



## **Use of High-Frequency Indicators by Central Banks: State Bank of Pakistan's Experience and Plans Going Forward**

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*High-frequency economic indicators provide valuable insights to policymakers, including those at the central banks. Especially in stress conditions, when decisions need to be taken at quick intervals - such as during COVID pandemic, timely availability of these indicators become very important. State (Central) Bank of Pakistan also closely track the changes in these indicators for policymaking purposes. This note share that experience especially after the COVID shock and also briefly touch upon the recent data initiatives and future plans.*

### **I. Introduction**

1. Evaluating the current state of the business cycle is of crucial importance to policymakers for making effective decisions. However, economic data are often noisy and available with a substantial lag. Determining the underlying state of an economy is thus very difficult in practice as traditional national accounts data are often available on quarterly or annual basis. Realization of this data shortcomings amongst the policymakers become more prominent when the COVID-19 pandemic hit the world economy in early 2020.<sup>1</sup> The health emergency created by the pandemic led to a sudden stop in economic activity all over the world. Global supply disruptions due to containment measures were magnified by large-scale demand destruction across major countries. This effect largely caused by employment and income losses, weakening of consumer and business confidence, heightened uncertainty, contraction in global trade and especially in tourism, and behavioral restrictions like social distancing measures.

2. To overcome these data gaps during the COVID related economic disruptions, policymakers across the world – especially those at the central banks, started to closely track the changes in high-frequency economic activity indicators. This has helped them to understand the state of the economy and its near-term path. Many of the central banks also attempted to produce a composite measure of monthly economic activity using available high-frequency economic data. Indeed, some of the central banks even started to track economic activity on weekly basis though such composite indices.<sup>2</sup> However, due to data constraint issues on such very high-frequencies, most of the central banks broadly track economic activity using monthly indices. This enabled them to include a large set of variables that help make their analysis more effective.

<sup>1</sup> Although the role of such high-frequency data use is become more in-fashion after the COVID, the sort of such tracking of real-time economic activity is not new amongst the policymakers. For instance, Stock and Watson (1989) first introduced the concept of leading economic indicators to policymakers to help understand the state of business cycles. Built upon this concept, there is a large strand of economic literature emerged over the next two decades attempting to measure the economic activity at relatively higher frequencies.

<sup>2</sup> For example, see Lewis et al. (2020) and Eraslan and Götz (2020).



3. Since high-frequency data use to fill the gaps between official reporting - which is available with lags, many of the researchers attempted to predict near-term economic activity using such composite economic activity indices. The results from such exercises broadly indicate the high predictive power of such indicators that help policymakers to understand the underlying state of the economy and detect turning points in the business cycles. These are very important inputs for the policymakers at the central banks. This is because decisions related to monetary policy generally takes place at higher frequency as compared to typical changes observed in country's other key macroeconomic policies.

4. In this context, the objective of this note is to present the use and availability of such high-frequency economic data in case of Pakistan, especially from the perspective of central bank's policy analysis during the COVID shock and onwards. The rest of the note is divided into three sections. In the next section, we will discuss the inventory of data available at higher frequency to the State Bank of Pakistan. In the subsequent section, we reflect upon their usage during the COVID crisis and onwards. In the last section, we will share the ongoing future plans to enhance the central bank's data repository and also the inclusion of new methods to handle such large data for effective policymaking going forward.

### **II. Availability of high-frequency economic data to policymakers in Pakistan**

5. It is an unfortunate fact to share but Pakistan - along with Bangladesh - are only two economies having GDP size larger than US\$350 billion and yet their national accounts data is only available on annual basis.<sup>3</sup> In crisis like COVID, especially this creates huge challenges for the policymakers to get handle on underlying economic trends to make - not only timely - but appropriate economic decisions. In particular, the stakes become higher when across the world governments and central banks response to the pandemic remained unprecedented.<sup>4</sup> In Pakistan too, the combined effect of both monetary and fiscal stimulus in COVID was around 8 percent of GDP. This included the direct but targeted cash transfers to vulnerable households, which covered around 46 percent of total households in the country.

6. We started to track changes in all the available high-frequency economic indicators to understand the state of the economy and anticipated effect of the lockdowns. For example, before the COVID induced complete lockdowns introduced in Pakistan in early April 2020, the global trade activity was already started to show disruptions due to closing of major ports. To capture this effect, we closely tracked the movement in shipping containers from country's key ports. Certainly, it had helped to measure the preliminary impact of COVID on trade volumes which consequently reflected when the actual data was available. The slowdown in external trade further corroborated by high-frequency global activity indicators such as the Purchasers Manager Index (PMI) for large economies.

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<sup>3</sup> According to the IMF data, there were 44 economies in 2021 having GDP size greater than US\$350 billion in nominal terms.

<sup>4</sup> Estimates suggested that around US\$10 trillion of stimulus provided by 54 countries during the first two months of the pandemic (Cassim et al., 2020).



7. Furthermore, to understand the underlying changes in consumption and investment patterns during the lockdowns, availability of high-frequency domestic sales' indicators for major sectors like auto, cement, petroleum, fast-moving consumer goods and fertilizer proved to be quite effective for timely analysis. In addition to hard data, availability of qualitative data from the pulse surveys is another regular major input for the central bank to broadly know where the state of the economy stands and its near-term outlook. These surveys have important implications for the course of monetary policy as they reflect upon future expectations about economic trends. Especially this information become critical if the central bank's primary objective is price stability.

8. Learning from the COVID related economic uncertainty and its impact on policy making, Choudhary et al. (2020) developed several Pakistan-specific uncertainty indices based on the pioneering work of Baker et al. (2016). This work has helped in providing an effective event based analysis for many of the very-high frequency trends observed in the financial and capital markets on daily basis. More interestingly, by applying the machine-learning approaches on the night-lights and other real-time data, Choudhary et al. (2021) attempted to nowcast the gross national income, covering 147 districts in Pakistan. In the absence of traditional national accounts data, this work in progress is another useful addition to central bank's repository of tracking economic activity at relatively higher frequency.

9. Besides several hard data indicators and results from the qualitative surveys, the availability of digital data such as the google mobility indices also appeared to be very useful to detect the economic activity during the COVID peak and subsequent recovery afterwards. We see close relationship of these mobility indices with other high frequency economic activity indicators, especially those covers the areas related to consumption of consumer durables, tax collection, manufacturing and trade.

10. Overall, [Table 1](#) list down the key high-frequency economic indicators for Pakistan that the central bank regularly track for understanding the trend in economic activity.

### **III. Presentation of high-frequency indicators at the State Bank of Pakistan**

11. Since there are several high-frequency economic activity indicators from different sectors that the central bank use to track on weekly or monthly basis, their ocular representation becomes very important for the policymakers in order to extract an underlying coherent message about the state of economic activity. By looking at the recent regular reports and analysis produced by the central banks (and also other research organizations), one common way to present such large information is to make a heat map of all indicators. Through this map, one can separate the period of stress from that of progress through designated color schemes.

12. Although such heat maps proved to be very useful as they quickly reflect upon the state of economic activity, however, one needs to be careful while interpreting an underling information from such heat maps. This is because, the presence of certain outliers in any sector could relay wrong signal to policymakers. Another issue with interpretation of such



heat maps arises when there is a mix of nominal and real figures from different sectors. For example, sales indicators could be available in volumetric terms but credit figures are nominal. Thus, this generates some debate from the policy angle that whether figures should be adjusted for prices or should be reported as they receive.

13. See [Table 2](#) for presentation of heat map based on key high-frequency data available to policymakers of the State Bank of Pakistan. The table clearly shows the significant impact of COVID on various indicators during the second quarter of 2020.

14. Besides using the heat maps, as highlighted earlier and as widely reported in recent literature, another common method to look upon the economic activity at higher-frequency is to construct composite indices by employing state of the art empirical methods. Generally, two approaches are often used for these types of estimations: (i) Principal Component Analysis (PCA); and (ii) Factor-augmented Vector Autoregression (FAVAR).<sup>5</sup> However, the use of PCA method is more preferred in such analysis as one needs to reduce the dimensionality of the data while retaining as much of the original variance as possible.<sup>6</sup>

15. Taking a lead from the emerging literature, Mahmood and Asif (2022) used PCA method to make such a composite economic activity indices for Pakistan. They used twenty-four seasonally adjusted selected indicators having consistent monthly data since July 2008.<sup>7</sup> Since some indicators are available in nominal terms, we first converted those indicators into real numbers using respective price deflators. We standardized each variable so their sample mean and standard deviation should be equal to zero and one, respectively. After that we applied PCA to extract loadings for principal components. We used the PCA1 loadings to weight the composite indices as it explained more than half of the variation among the selected variables.

16. [Figure 1](#) plots the composite economic activity index for Pakistan. To compare the pre-COVID activity, we index economic activity indicator with 2019 as base year. The trend shows that the economic activity was already slow in Pakistan when the COVID hit in early part of 2019. This reflected the impact of stabilization policies that were required due to sharp widening in current account deficit during 2017-18 period. The impact of COVID was strong as the index declined by around 60 percent from the base level. However, the subsequent V-shaped recovery in economic activity appeared quite strong in Pakistan. Indeed, this is also true when compared to Pakistan's economic recovery with many regional and peer economies in the post COVID period ([Figure 2](#)). Certainly, this more than anticipated pace of economic recovery along with adverse terms-of-trade shock had made things again

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<sup>5</sup> See, for example Delle et al. (2021), World Bank (2020) and Zhang and Zhuang (2002).

<sup>6</sup> The FAVAR method is preferable when the purpose is to test a theoretical model of latent factors causing observed variables. If the goal is to simply reduce the correlated observed variables to a smaller set of important independent composite variables, then use PCA is mostly recommended. See, for example Conway & Huffcutt, (2003) and Beavers et al. (2013).

<sup>7</sup> These variables consist of sales indicators, credit and trade developments, fiscal performance, changes in capital and financial markets, and pulse surveys.



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vulnerable. This forced the central bank to raise the policy rates both quickly and with higher relatively higher magnitude over the last twelve months.

17. As highlighted earlier, in the absence of traditional benchmarks – like quarterly national accounts data in case of Pakistan, it is difficult to test the predict power of such indices vis-a-vis annual data. Notwithstanding this shortcoming, such composite indicators, however, still provide valuable information about the underlying state of the economy and its near-term trajectory. This is an important input for the monetary policymakers and also a measure to reflect upon the impact of their decisions to achieve designated policy goals.

### **IV. Use of high frequency indicators – Future plans at the State Bank of Pakistan**

18. Learning from the pandemic experience, State Bank of Pakistan is making substantial efforts to not only increase the usage of already available high-frequency data for effective policy analysis but also to produce new ones. We have recently launched a dedicated *Easy Data* portal to access huge repository of information available with the central bank. Importantly, for the first time, the amended 2021 Act empowers the central bank: ‘To collect and produce statistics relevant to the Bank's objectives and functions.’ Within the central bank we are developing key skills to integrate granular data into our policy decision making. In this regard, some of the recent initiatives taken by the central bank are discussed below.

19. We observe that the payment system data is an invaluable source of information to reflect upon underlying economic trends. In fact, recent studies have found that payment transactions – specifically data gathered from payment cards – can help with nowcasting and forecasting GDP and private consumption in the short term. So far, this data is available on quarterly frequency with large lags to the central bank. With increasing role of digitalization, we are making concerted efforts to enhance the frequency of this big data availability to policymakers and researchers.

20. Related to digitalization, we are in process of collecting huge data on prices from retail stores and shopping malls that would help us to understand the real-time trends in inflation. This will be an important input for the monetary policymakers. As highlighted above, we are also in a process of making use of satellite data as a regular feature to track economic activity at sub-national levels. This will help us design better more inclusive economic policies going forward.

21. Another important area where we investing our resources is to track labor market dynamics at higher frequency. By using state-of-the-art tools, we are working from both demand-supply perspectives to get better handle on underlying labor market trends.

22. Last but not least, within its space, the central bank is taking steps to encourage green investment in the economy. This is a new area but substantially important being the country is highly vulnerable to climate change. Over the coming years, this will require reliable data to understand the exposure of our financial system and firms to climate change risk.



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**Table 1: Key High-frequency Economic Activity Indicators - Pakistan**

Indicator	Frequency	Source
Port Traffic	Daily	BRecorder.com
PSX Index	Daily	Pakistan Stock Exchange
Google Mobility	Daily	Google
Exchange Rates	Daily	State Bank of Pakistan
Interest Rates	Daily	-do-
Government Borrowing	Weekly	-do-
Detailed Credit to Private Sector	Weekly	-do-
Import & Export Data	Monthly	-do-
Consumer Credit	Monthly	-do-
Agriculture Credit Disbursement	Monthly	-do-
Bank Deposits	Monthly	-do-
FDI/FPI	Monthly	-do-
Remittances	Monthly	-do-
Banking System Data	Monthly	-do-
POL Sales	Monthly	Oil Companies Advisory Council
Fertilizer Sales	Monthly	National Fertilizer Development Centre
Auto Sales	Monthly	Pakistan Automotive Manufacturers Association
Cement Sales	Monthly	All Pakistan Cement Manufacturers Association
Large-scale Production	Monthly	Pakistan Bureau of Statistics
Prices	Monthly	-do-
Electricity Generation	Monthly	National Electric Power Regulatory Authority
# of Companies Registered & Dissolved	Monthly	Securities and Exchange Commission of Pakistan
PSDP Spending	Monthly	Planning Commission
Water Availability	Monthly	Space & Upper Atmosphere Research Commission
Temperature & Rainfall	Monthly	Pakistan Meteorological Department
Tax Collection	Monthly	Federal Bureau of Revenue
Pakistan Railways (Passenger & Cargo)	Monthly	Pak Railways
Uncertainty Index	Monthly	Policyuncertainty.com





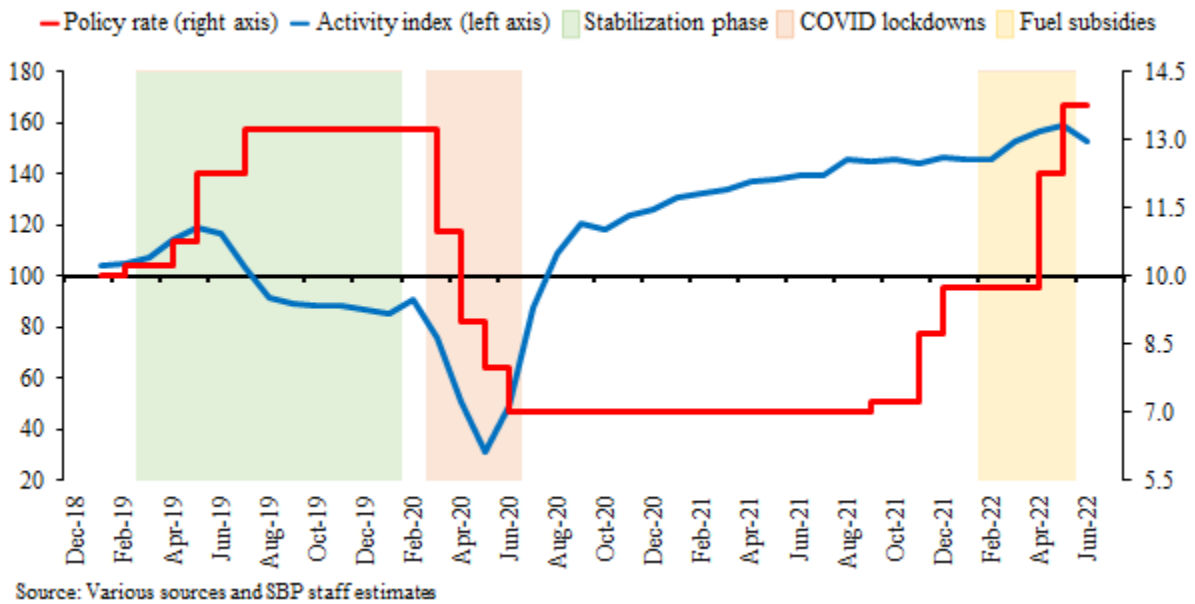
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**Table 2: Heat Map of Key Economic Activity Indicators – Pakistan**



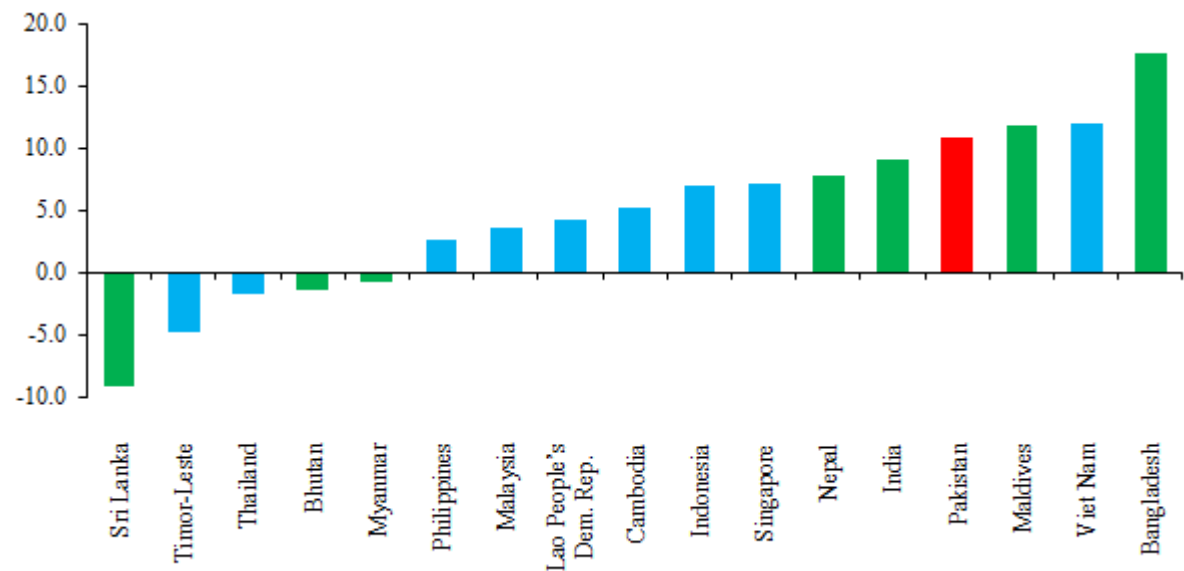
**Figure 1: Pakistan - Monthly Economic Activity Index and Central Bank Policy Rate**

(activity index, 2019=100, policy rate in % per annum)



**Figure 2: Developing Asia – Cumulative Real GDP Growth**

(% growth during 2020-22)







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