데이터 기반 정책을 위한 건축물 생산량 지수 개발 연구

A Study to Develop Building Production Indices for Data-Driven Policy

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Building production data is of high interest to the public and is closely related to the economy, culture, society, population, etc., of a country or region. In particular, the output of buildings is considered important, as it reflects the economic dynamics of the construction market. As such, South Korea collects and distributes data related to building production as statistics under the Building Act and other relevant laws. However, the statistics currently available are mere summaries, e.g., the area and number of buildings, with which it is difficult to understand intuitively the building production and grasp the current situation. In particular, statistics on building production are of high interest to the public, and there is a need to improve building production statistics in order to establish effective data-driven building policies. Doing so requires developing a statistical index to monitor the current situation of the building industry and view it in comparison to other sectors or over time, rather than simply providing figures. In addition, such an index should be provided in a form that is standardized and easy for users to understand. In other words, it is necessary to develop building production indices that allow the intuitive understanding of building output and determine the causes of changes in building output in comparison to statistical

indices and indicators in other sectors.

Necessity for developing building production indices and orientations

- Develop indices that allow for the clear and intuitive understanding of building output.
- Develop indices that highlight the association between the building market and policy.
- Develop indices that allow for comparisons over time.
- Develop indices that take into account building characteristics such as size, use, commencement, and completion.

The purposes of this study are to 1) develop building production indices that allow for comparison between different points of time and comparison to other indices and indicators and produce a pilot index, 2) use the pilot index for comparative analysis with other indices and indicators such as economic and demographic indices, and 3) prepare measures for sustainable production and publication of the building production indices.

Guided by these purposes, the authors aim to 1) delve into relevant theories and trends to establish the concept of the building production indices, 2) develop the index production methodology and produce a pilot index, 3) consider foundations for the production and interpretation of the building production indices to encourage their use, and 4) draw policy implications of the building production indices based on this.

In order to clarify the need to develop building production indices and set the direction for their development, we examined and analyzed relevant case studies. We reviewed previous studies of indices for the building industry and trends, domestic building output statistics and physical environment—related statistics, and overseas building statistics and indices. It is important to establish building policies based on the trends in the construction industry, and our case studies revealed that it is common to use indices to identify such industrial trends. In other words, it is necessary to produce an index to understand trends in the construction industry, based on which building policies should be developed.

For domestic building statistics and indices, South Korea publishes the building permit and commencement statistics. The data include the gross floor area and number of buildings by use, structure, building type, and project owner. These statistics are used for building administration policies and planning by building—related businesses. Indices related to building prices and finance are produced. The housing price index and the real transaction price index of apartment buildings, which are the main concerns of the public, can be considered as building—price—related indices, while the housing purchase

burden index and the housing (apartment) purchase volume index are financial indices. In addition, many other statistics and indices are produced and published, including real estate market indices such as the real estate market consumer sentiment index, the real estate market pressure index, and construction indices including the construction cost index and the construction survey index.

The international-building-related statistics and indices the authors considered included the European Union's building permits index and U.S. new home construction statistics. The EU's building permits index measures building activities per square meter of useful floor, applies a seasonal adjustment to monthly gross floor areas, and takes 2015 as the base year, which is adjusted to 100. The EU's building permits index uses seasonal adjustments to provide a month-over-month change. The U.S. new home construction statistics provide housing construction permits, commencements, and completions data. Unlike the EU's building permits index, they provide statistics and indices based on the number of housing units. They provide monthly raw data, seasonally adjusted seasonal indices, and seasonally adjusted and annualized rates.

Given these previous studies and case studies, unlike other countries, South Korea publishes statistics related to the volume of buildings but does not publish a statistical index. Therefore, it is necessary to produce a statistical index related to the volume of buildings, namely, the building production indices. In consideration of the examples of statistics and indices related to the construction industry at home and abroad, the building production indices need to satisfy the following three requirements. First, they should be easy and intuitive for users to understand. Second, they should be comparable across time and to other indices. Third, foundations should be established for sustainable and periodic production of the indices.

For the purposes of this study, the authors made an operational definition of the building production indices. The operational definition of the building production indices is as follows:

Operational definition of the building production indices

The building production indices are statistical indices that allow for the intuitive understanding of the fluctuations in building production by seasonally adjusting the sum of the monthly building permit areas, the sum of construction commencement areas, and the sum of the use approval areas along the building administration procedures, and converting them in comparison to the reference index of 100 to improve the readability of the adjusted figures.

The development process of the building production indices can be divided into four parts: the selection of raw data, seasonal adjustment, the production of fixed-weighted indices, and review of the results of the index production. The raw data for the production of the building production indices are the building administration data entered in the building administration system and the national approval statistics. The indices produced were largely categorized into "building permits," "commencements," and "completions," under which a total of 77 building production indices were selected and piloted by structure, use, and city/province.

Seasonal adjustment removes the effect caused by seasonality in the calculation of statistical indices, i.e., controlling the repeated movement of the same patterns in a yearly cycle. To allow for comparison over time, for example, month-over-month comparison, it is necessary to develop statistical indices that remove not only the effect of seasonality, but also the week and holiday effects. For seasonal adjustment, we used the BOK-X-13ARIMA-SEATS developed by the Bank of Korea. The BOK-X-13ARIMA-SEATS is a seasonal adjustment program that reflects South Korea's holidays and the resulting holiday and business day effects based on the U.S. Census Bureau's X-13ARIMA-SEATS.

A fixed-weighted index is an index produced by applying a fixed-weighting method to calculate the index at an earlier and later point in time from the reference year. In this study, we set 2015 as the reference year, the same as the EU's building permits index with the 12-month average of 2015 adjusted to 100. From 2013 to 2022, the building production indices start with 67.19 for permits, 70.97 for commencements, and 97.05 for completions in January 2013, with all three indexes averaging 100 in the 12 months of 2015, followed by a downward trend for permits and commencements and, for completions, a downward trend after a rise.

We individually reviewed the pilot building production indices. We reviewed the pilot building production indices in comparison to the EU's building permits index, compared individual indices year-over-year and month-over-month, and conducted comparison to other indices, for example, seasonally adjusted series and trend cycles.

In order to understand the meaning of the building production indices and examine the possibility and direction of use of the building production indices, we compared them to many economic and social indicators. The output of buildings is not merely an

indication of economic activity in the construction industry, but it is also associated with various socioeconomic factors. These factors are published as indicators and indexes in various sectors, and the state produces national statistics for major socioeconomic aspects. We collected various indices and indicators in different socioeconomic sectors and compared them to the building production indices piloted in this study to understand the meaning of the building production indices and examine the possibility and direction of use of the building production indices.

Cross-correlation analysis was used to compare the building production indices to other indices and indicators. Cross-correlation analysis is a correlation analysis between two time series of data, which allows us to determine whether there is a correlation between the building production indices and other indices and indicators, and if so, how much of a time lag there is between them. For the cross-correlation analysis, we used the 100 major statistical indicators of the Bank of Korea's Economic Statistics System, the 100 major indicators on the National Statistics Portal, and 12 indices related to the physical environment in South Korea.

The cross-correlation analysis revealed a lagged correlation between gross domestic production (GDP) (as a monthly percentage change) and building permits and construction commencements. They are positively correlated with GDP, with lags of eight quarters for building permits and seven quarters for commencements. In other words, an increase or decrease in GDP would be followed by a corresponding increase or decrease in commencements seven months later and building permits eight months later. We also found that among the GDP-related indicators, capital expenditures have a four-quarter lag with commencement and go side by side with completions.

We presented four improvements for the continued production and publication of the building production indices. First, the building completion statistics, which are currently not national statistics, should be approved as national statistics so that the building production indices can be produced for the completion of buildings. Second, we proposed ways to approve the building production indices as national statistics to provide a basis for the sustainable production of the indices. Third, we proposed measures to improve the table of contents of the statistical report and information contained therein to encourage the use of the building production indices. Finally, we proposed designating an organization responsible for the production and management of statistics to clarify who produces the building production indices.

In this study, we developed and piloted the building production indices and examined their utility. The building production indices have significance in three ways. First, they improve the understanding of building production. The existing monthly statistics on gross floor area were indicated in hundreds of thousands or millions of square meters; hence, they were difficult to understand intuitively. On the other hand, the building production indices we developed in this study are based on a value of 100, which makes it easier to understand intuitively whether building production has increased or decreased. Second, applying seasonal adjustment allows for comparisons between time points such as month-over-month and year-over-year. It is also possible to make one-to-one comparisons with the EU's building permits index, which uses the same reference year. Finally, they allow for comparison between building production and indices and indicators in other sectors. By doing so, we found that building permits and commencements lag GDP by eight months and seven months, respectively, based on which we suggested to take a different approach to preparing press releases to explain the statistics on building permits and commencements.

Although the building production indices have been shown to be significant in many different ways, we also found some limitations and room for improvement during the study, which warrants further study. First of all, it is necessary to verify and process input data errors to improve the building production indices. The data on building production used in the study were collected from building administration information, but there were cases where the data themselves contained errors; hence, further research is needed. In addition, it is necessary to select more useful indices among the 77 building production indices piloted in this study and examine them more in depth. It is necessary to select building production indices that reveal the relevance of current policies, or to improve the indices by deriving indices that are highly relevant to other socioeconomic sectors and can be used for policy development. Finally, the building production indices discussed in this study are related to the flow of buildings, but in the future, it is necessary to conduct research on building stock.