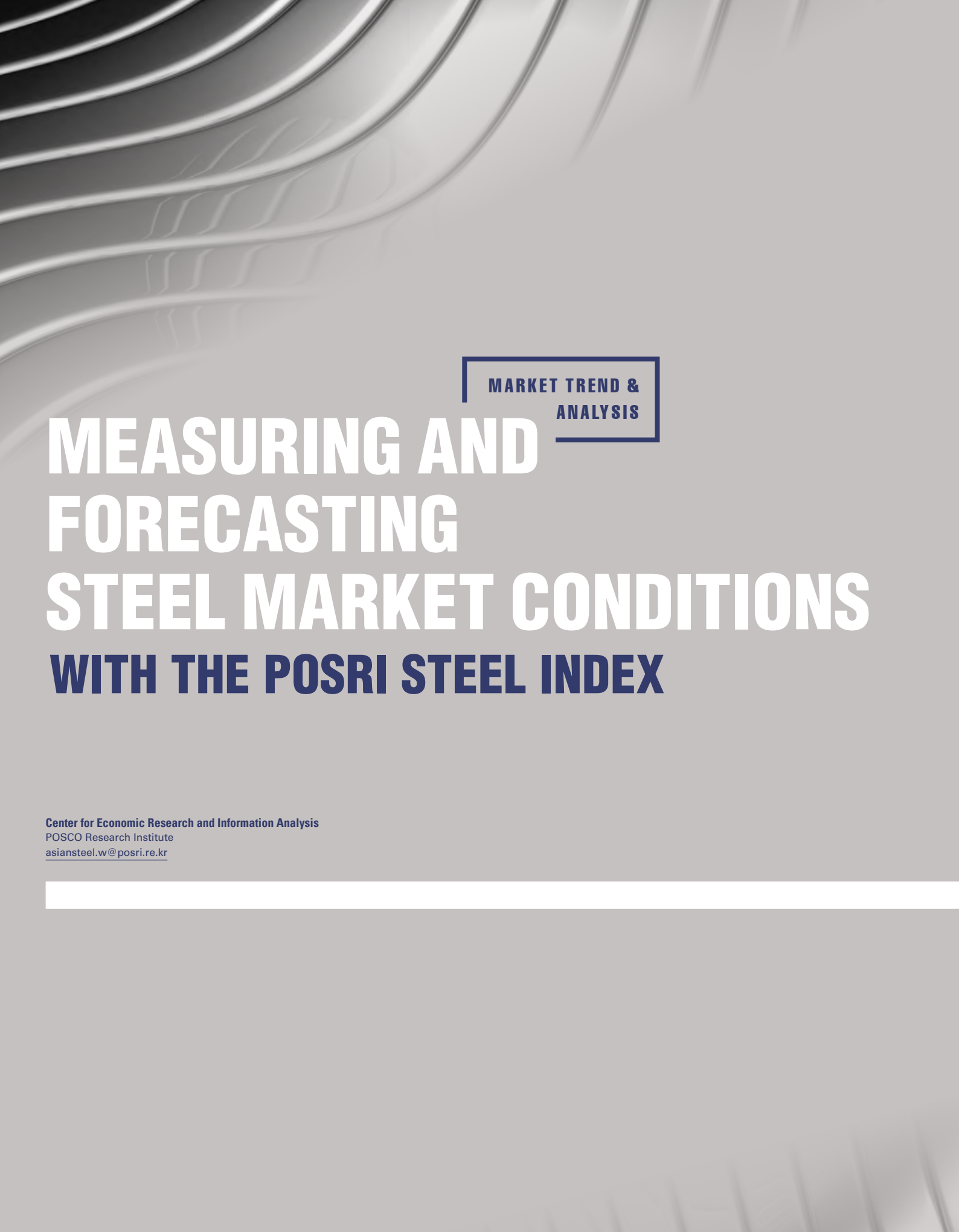




MARKET TREND &
ANALYSIS

MEASURING AND FORECASTING STEEL MARKET CONDITIONS WITH THE POSRI STEEL INDEX

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“Steel market conditions have improved slightly in some regions, but crisis conditions continue to prevail in some economies. It is uncertain whether the positive momentum observed earlier this year is robust and sustainable.”

(OECD, Steel Market Developments - Q4 2016)

“Conditions in the world steel market have improved over the past year. However, there are indications that this trend may be temporary.” (Statement by Ronald Lorentzen, Chairman of the OECD Steel Committee, March 2017)

As the quotes above show, steel industry insiders often describe how steel market conditions are good or bad, or have improved or declined. However, it is difficult to be certain precisely what the “market conditions” may be since meanings and definitions vary according to the speaker. In some cases, ‘market conditions’ refer to demand and supply, while in other cases it can mean prices. Sometimes it is describing all three.

If steel market conditions could be properly defined using common indicators, it would be useful for determining the current status of the steel market and predicting its future. In reality, however, this is no simple task for a variety of reasons, such as the difficulty of selecting key indicators, the complexity of models, and a lack of statistical expertise.

This article examines different conventional means of measuring and forecasting steel market conditions, and introduces a simple but effective methodology that POSCO Research Institute (POSRI) has developed and named the “POSRI Steel Index.”

Signaling the business cycle:

Composite economic index

Over the history of the field of economics, a number of attempts have been made at explaining a particular state or status using indicators. Both officially and casually, people often discuss how an economy is good or bad, and the media routinely broadcasts predictions about the global economy. In such cases, what does ‘market conditions’ mean? How are they estimated and how can it be determined whether an economy is doing well or poorly? To answer these questions, economists have made continuous efforts

to measure changes in market conditions and use them to predict the future of the economy.

The United States has long led the systematic development of econometrics. One representative institution is the National Bureau of Economic Research (NBER), which was established in 1919. The NBER has developed a composite index that measures both the direction and scope of market changes. In 1968, the U.S. Department of Commerce further developed this NBER research into a composite economic index comprised of 26 indicators and began to use it to measure and predict market fluctuations.

Composite economic indexes are periodically (primarily on a monthly basis) released by the OECD, the Economic Cycle Research Institute (ECRI), the Conference Board, and respective countries’ bureaus of statistics. They are widely used as a major indicator to measure and predict the economy. The components of the monthly composite economic indexes used in the USA, China, and Korea are shown in Table 1. Each country includes unique components comprised of coincident and leading indexes. The composite economic index is divided into a coincident index as a measure of the overall performance of the economy and a leading index indicating economic performance in advance.

A composite index features the advantage that changes in various indicators can be comprehensively reflected in a single index, while it is hindered by the fact that only experts can understand the complex processes of calculation involved. The calculation of a composite index is difficult to understand since it uses a variety of statistical techniques, including de-trending, seasonal adjustment, smoothing, normalization, and principal component analysis. People at the working level are able to use the index without any need

Table 1. Components of Composite Economic Indexes

	Coincident Index	Leading Index
USA	• Employment on non-agricultural payrolls • Personal income less transfer payments • Industrial production • Manufacturing and trade sales	• Average weekly hours, manufacturing • Average weekly initial claims for unemployment insurance • Manufacturers' new orders, consumer goods and materials • ISM new order index • Manufacturers' new orders, non-defense capital goods excluding aircraft • Building permits, new private housing units • Stock valuations, 500 common stocks • Leading credit Index • Interest rate spread, 10-year Treasury bonds less federal funds • Average consumer expectations for business and economic conditions
China	• Industrial production index • Employment at industrial enterprises • Completion of the amount of investment in fixed assets • Total consumer retail sales • Total value of imports and exports at customs • Total profits of industrial enterprises • State tax revenue • Disposable income of urban households	• Market interest rate spread between short-term and medium-term treasury bill • Industrial ratio of sales to output • Total freight traffic • Volume of freight handled in major coastal ports • Hang Seng mainland free float index • Number of investment projects in fixed assets newly started • Area of commercial buildings newly started • Money and quasi-money (M2) • Consumer expectation index
Korea	• Industrial production index (all) • Index of services (excluding wholesale and retail sales) • Value of construction completed (real) • Retail sale index • Domestic shipment index • Imports (real) • Number of employed persons (excluding agriculture, forestry and fishing)	• Inventory circulation indicator • Consumer expectations index • Producer shipment index, machinery for domestic demand (excluding vessels) • Construction orders received (real) • Net barter terms of trade (price) • Opening-to-application ratio • Korea composite stock price index • Interest rate spread, five-year treasury bonds less call rate

Source: The Conference Board, National Bureau of Statistics of China, and Statistics Korea

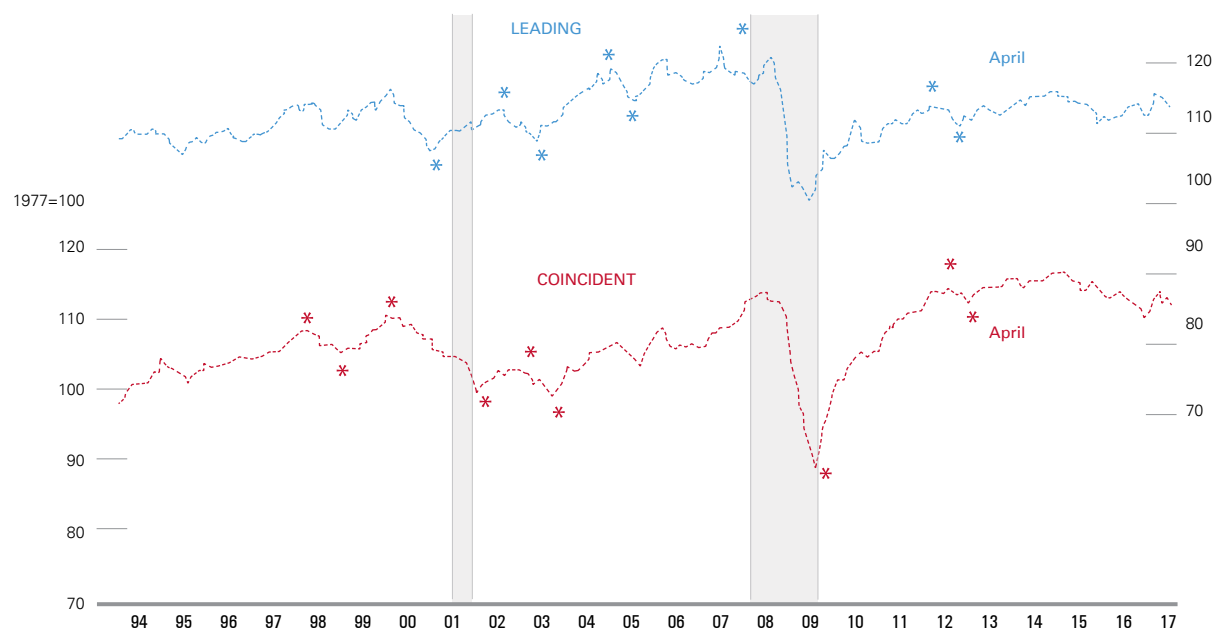
to fully understand the calculation process of course, but the numbers provided by an index can be so abstract as to make it difficult to intuitively grasp. For example, when a composite index increases from 100 to 105, is it comprehensible precisely what such a rise implies?

As the concept of economic conditions itself is vague in the general economy, certain figures in the form of an index can be meaningful for macroeconomics. In that case, would it also be useful to apply the composite index to predict particular industries rather than the general economy? At the industry level, a business survey index (BSI) of customers or producers is more widely used than a composite index. However, a BSI is simply a supplementary indicator that helps to observe the economy, and on its own it is insufficient to measure it.

Nevertheless, composite indexes are not widely used at

the industry level. For consumer goods such as automobiles and home appliances, business conditions can be measured by certain sales and production indicators, making a composite index superfluous. However, heavy industries such as steel and shipbuilding are deeply influenced by the overall economy and by the performance of related industries, so there has been an increasing demand for the development of a composite index. This article contains examples of a composite index used in the steel industry.¹

¹ For the shipbuilding industry, the Bank of Korea developed its monthly Shipbuilding Business Index (SBI) in 2012, but it has not been used continuously. The SBI applies 11 indicators: world fleet, world demolition, world orderbook, newbuilding price, the Baltic Dry Index (BDI), world seaborne trade, OECD Composite Leading Indicators, Thomson Reuters CRB Index, oil price (Dubai), US treasury bill rate (10-year), and a Volatility Index (VIX).

Figure 1. Trends of U.S. Steel Industry Indexes

Source: Re-cited from the U.S. Geological Survey

Note: Shaded areas are business cycle recessions. Asterisks (*) signify peaks and troughs in the economic activities reflected by the indexes.

Examples of composite steel index

To understand market conditions in particular industries, including steel, it is necessary to identify specialized component indicators differentiated from those for the general economy. How do respective countries develop their own composite steel indexes and what indicators comprise them?

The Steel Industry Index ²(monthly) developed by the United States Geological Survey (USGS) is a representative composite index for the steel industry. As shown in Figure 1, the Steel Industry Index is divided into a coincident index and a leading index. As of April 2017, the coincident index stood at 116.4 and the leading index at 114.3. The continuously rising coincident index and slightly falling leading index signal that steel market conditions will slightly slow.

Table 2 shows what kinds of indicators the USGS used to compile its Steel Industry Index. The coincident index includes three indicators: the industrial production index

of iron and steel products, value of iron and steel mill shipments, and total employee hours at iron and steel mills. The leading index uses nine indicators: average weekly hours at iron and steel mills, new orders at iron and steel mills, shipments of household appliances, the S&P stock index for steel companies, retail sales of U.S. passenger cars and light trucks, the growth rate of the price of steel scrap, an index of new private housing units authorized by permit, the

Table 2. Components of U.S. Steel Industry Indexes

Coincident Index

- Industrial production index, iron and steel products
- Value of shipments, iron and steel mills
- Total employee hours, iron and steel mills

Leading Index

- Average weekly hours, iron and steel mills
- New orders, iron and steel mills
- Shipments of household appliances
- S&P stock index, steel companies
- Retail sales of U.S. passenger cars and light trucks
- Growth rate of the price of steel scrap
- Index of new private housing units authorized by permit
- Growth rate of US M2 money supply
- PMI

² <https://minerals.usgs.gov/minerals/pubs/mii/>

Source: U.S. Geological Survey

Table 3. Components of Chinese Steel Industry Sentiment Index

- Crude steel production
- Steel industry fixed asset investment
- Steel mill shipment price index
- Steel exports
- Steel industry sales
- Tax on steel industry
- Profit index of steel industry
- Employees in steel industry
- Current fund for finished products
- Steel industry accounts receivable

Source: The Economic Daily

growth rate of U.S. M2 money supply, and the purchasing managers' index (PMI).

The Chinese steel industry also has a targeted monthly composite index: the Steel Industry Sentiment Index³ jointly developed by the Economic Daily Climate Index by Industry Research Center and the China Economic Monitoring and Analysis Center under the National Bureau of Statistics of China. Table 3 shows ten components of the Steel Industry Sentiment Index. Considering these elements, the Steel Industry Sentiment Index is deemed a coincident index rather than a leading index for Chinese steel market conditions.

Although numerous countries have made significant efforts to develop composite steel indexes, it is difficult to find a globally accepted index, and especially so for a leading index. One of the reasons for this is the challenge of reaching a consensus on indicators to constitute a composite steel index. Countries and steelmakers apply different key indicators that represent their unique steel market conditions well, so they may prefer to use their own key indicators to measure market conditions. As stated earlier, however, the methodology of creating a composite index cannot be easily utilized by laypersons, so they must depend on indexes

produced by multiple distinct institutions. If it were possible to make an index that was easy to understand and reflected well the market conditions by using consistent set of indicators, people at the working level could develop and apply their own steel indexes.

POSRI Steel Index: A balanced steel scorecard

As a research institute specializing in steel, POSRI has been conducting research into methodology that would be able to accurately and astutely predict steel market conditions: the POSRI Steel Index. This monthly index requires neither specialized statistical analysis nor econometric techniques. It simply emphasizes a balanced viewpoint when selecting indicators. The POSRI Steel Index aims to cover a wide range of indicators and avoid bias to any particular sector.

To achieve this goal, the POSRI Steel Index explicitly uses four sectors—the economy, steel-consuming industries, steel demand/supply, and raw materials—to reflect steel market conditions.⁴ The USGS's leading steel index seems to implicitly consider these four sectors, as depicted in Table 2. However, the index uses only nine indicators, a mere one to three indicators per sector. To the contrary, the POSRI Steel Index uses five indicators each for the four sectors, or twenty in total.

The indicators were selected based on their correlation to steel prices since POSRI considers steel price to be the coincident index that best reflects current steel market conditions. For a broad general economy, it is difficult to use only a single indicator to represent market conditions. Gross domestic product (GDP) is the most widely used stand-alone economic indicator, but this index is inappropriate for examining rapidly-changing conditions since it is estimated only

³ <http://www.ce.cn/cysc/ztpd/zszl/index.shtml>

⁴ The idea of examining steel market conditions from a balanced perspective by explicit sector is borrowed from the concept of the Balanced Scorecard (BSC), which is widely used in business administration. Indicators applied to the POSRI Steel Index are equivalent to the BSC's key performance indicator (KPI). For this reason, POSRI's initial steel index was named the "Balanced Steel Scorecard (BSSC)."

Table 4. Changes in Chinese Steel Indicators and Calculation Methodology for the POSRI Steel Index (Example)

Sector	Indicator	2016	2017			
		December	January	February	March	April
Economy	Indicator 1	+	+	+	+	+
	Indicator 2	+	–	+	+	+
	Indicator 3	+	+	+	+	+
	Indicator 4	+	+	+	+	+
	Indicator 5	+	+	+	+	+
	Sector Score	+5	+3	+5	+5	+5
Steel-Consuming Industry	Indicator 6	+	–	+	+	–
	Indicator 7	+	+	+	+	+
	Indicator 8	+	+	+	+	+
	Indicator 9	–	–	–	–	–
	Indicator 10	+	+	+	+	+
	Sector Score	+3	+1	+3	+3	+1
Steel Demand/ Supply	Indicator 11	+	+	+	+	+
	Indicator 12	+	+	+	–	+
	Indicator 13	+	–	+	–	–
	Indicator 14	+	+	+	–	–
	Indicator 15	+	+	+	+	+
	Sector Score	+5	+3	+5	-1	+1
Raw Materials	Indicator 16	+	0	+	+	+
	Indicator 17	+	–	–	–	–
	Indicator 18	–	+	+	+	–
	Indicator 19	+	+	+	+	+
	Indicator 20	+	+	+	+	+
	Sector Score	+3	+2	+3	+3	+1
Total Score		+16	+9	+16	+10	+8

Note: The detailed definitions of the indicators are not disclosed here in accordance with POSCO's information protection regulations.

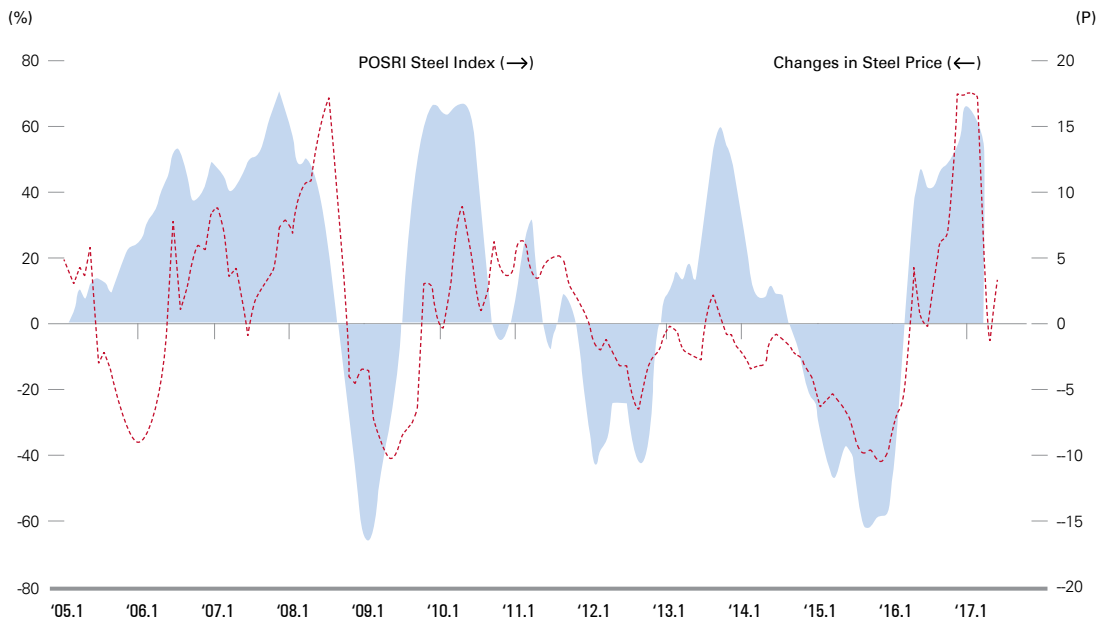
on a quarterly basis. That is why additional composite coincident indexes are required to produce a more useful measure of economic conditions. In the meantime, companies in any given industry are mainly interested in sales and profits, which are primarily determined by price variables. Therefore, price deserves to be the focus of attention. POSRI presumes that steel prices alone are sufficient to represent steel market conditions. Instead of developing a new coincident steel index, it has been attempting to identify leading indicators closely related to steel price fluctuations.

For example, in order to determine the status of the Chinese steel market, the POSRI Steel Index uses such indicators as the OECD leading indicator, manufacturing PMI, automobile production, crude steel production, steel mill shipments, and iron ore imports. The process of calcu-

lating the steel index using these indicators is simple. First, changes in indicators year-on-year (YoY) or month-on-month (MoM) are measured and scores are assigned to the indicators according to the direction. If an indicator rises YoY or MoM, +1 is added to the indicator score. If it falls, one point is taken away. Finally, the scores from indicators for each sector are combined to calculate the sector score.⁵ The maximum value for sector scores is +5 (if all five indicators rise) and the minimum value is -5 (if all five indicators fall). The combined total of the scores from the four sectors is the POSRI Steel Index. It has a maximum total score of +20 and a minimum total score of -20 (See Table 4).

Using the changes in the total scores, the POSRI Steel Index can predict steel market conditions, especially prices. The primary advantage of the POSRI Steel Index is that it

⁵ If there is a rare case of no change in indicators, '0' is assigned to the indicator.

Figure 2. Changes in Chinese Steel Price (YoY) vs. POSRI Steel Index

Source: POSCO Research Institute, Mysteel
 Note: POSRI Steel Index is a 3-months average

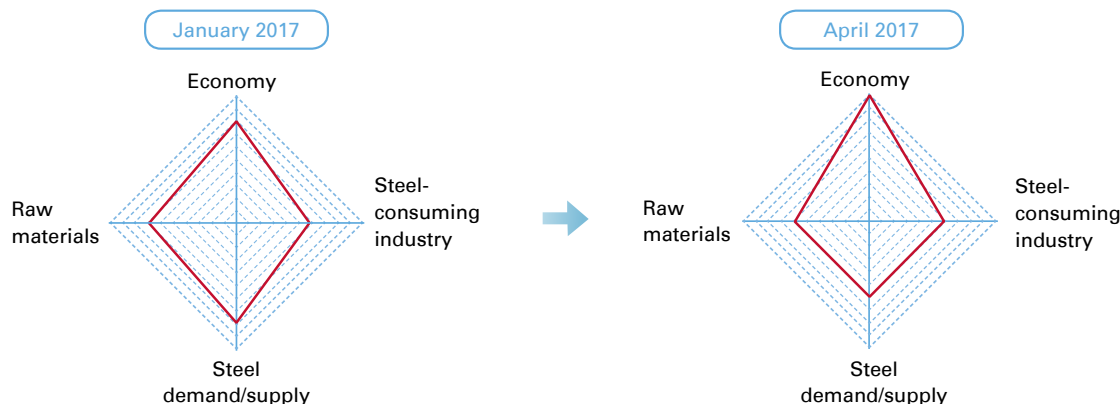
can be intuitively visualized through a comparison of changes in indicators and scores among sectors. (This is because the POSRI Steel Index is produced through a simple calculation of +1, -1, or 0.) As shown in Table 4, which examines key indicators for the four sectors in the first half of 2017, only two indicators had a negative impact on Chinese steel prices in February, but the number increases visually after March. This intuitively indicates that the Chinese steel market is likely to slow gradually in the next quarter.

The POSRI Steel Index is so simple to calculate that some might doubt its accuracy in predicting steel market conditions. In the comparison between the POSRI Steel Index and actual steel price fluctuations illustrated in Figure 2, the POSRI Steel Index moves closely with steel prices, leading by three to four months. (The cross-correlation coefficient between the two series is about 0.7.) Notably, the movement of the POSRI Steel Index from the end of 2016 to April 2017 shows that it continued to fall after peaking in December

2016 (3-month moving average), foretelling the continuous price decline that took place in China after March 2017.

Considering the simplicity of the model, this is a substantially impressive result. If it were to undergo a complex and sophisticated process like the OECD composite index, it would achieve better results. However, taking into account the advantage of the POSRI Steel Index that even laypersons can easily calculate and instantly utilize it, time- and money-intensive technical analysis would actually not bring about significant improvements.

As emphasized earlier, the most important characteristic and key advantage of the POSRI Steel Index is that it offers a balanced perspective on the indicators for the four sectors. By transforming sector scores into radar charts, the POSRI Steel Index makes it easy to compare economic imbalances and intuitively grasp market conditions. For example, score changes for the four sectors in the first half of 2017 are illustrated in Figure 3. Compared to January 2017, the score for

Figure 3. Radar Chart from the POSRI Steel Index (Example)

Note: The center of the radar chart represents -5 and the four apexes indicate +5. The larger the square, the better the economy becomes.

the economy sector increased in April 2017, while scores for steel supply and demand and raw materials sectors declined. This reflects how the demand and supply balance in the Chinese economy was recently aggravated by high mill inventory and falling exports, and coke spot prices continued to decline. This outcome suggests that the Chinese steel market is highly likely to slow after the third quarter. However, with robust scores in the economy and steel-consuming industry sectors, a sudden fall is unlikely to occur in the second half of 2017.

As explained, the POSRI Steel Index methodology is differentiated from other composite steel indexes in that it is able to track and manage indicators for the four component sectors in a balanced manner. Without the need for specialized analytical techniques, this methodology can be easily adopted in other industries. Moreover, with proper indicators in place, anyone can construct their own index. Therefore, the POSRI Steel Index may be applicable not only in the steel industry, but in other areas as well.

A need for a high-frequency index

The most important factor for improving the predictability of the POSRI steel index is finding the most appropriate indi-

cators to effectively reflect the economy. In reality, however, appropriate indicators do not guarantee high predictability, since any and all indicators include an inherent time lag. Due to the time differences in the collection of the statistics, indicators used to calculate the index are only publicly released one to two months later. Simply put, assuming that one is predicting the economy for July in June, indicators from April have to be used. This time lag is the main factor that hinders the predictability of the steel index, since it is difficult to predict what sudden changes might occur in the market over these two months.

To solve this problem, higher frequency data should be used rather than monthly data as a means to enhance predictability. For example, if the POSRI Steel Index's indicators for the four sectors used weekly data, the time lag could be better mitigated and current market conditions could be better reflected in a timely manner. In reality, however, the amount of weekly data available is considerably less than that of monthly data. Given the importance of predicting the steel market, both monthly indexes and weekly indexes should be used complementarily to enhance predictability. This would not only improve predictability, but also boost understanding of the steel market through a multi-faceted and detailed examination of market conditions. 🗨️