 1981.

Three main CI's are leading, coincident and lagging CI. And two supplementary indexes, growth cycles, are a twelve-month smoothed

change in leading CI and a cyclical component of coincident CI. In Korea, a growth cycle has been used extensively in identifying and predicting turning points. It is because, over the last thirty years, Korean economy has been growing so rapidly that the trend has been a dominating component in Korean business cycle.

The CI's have been compiled in the end of the following month and disseminated in the monthly publication called the Composite Indexes of Business Indicators. The current methodology is very similar to what is being used by the US Department of Commerce except weighting and trend adjustment. Since their first development, CI's have been playing major role in describing business cycles for Korea and evidenced eleven reference turning dates.

The CI's are subject to yearly revision, on every February, which introduces new factors for standardization, and for seasonal and GDP adjustment. It addition to this regular revision, CI's had been revised for four times and the fifth one is in progress to reflect the latest economic situation more accurately. Every revision consists of improvements of components and evaluations of compilation methods to enhance the quality of the CI's. In spite of these efforts, there still remain many difficulties in obtaining an accurate picture due to the ever-changing economic conditions.

Ⅳ.2. Components of Current Indexes

Component series are one of the most important factors which determine the efficiency and the predictability of CI's. In Korea, there are about two hundred monthly economic time series available for CI's. The NSO selects component

series for CI's based on the following criteria - economic significance, statistical adequacy, timing, conformity, smoothness, timeliness, etc.

Table Ⅳ.1 shows the component series of the current CI's. Leading CI consists of ten component series while coincident and lagging of eight and five, respectively. The component series were chosen because they demonstrated some measure of consistency in their turning points when compared with identified turning points in the growth of aggregate economic activity in Korea. Moreover, those combinations behave the best at the turning points against possible alternatives.

Table Ⅳ.1 : Component Series for Composite Index

Leading Index(10)	Coincident Index(8)	Lagging Index(5)
Floor Area of Building Construction Permitted* (Residential and Industrial)	Industrial Production Index (All)	Imports of Machinery (Excl Vessels & Aircrafts; Real)
Industrial Production Index* (Intermediate Construction Goods)	Operation Ratio Index (Manufacturing)	Producers' Inventory Index*
Value of Machinery Orders Received (Private and Public ; Excl. Vessels: Real)	Producers' Shipment Index(All)	Producers' Shipment Index (Durable Consumer Goods)
Export Letters of Credit Arrival(Real)	Wholesale and Retail Trade Index	Yields on Corporate Bonds*
Imports Licenses Issued(Real)	Producers' Shipment Index(Nondurable Consumer Goods)	Unemployment Rates (Non-farm Household; Inverted)
Loans of Deposit Money Banks*(Real)	Imports (Real)	
Ratio of Inventory to Shipment Index(Manufacturing)	Domestic Cement Consumption	
Intermediate Goods Shipment Index*(Manufacturing)	Numbe of Employed Persons (Non-farm Households)	
Ratio of Workers Placed to Displaced (Manufacturing)		

Note:* indicates twelve-month smoothed change of the series

As is shown, more than a half of the component series of leading CI are not in levels but in changes in order to increase the leading lages of the series. This is because, in Korea, there are limited number of component series for leading CI. Most of component series possible for leadign CI lead only a couple of month.

Ⅳ.3. Current Methodology

The method used by NSO to compile the CI's is based on the standard composite index methodology without weight adjustments developed be NBER researchers Drs. Geoffrey H. Moore and Julius Shiskin in the 1950's. Briefly, method consists of the following steps:

(1) Elimination of acyclical fluctuation: elimination of seasonal and irregular components
(2) Calculation of average rates of changes
(3) Calculation of preliminary composite indexes
(4) Calculation of trend adjusted composite indexes
(5) Calculation of final composite indexes

The methodology has been reviewed and revised to be suitable for Korean economic conditions. NSO does no longer weigh the component series depending upon their score. And trend adjusted leading CI is calculated in two separate regions to incorporate structural changes. And equal weigh is applied to all component series The detailed methodology is presented in appendix by comparing with that of OECD.

Ⅳ.4. History of Revision

Since their first compilation in 1981, the CI's have been subject to yearly revision, on every February, which introduces new factors for standardization and for seasonal and GDP adjustment. In addition to this regular revision, CI's had already been revised four times to reflect the latest economic conditions.

There have been growing concern over the methodology and components of the indexes due to the structural change or policy reform. All the previous revisions improved the CI's by extending and complementing the component series taking into consideration that it is required to reflect the latest changes in characteristics of business fluctuations.

Every revision consists of improvements of components to measure the latest business cycles more closely and evaluations of compilation methods to enhance the quality of composite indexes. In spite of these efforts, there still remain many difficulties in obtaining an accurate picture due to the ever-changing economic conditions.

The fifth revision, therefore, is in progress which expected to be completed by the end of 1996 and the results will be published in NSO's The Report of the Composite Indexes Revision in early 1997. The important feature of the revision can be summarized in three aspects: 1) new establishment of the reference turning date for the latest business cycle, 2)improvement and complementation of statistical techniques related to the index compilation, 3) complementation of the component series.

Table Ⅳ.2 : The Contents of Revision

	Number of Components	Major Improvement		Background
		Component series	Methodology	
Original CI ('81.3)	-19components leading : 9 coincident : 5 lagging : 5			
First Revision ('84.3)	-22componets leading : 10 coincident : 5 lagging : 7	-Add M3 to leading CI -Add a couple of series to lagging CI	- 3 month MA for all series to eliminate irregular movemetn	- Change in economic environment - Weakened economic conformity of CI's
Second Revision ('88.7)	-21componets leading :9 coincident :5 lagging : 6	-Elaboration and replacement of leading & lagging series	- 1 or 3 months MA depending on their irregularity - Apply different σ-control limit of extreme values to different series for prior adjustment	- Change in base year(1980→1985) - Weakened economic conformity fo CI's
Third Revision ('91.9)	-23components leading : 10 coincident : 8 lagging : 5	-Include variables representing construction sector -Add 4 more series to coincident CI	- Equal weight for all component series	- Structural change in Korean economy due to increase in wage level or trade deficit - Construction of 2 million housing units
Fourth Revision ('93.9)	-23components leading : 10 coincident : 8 lagging : 5	-Replacement of a number of leading series in rate to enhance predictability		- Change in base year(1985→1990) - Weakened economic conformity of CI's

Ⅳ.5. Forecasting with Composite Indexes

In Korea, CI's have widely been used in predicting the directions of economic movements for Korean economy. The 12-month smoothed change in leading CI, growth cycle, leads about 11 and 7 months at the peaks and troughs, respectively. In other words, the growth cycle of leading CI signals the peaks 11 months in advance of the realizations of the actual peaks on average.

In this section, we analyzed the forecasting performance of Korean CI's based on different approaches: deterministic method and stochastic method. The two or three consecutive rule method (TTCR) and the sequential signaling method (SS) are applied for the deterministic method and Neftci method for the stochastic.

1. The deterministic method

1.1 Two or three consecutive rule mehtod(TTCR)

TTCR is one of the oldest methods to detect turning points with CI. It signals a turning point if leading CI moves to the opposite direction 2 or 3 months in a row. Table Ⅳ.3 shows the forecasting performance of CI at the turning points by TTCR. For the peaks, it only indicates two true signals out of five, February's of 1974 and 1979, and one false signal.

And for the troughs, it indicates three true singals out of six: Mar. 1972, Jun. 1975, and Sep. 1980. This probably is due to monotonic increase of leading CI since the early 1980s and TTCR is not useful for such a pattern.

Table Ⅳ.3 : The signals for turning points by the two or three consecutive rule method

Peaks			Troughs		
Turning Points	Two CR	Three CR	Turning Points	Two CR	Three CR
'74.2	-3 months	-2	'72.3	+1 months	+2 months
'79.2	+2 months	+3	'75.6	-5 months	-4 months
'84.2	No signal	No signal	'80.9	0 months	+1 months
'88.1	No signal	No signal	'85.9	No signal	No signal
'91.1	No signal	No signal	'89.7	No singal	No signal
			'93.1	No singal	No signal
False Signal	'71.9	'71.10	False Signal	'71.2	'71.3

Note: '-' and '+' represent leading and lagging lags, respectively, between actual turning points and those identified by TTCR.

1.2. Sequential Signaling method(SSM)

SSM was first developed by Drs. Moore and Zarnowitz in 1982 by ananlyzing business cycles of the U.S. economy after World War Ⅱ. It uses growth rates of both leading and coincident CI's to identify a turning point: predicts a turning point if the growth rate of leading CI reaches to certain level and confirms if that of coincident CI reaches to the level.

We used 6-month smoothed changes of leading and coincident CI's to investigate the forecastability of CI's by SSM for Korean economy. The upper bound for the change is 8.4% which is average GNP growth rate of Korea from 1970 and 11, and the lower bound is 2.8% average growth rate of coincident CI for contractions for the same period.

TableⅣ.4 : The signals for turning points by the sequential signaling method

Peaks				Troughs			
Turning pts.	Signal 1	Signal 2	Signal 3	Turning Pts.	Signal 1	Signal 2	Signal 3
'74.2	-3 months	+1 months	+8 months	'72.3	+5 months	+6 months	+11 months
'79.2	-7 months	-2 months	+4 months	'75.6	-2 months	+5 months	+11 months
'84.2	No Signal	+2 months	+11 months	'80.9	+4 months	+8 months	No Signal
'88.1	No Signal	No Signal	No Signal	'85.9	-3 months	+1 months	No Signal
'91.1	No Signal	+4 months	+6 months	'89.7	-2 months	+3 months	No Signal
				'93.1	+3 months	+7 months	No Signal
False Signal		'71.11	'71.12				

Note: '-' and '+' represent leading and lagging lags, respectively, between actual turning points and those identified by SSM.

Table Ⅳ.4 shows SSM indicates one no signal and one false signal, and fails to signal the at first stage for the peaks. For the troughs, SSM signals with lagged lags and often fails to signal at the third stage. Overall, SSM is not a very reliable tool in predicting turning points for Korean CI's.

2. Stochastic method (Neftci method)

Finding the posterior probability that actual turning point occur in recursive formula which Neftci defined requires information on the probability density function, prior probability and initial value for the posterior probability. Initial value is normally assumed to be zero since it is very unlikely for the turning point to be followed by a new turning point in the very next period.

We used 6-month smoothed changes of leading and coincident CI's to investigate the forecastability of CI's by SSM for Korean economy. The upper bound for the change is 8.4% which is average GNP growth rate of Korea from 1970 and 1991, and the lower bound is 2.8% average growth rate of coincident CI for contractions for the same period.

Table Ⅳ.5 : The signals for turning points by Neftci method

Turning Points	Peak Signal	Turning Points	Trough Signal
'74.2	-3 months	'72.3	-7 months
'79.2	-10 months	'75.6	0 months
'84.2	-7 months	'80.9	-1 months
'88.1	-3 months	'85.9	-2 months
'91.1	-1 months	'89.7	-1months
		'93.1	-7 months

Note:'-'represents leading lags, respectively, between actual turning points and those identified by Neftci method.

Ⅴ. BUSINESS SURVEY INDEXES OF KOREA

Ⅴ.1. Overview

Since the Korea Productivity Center (KPC) produced its first BSI in 1964, BSI has been considered as one of the most popular business indicators in Korea. The Korea Development Bank carried out its first survey in 1965 and most of the other organizations in the middle of 1970s. Table Ⅴ.1 presents general characteristics of seven BSI's currently being produced in Korea: fields and sample covered, frequency, questionnaires, etc.

Table V.1 : Characteristics of Korean BSI

Field	Organi-zation	Frequency (Since)	Sample	Main Variables	Dissemi-nation	Sea-sonal Adjust-ment
Manufa-cturing	KDB	Quarterly (1965)	about 1,200 enterprises (over 200 employees)	past, current, expected activity on investment, sales, etc.	end of final month of a quarter	X-11
	IBK	Quarterly (1979)	about 2,800 small · medium size enterprises (over 5-299 employees)	past, expected activity on sales, investment, etc.	1st of final month of a quarter	X-11
	BOK	Quarterly (1991)	about 1,500 manufacturing, 1,000 non-manufacturing enterprises	past, expected activity on sales, investments, etc.	1st of final month of a quarter	NA
	KCCI	Quarterly (1975)	about 2,000 enterprises (over 20 employees)	past, expected activity on sales, investments, etc.	1st of final month of a quarter	NA
	FKI	Monthly (1976)	about top 500 enterprises	past, expected activity on sales, investment, etc.	end of every month	NA
Const-ruction	KHB	Quarterly (1978)	about 300 construction enterprises	past, expected activity on sales, investment, etc.	end of 1st month of a quarter	NA
Labor	MOL	Quarterly (1995)	about 1,200 enterprises (over 30 employees)	past, current, expected activity on investment, sales, etc.	May-June (once a year)	NA

Note:

- KDB: Korea Development Bank; Industrial Bank of Korea;
  KCCI: Korea Chamber of Commerce and Industry; FKI: Federation of Korean Industries;
  KHB: Korea Housing Bank; MOL: Ministry of Labor

The surveys cover only limited sectors of the economy: manufacturing, construction, and some non-manufacturing. BSI's are compiled quarterly and the results are published by the end of every quarter except one by the Federation of Korean Industries. And they require the active participation of executives of about 300 or 3,000 enterprises. In Korea, however, most of the executives are very reluctant to answer the survey. And most of organizations publish seasonally unadjusted BSI's only. As a consequence, it is advised to interpret the BSI with care. At present, NSO is developing BSI for manufacturing and non-manufacturing sectors and planning to publish it is the end of 1996.

V.2. Evaluation

Table V.2 presents the correlation coefficients between actual BSI's of various organization and growth rate of GDP.

Table V.2 : Correlation coefficients between Actual BSI and growth rates of GDP

		BSI				
		Korea Development Bank	Industrial Bank of Korea	Korea Housing Bank	Korea Camber of Commerce and Industry	Bank of Korea
Growth rate of GDP	Aggre-gate	0.38	0.36	0.32	0.24	0.83
	Sectoral	0.92 (Manufacturing)	0.51 (Light industry)	0.71 (Construction)	0.59 (manufacturing)	-

Note: Sectors of GDP are in parentheses.

The BSI of the Korea Development Bank is highly correlated with the growth rate of GDP in manufacturing sector with correlation coefficient of

.92 while poorly with that of aggregate GDP with .22. This pattern is true for most of BSI's for the other organizations. This means that a BSI provides valuable information on the economic activity of its own sector, while it is not necessarily true for the economy as a whole.

BSI possesses characteristics as a leading indicators since it reflects expectations of entrepreneurs on future economic activities through their plans for production and investment. In this section, we investigate this property of BSI as a leading indicator. BSI of the Korea Development Bank from 1977. 1/4 to 1995. 3/4 is used for analysis. And Table V.3 shows that turning points of BSI appear to lead official turning points of BSI appear to lead official turning points for about two quarters on average. We will apply the same methods, the deterministic and stochastic methods, to investigate the forecastability of BSI at turning point.

Table V.3 : Leading lags of BSI

	Cycle 3	Cycle 4	Cycle 5	Cycle 6
Peak	-1 quarter	-2 quarters	-2 quarters	-2 quarters
Trough	0 quarter	-6 quarters	-2 quarters	

Note: Data are for the Korea Development Bank

1. The deterministic method(Two or three consecutive rule method)

Table V.4 shows the troughs are very identified with one quarter of leading lag, while lags are longer and sometimes lagged at the peaks.
This result is better than the result of CI with no false signal nor no signal.

Table V.4: The signals for turning points by the two or three consecutive rule method

Peaks			Troughs		
Turning Points	Two CR	Three CR	Turing Points	Two CR	Three CR
'79.1/4	-1 quarter	- quarter	'80.3/4	0 quarter	0 quarter
'84.1/4	+1 quarter	+1 quarter	'85.3/4	-1 quarter	-1 quarter
'88.1/4	-5 quarter	_5 quarter	'89.3/4	-1 quarter	-1 quarter
'91.1/4	-1 quarter	_1 quarter	'93.1/4	-1 quarter	-1 qurater

Note: '-' and '+' represent leading and lagging lags, respectively, between actual turning points and those identified by TTCR.

2. Stochastic method (Neftci method)

Table V.5 shows that most of the turning points are detected by Neftci method at the critical value of 90% except a trough of 1980 3/4 and a peak of 1984 1/4. Since then, Neftci method correctly identify the turning points. These results suggest that BSI provides useful information on economic situation in advance.

Table V.5 : The signals for turning points by Neftci method

Turning Points	Peak Signal	Turning Points	Trough Signal
'79. 1/4	0 quarters	'80.3/4	No signal
'84. 1/4	No signal	'85.3/4	0 quarters
'88. 1/4	-3 quarters	'89/3/4	0 quarters
'91. 1/4	0 quarters	'93.1/4	-1 quarters

Note : '-' represent leading lags, respectively, between actual turning points and those identified by Neftci method.

CONCLUDING REMARKS

In this paper, we investigate characteristics of Korean leading indicators, especially CI and BSI. The composite index (CI) of business indicators is designed to approximate movements in aggregate economic activity. The Statistical Analysis Division of NSO has been compiling a set of three main and two supplementary CI's every month since March of 1981.

Since their first development, CI's have been playing major role in describing business cycles for Korea and evidenced eleven reference turning dates. In Korea, a growth cycle such as a twelve-month smoothed change in leading CI and cyclical component of coincident. It is because, over the last thirty years, Korean economy has been growing so rapidly that the trend has been a dominating component in Korean business cycle.

CI's are subject to yearly revision of introducing new factors for standardization, and for seasonal and GDP adjustment. In addition to this yearly revision, CI's had been revised for four times. Every revision consists of improvement of components and evaluations of compilation methods to enhance the quality of the CI's.

Despite these efforts, CI has criticized for a few matters. First, the impact of the filter to eliminate trend or non-cyclical components from the series. The second is the problem of selection of component series extensively on the basis of turning points. Finally and most importantly, the shortage or proper components. All these are too difficult questions to be solved directly in the short-run.

Since the Korea Productivity Center (KPC) produced its first BSI in

1964, BSI has been considered as one of the most popular business indicators in Korea. The Korea Development Bank carried out its first survey in 1965 and most of the other organization in the middle of the 1970s. At present, seven organization are producing BSI's every month or quarter.

The surveys cover only limited sectors of the economy : manufacturing, construction, and some non-manufacturing. And they require the active participation of executives of enterprises who are reluctant to answer the surveys. As a consequence, it is advised to interpret the BSI with care.

Forecasting performances of CI and BSI are investigated by the deterministic and stochastic methods. For the deterministic method, the 2 or 3 consecutive rule method and the sequential signaling method are utilized and for stochastic the Neftci method. Both CI and BSI exhibit reasonably good forecasts for the turning points

APPENDIX 1 : Comparison of CI between Korea and OECD

	Korea(Leading · Coincident · Lagging CI)	OECD(Leading CI)
Seasonal Adj	o X-11-ARIMA	o X-11-ARIMA
Irregular Adj	o 1, 3 Months MA based on MCD Span	o MA based on MCD span
Trend Adj	o NA	o PAT method
Standardized Rate of Change	o Symmetric rate of change $(y^k_{j,t})$ $y^k_{j,t} = 200 \times \frac{Y^k_{j,t} - Y^k_{j,t-1}}{Y^k_{j,t} - Y^k_{j,t-1}}$ for $t = 1, \ldots, T$ where $Y^k_{j,t}$: Component's value for the current month o Standardized rate of change $(z^k_{j,t})$ $z^k_{j,t} = \frac{y^k_{j,t}}{S^k_j}$, for $t = 1, \ldots, T$ where $S^k_j = \Sigma \lvert y^k_{j,t} \rvert / T$	o Standardized deviation (SD_i) of component $= \frac{d_{i,t} - \overline{d_i}}{\Sigma \lvert d_{i,t} - \overline{d_i} \rvert \cdot w_i}$ where $d_{i,t}$: Cyclical Movement $\overline{d_i}$: Mean of $d_{i,t}$ w_i : Weight
Average Rate of Change	o Average rate of change of index (AC^k_t) $AC^k_t = \frac{\Sigma_j Z^k_{j,t}}{J}$, J is the number of components in each index	Total standardized deviation (TSD_i) $= \frac{SD_i - \overline{SD_i}}{\Sigma \lvert SD_i - \overline{SD_i} \rvert \cdot w_i}$
Modified Rate of Change	o Modified rate of change (MAC^k_t): $MAC_t^{lead(lag)} = AC_t^{lead(lag)} \times \frac{\Sigma \lvert AC_t^{coin} \rvert / T - 1}{\Sigma \lvert AC_t^{lead(lag)} \rvert / T - 1}$	o Modified rate of change of total standardized deviation $(MTSD_i)$: Industrial Production Index is used
Preliminary Index	o Preliminary indexes: Cumulative sum of MAC^k_t $PCI^k_t = PCI^k_{t-1} \times \frac{200 + MAC^k_t}{200 - MAC^k_t}$, where k = lead, coin, lag	o Final cyclical movement (C_i) $C_i = MTSD_i + 100$
Trend Adjusted Index	o Trend adjusted change (TAC^k_t) $TAC^k_t = MAC^k_t + TADJ^k$ o Trend adjusted Composite Index (TCI^k_t) $TCI^k_t = TCI^k_{t-1} \times \frac{200 + TAC^k_t}{200 - TAC^k_t}$ for $t = 1, 2, \ldots, T$, k=lead, coin, lag	o Target trend is computed (Ti)
CI	o Composite Index (base year=1990) $CI^k_t = 100 \times (\frac{TCI^k_t}{BASE})$ for $t = 1, 2, \ldots, T$ k=lead, coin, lag	o Composite Index(CI) $CI_i = C_i \times T_i$

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Figure 1 : Korean Business Cycles (Composite Indexes)

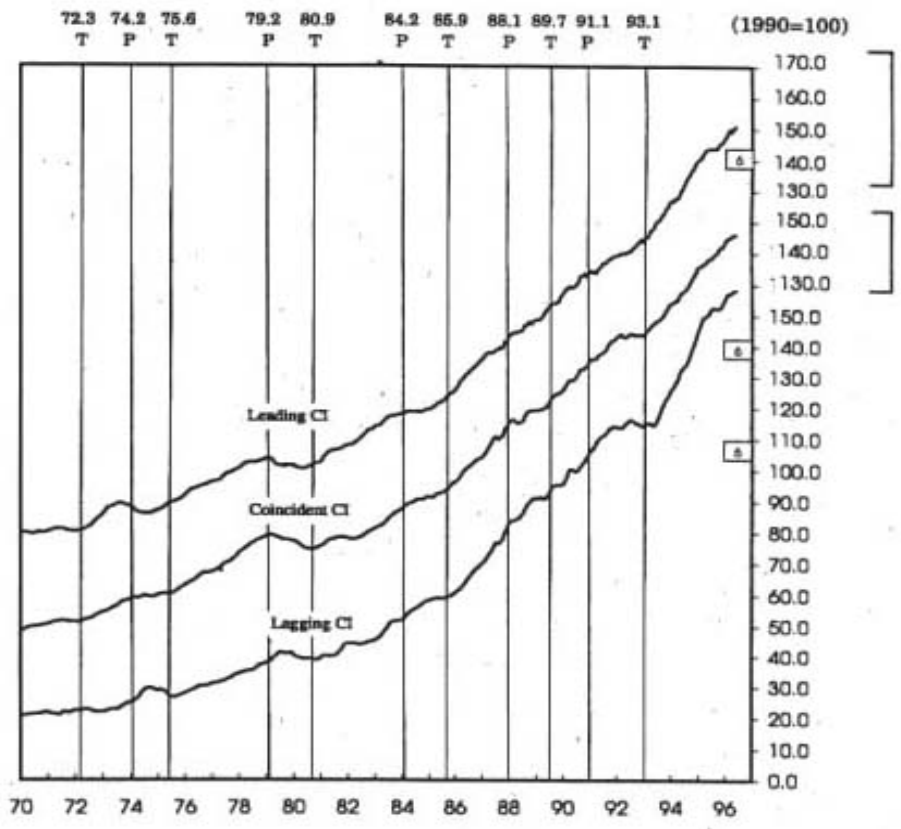
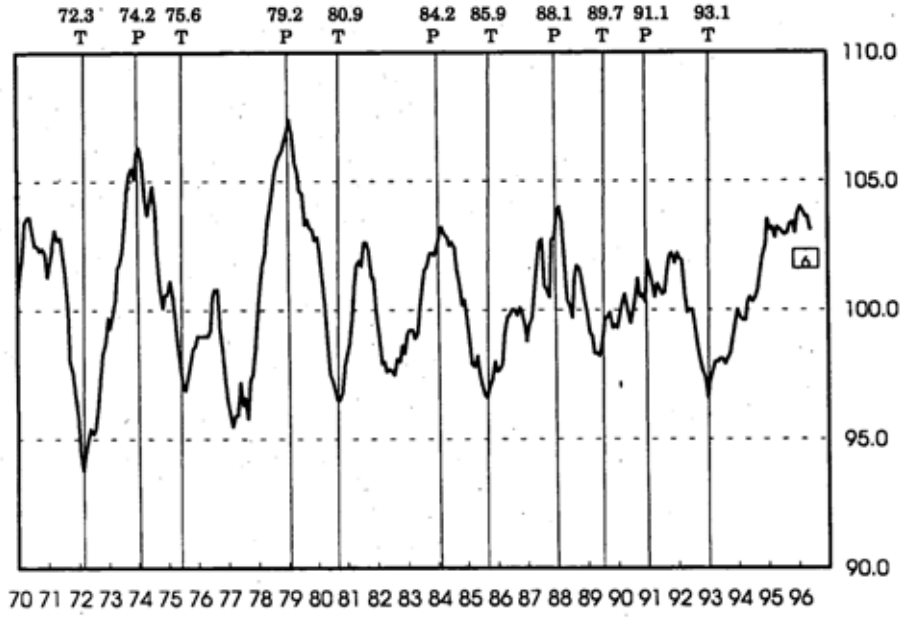
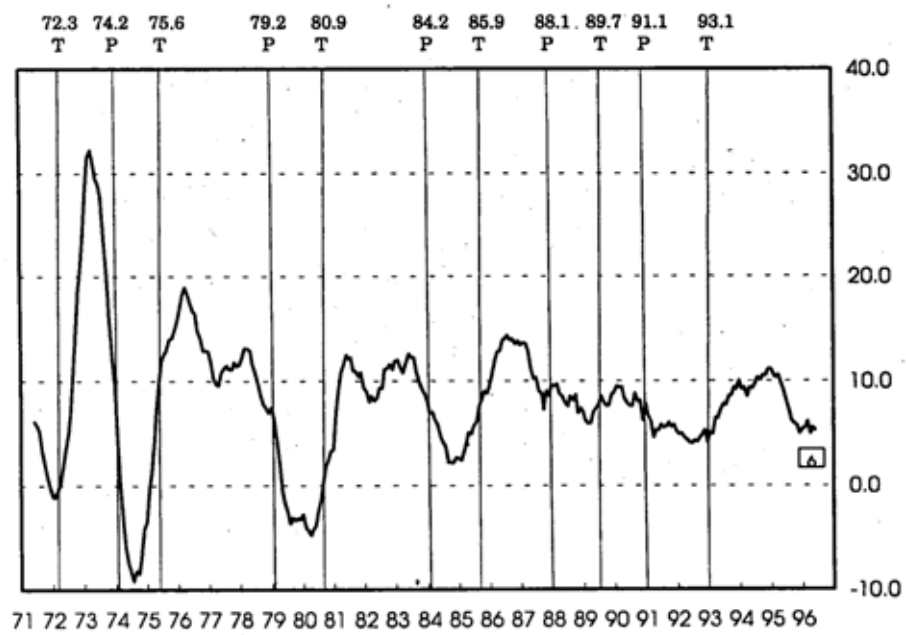


figure 2 : Korean Growth Cycles

1. Cyclical Component of Coincident CI



2. Twelve-month Smoothed Change in Leading CI



한국의 선행지수 체계

홍 은 표

< 요 약 >

한국에서는 1964년 한국생산성본부에서 기업경기전망조사를 통해 경기변동을 처음으로 측정한 이래로, 통계청과 한국은행을 비롯한 여러 기관에서 다양한 방법으로 한국의 경기순환을 판단하고 예측해 왔다. 특히 한국에서는 경기전환점(정·저점)을 판단하고 예측하는데 성장순환이 보다 많이 이용되어 왔다. 본 고는 경기종합지수와 기업경기전망(BSI)에 의해서 한국의 경기를 예측하는데 있어서 그 유용성을 판단해 보았다.

현재 한국에서는 7개 기관에서 월별·분기별로 BSI를 작성하여 공표하고 있다. 그러나 이러한 BSI는 제한된 부문들에 대해서만 조사되고 있고 기업의 경영자들이 응답을 꺼리기 때문에 이용상 많은 주의를 요한다.

경기종합지수는 1981년에 처음 작성된 이래 한국의 경기예측을 하는 공식지표로서 매우 유용한 정보를 제공해 주고 있다. 그리고 경기종합지수는 그간 경기반영도를 높이기 위하여 구성지표 및 작성방법을 바꾸는 개편작업을 4차례에 걸쳐서 시행에 왔다. 하지만 아직도 경기종합지수만을 이용해서 한국의 경기를 완벽하게 설명하는데는 많은 어려움이 있다.

그리고 한국에서는 작성되고 있는 BSI와 경기종합지수의 예측력을 연속신호법, 네프치의 확률적방법을 등을 이용하여 판단해 본 결과 각각의 지수들의 한국의 경기전환점 예측에 있어서 만족할 만한 결과를 보여주는 것으로 판명되었다.