Box article no. 3: Constructing a Philippine Supply Pressure Index[1]

Background of the Study

Global Supply Chains (GSCs) faced supply disruptions in 2020 and 2021 as pandemic-related lockdowns hindered businesses operating in emerging market economies (EMEs) from meeting the recovering demand in advanced economies (AEs). Multiple waves of COVID-19 infections led to the repeated imposition of pandemic-related restrictions, which in turn delayed the production schedule of manufacturers and limited the operational capacity of critical logistics facilities (ILO, 2020 and Twinn, Qureshi, Conde, & Rojas, 2020).[2,3] While certain pandemic-related disruptions began to ease as economies relaxed quarantine restrictions towards the end of 2021, the escalation of geopolitical tensions in Eastern Europe and the Middle East, along with adverse weather disturbances, further exacerbated and prolonged the supply shocks initially caused by the pandemic. Consequently, this led to a reduction in the availability of raw materials, food commodities, and manufactured goods which contributed to broadened price pressures that affected AEs just as acutely as EMEs. Governments found themselves compelled to implement non-monetary interventions to address the shortfall in supply, while central banks tightened financial conditions to anchor inflation expectations and prevent second-round effects from taking root in their respective economies.

In the Philippines, the resulting shortages and subsequent increase in input prices reverberated throughout domestic industries as the backward linkages of firms to GSCs created mechanisms in transmitting global supply shocks into domestic prices (de Soyres & Franco, 2019).[4] Accordingly, the BSP has since expanded its surveillance toolkit to monitor supply-related risks that could potentially impact the formation of inflation expectations. However, available indicators at the time failed to provide a comprehensive overview of supply chain-related developments, and this prompted the BSP to develop an indicator that can quantitatively assess the supply-side pressures impacting the domestic economy.

The Philippines Supply Chain Pressure Index (PSPI) serves as an additional surveillance tool for the BSP to estimate the impact of supply-related shocks on domestic prices, second-round effects, and inflation expectations. It offers a systematic approach to analyzing supply chain dynamics by breaking down shocks into components that can be easily monitored and assessed by technical staff. Integrating the PSPI into the BSP's analytical framework will enhance the institution's capacity to monitor developments that pose risks to the inflation outlook, thereby strengthening its ability to fulfill its primary mandate of maintaining price stability.

Data and Methodology

To ensure that the PSPI adequately reflects supply shocks commonly experienced by small open economies such as the Philippines, the BSP has integrated global and domestic supply indicators into the index's structure. These indicators include inventory PMIs, domestic supply of select food commodities, global oil inventory, and world food prices. In addition, logistics indicators have been included to capture how transport disruptions affect the cost of moving goods across domestic industries and GSCs. These indicators include supplier delivery PMIs, the Baltic Dry Index, timecharter averages of clean and dirty tankers as published by the Baltic Exchange, the Drewry World Container index, and Drewry air freight rates.

The construction of the PSPI begins by obtaining residuals after regressing all indicators on the contemporaneous and lagged values of global as well as domestic new order PMIs. This process is intended to remove as many demand factors as possible from the identified indicators. In theory, the residuals should solely reflect the non-demand effects of the identified index components (Benigno, di Giovanni, Groen, & Noble, 2022).[5] Subsequently, the obtained residuals are winsorized[6] to reduce the effect of spurious outliers that could disproportionately affect the statistical analysis. The winsorized indicators are then standardized to ensure that all indicators are scaled uniformly. Without standardization, variables with larger variances would disproportionately influence the principal components, potentially biasing the results. Following this, the index was created by calculating the corresponding weight of each component through principal component analysis.[7]

Preliminary Estimates and Potential Applications of the PSPI

As shown in Chart 1, preliminary estimates of the PSPI have effectively captured notable events that precipitated supply-related shocks in the domestic economy. These events include tight domestic supply conditions resulting from weather disturbances and typhoon Yolanda in 2013; the imposition of a truck ban in Manila and ensuing port congestion in 2014; elevated crude oil inventory from 2015 to 2017 following the US shale boom; the delay of rice imports in 2018; and the impact of the rice tariffication law on domestic grains inventory in 2019. Additionally, the PSPI reflected the disruptions caused by COVID-19 lockdowns in 2020, global supply chain disruptions in 2021, Russia's invasion of Ukraine starting in 2022, and the food export bans implemented by several countries amid a global shortage of fertilizers in 2023.

Chart 1. Preliminary Estimates of the Philippine Supply Pressure Index (PSPI), June 2011 – December 2023
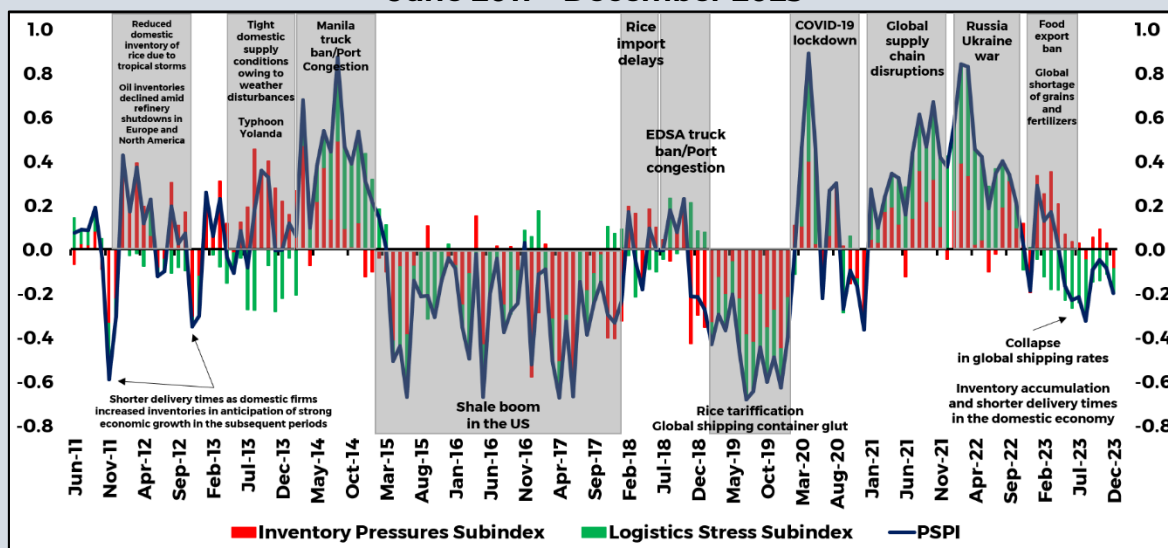
Source: DER Staff Estimates

To enhance the analysis of the current study and capitalize on the potential applications of the new indicator, the BSP will develop econometric models to quantitatively assess the impact of supply shocks—as measured by the PSPI—on key macroeconomic variables such as domestic prices, second-round effects, and inflation expectations, among others. Furthermore, the BSP intends to extend the PSPI to include supply pressures emanating from the service sector, including labor shortages resulting from demographic shifts and migration.

Endnotes:

1/ The author of this box article is Justin Jerome G. Valle of the Department of Economic Research. A full version of this study will be forthcoming.

2/ ILO. (2020). *The effects of COVID 19 on trade and global supply chains*. **International Labour Organization.**

3/ Twinn, I., Qureshi, N., Conde, M., & Rojas, D. (2020). *The Impact of COVID-19 on Logistics*. **International Finance Corporation - World Bank Group.**

4/ De Soyres, F., & Franco, S. (2019). *Inflation Dynamics and Global Value Chains*. **World Bank.**

5/ Benigno, G., di Giovanni, J., Groen, J., & Noble, A. (2022). *A New Barometer of Global Supply Chain Pressur*es. **New York: Federal Reserve Bank of New York (FRBNY).**

6/ The bottom and top 5 percent (outliers) with the 5th and 95th percentiles, respectively. This is commonly referred to as 90 percent winsorization.

7/ In essence, Principal Component Analysis is a statistical technique that measures the significance of pre-selected variables in determining the principal components of the index. It offers the benefit of evaluating the individual importance of the indicators used, ensuring that each receives a weight consistent with its historical relevance to changes in the index. A notable advantage of this method is that the more correlated a component is with the other indicators, the greater its assigned weight becomes. Therefore, a slight change in a heavily weighted component holds more significance in capturing variations within the index than a sizeable fluctuation of a component with minimal weight. **(See: Smith, L. I. (2002).** *A tutorial on Principal Components Analysis*. **University of Otago. and Holland, S. M. (2019).** *Principal Components Analysis (PCA)*. **R.)**