Murtaza Syed: Economic modeling and forecasting – practices in central banks

Inaugural remarks by Mr Murtaza Syed, Deputy Governor (Policy) of the State Bank of Pakistan, at the SAARCFINANCE Seminar, 6 April 2021.

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Respected speakers, delegates from SAARC central banks, ladies and gentlemen!

On behalf of the State Bank of Pakistan, it is a great honor and privilege for me, to welcome you all to this SAARCFINANCE seminar on the important topic of "Economic Modeling and Forecasting – Practices in Central Banks". In particular, I would like to extend a warm welcome to our guest lecturers, Professor Vasco Gabriel, Dr. Wasim Shahid Malik and Mr. Azhar Iqbal.

As you are all aware, SAARCFINANCE is a premier forum for regional cooperation among South Asian policy makers. Over the years, the SBP has had the privilege of hosting numerous seminars on topical issues under its ambit. In continuation of this tradition; the topic of today's seminar is both interesting and challenging, especially in the current context, when the Covid-19 pandemic has disrupted the normal course of macroeconomic data and policy making.

Ladies and gentlemen, in my opening remarks, I will briefly touch upon three areas, including the need of macroeconomic models in central banks, the evolution of such models, and current practices.

Let me begin by discussing the need for macroeconomic models for policy analysis in central banks.

Price stability is the key objective of almost all central banks, which they try to achieve through different monetary policy tools available to them. However, this can only be done indirectly through various transmission mechanisms, which are not only uncertain but also take time to work. Therefore, for an efficient application of policy instruments, central banks need to have a fairly good idea of the interplay between macroeconomic variables, the extent of uncertainty and policy lags. That is where macroeconomic models come in.

Being a forward-looking policy institution, a central bank tries to analyze trends in economic and financial variables and to predict their future path under different possible scenarios. Macroeconomic models provide the analytical framework for us to do so. These models comprise a set of behavioral equations and definitional relationships that mimic the dynamics of actual economy; and provide a laboratory for scenario analysis and forecasting.

These models are, of course, only approximations to complex macroeconomic reality; and also there is no universal model for economic analysis and forecasting which can answer all potential policy questions. Therefore, central banks need multiple models for policy advice. Some macroeconomic and econometric models which central banks use nowadays include univariate, reduced-form, simultaneous equation, state-space, semi-structural, Bayesian methods and dynamic stochastic general equilibrium models (DSGE models).

Let me now turn to the evolution of the macroeconomic models at central banks over the years.

Macroeconomic modeling experienced a paradigm shift after the general acceptance of the Lucas critique and the emergence of rational expectations theory. This in effect rendered simultaneous equation models, which were popular until the late seventies, obsolete and unleashed a revolution in the form of Real Business Cycle (RBC) theory. Lucas posited that as the behavior of economic agents adapts to changes in the economic structure, policy advice based on models becomes increasingly useless. To address the Lucas critique,

macroeconomists came forward with models that contained stronger micro foundations. This class of models dates back to 1982 and is today classified as DSGE models.

In later incarnations, a wider set of distortions and a host of shocks came to play a larger role in these macroeconomic models. For instance, the incorporation of nominal frictions in RBC theory transformed these models into New Keynesian DSGE models. The popularity of such models among central banks has grown manifold, mainly due to their ability to explain how nominal shocks can create real impacts in the short-run. Over time, these models have become workhorse policy analysis tools, especially for monetary policy advice, scenario analysis and forecasting.

Alongside standard micro founded DSGE models, central bankers also utilize reduced-form versions of DSGE models, including Forecasting and Policy Analysis System (FPAS) and Quarterly Projection Models (QPM), for policy advice and forecasting. Like DSGE, these models also serve as useful tools for shock decomposition and scenario analysis.

In terms of the use and advancement of macroeconomic models, the role of central bank researchers has been stellar in recent years. Researchers at major central banks have developed in-house DSGE models, calibrated on specific characteristics in their economies. Today many central banks, both in developed and emerging market economies (EMEs) have developed their own models and central banks in SAARC countries are no exception. Central banks in some of the SAARC countries have invested heavily in human resources and computational tools for building DSGE and FPAS models tailored to particular dynamics of their economies.

In addition to DSGE and FPAS models, central banks also make use of various small-scale and special purpose models called satellite models that help bring an independent perspective into policy formulation. Due to their ability to outperform DSGE models in short-term forecasting, such models can supplement the medium to long-term forecasting process of DSGE models.

Finally, let me touch upon some best practices of central banks with regard to the use of macroeconomic models.

Central banks usually follow a modular approach in building macroeconomic models. Initially, they build smaller models, and then gradually expand them by incorporating sectoral dynamics, rigidities and shocks. These theoretically rich empirical models can later be integrated with core models, if deemed necessary. This modular approach enables economists to understand key transmission channels and policy tradeoffs. Another major benefit in constructing such a suite of analytical tools is to minimize forecast uncertainty. In this regard several central bankers utilize Bayesian forecast combination and model averaging.

From a practical perspective, lack of high frequency data, especially on quarterly National income Accounts (NIA), restricts business cycle analysis. Several SAARC countries including Pakistar do not publish such quarterly data and this severely constrains short-run macroeconomic analysis as well as limits utility of DSGE models. To help address this issue, Nowcasting information from competing models can be used as external inputs to improve DSGE and FPAS model forecast performance over a short-term horizon. Such high frequency information could include independent forecaster’s views on output and inflation developments, expectations of the short-term interest rate and long- run output growth and inflation expectations.

Ladies and gentlemen, let me end by noting that the development of the macroeconomic models is a continuous process. Central bankers continuously tinker and enhance models by incorporating real world macroeconomic events, crises, and new computational techniques. In this context, the challenge that Covid-19 has posed in terms of economic data and modelling has no recent parallel. Predicting the trajectory of macroeconomic variables was rarely as difficult as it is today, given their dependence on health factors. Recent research proposes integrated

epidemiological and macroeconomic models to analyze the interplay between the Covid-19 outbreak and macroeconomic activity.[1] These models generally link Covid-19 and labor supply decisions to the current state of the disease progression, allowing for relevant behavioral responses that lead to multiple feedback channels.

Another area that has garnered notable popularity of late is E-DSGE (or Environmental DSGE) models. The prospect of climate change and its potentially grave impacts on economic well-being are central concerns for policymakers around the world today. E-DSGE models build on the Integrated Assessment Models (IAMs) pioneered by Nordhaus[2], to evaluate social costs of environmental degradation. Today, work on this area is in full swing. Going forward, novel models that incorporate dynamics linking pandemic and environmental conservation to the macroeconomy are likely to feature alongside unified framework models as a key tool of policy advice.

In concluding, I would like to leave you with an exciting question, motivated by the rapid strides that we have made in recent years in both computer processing power and unorthodox data collection. The question is; **as central bankers, how can we best marry insights *from big-data and unconventional real time high frequency indicators to further enrich our macroeconomic models?*** Utilizing real time information is central to effective policymaking and new real-time indicators and proxies of macroeconomic activity have proved extremely useful during the current pandemic. The logical next step would be to devise formal modeling procedures to make effective use of such unorthodox indicators as web scraping, credit card transactions data, and real time data on transportation, port activity, and the like.

Let us try to embrace this as our common challenge as we look to strengthen our modelling activity in the coming years. I look forward to insightful presentations from our experts and a rich discussion on the latest modeling practices in different SAARC central banks.

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[1] Ansah J.P., Epstein N. & Nalban V. (2020)," COVID-19 Impact and Mitigation Policies: A Didactic Epidemiological-Macroeconomic Model Approach," IMF Working Paper No. 20/233.

[2] Nordhaus (2013) has garnered considerable attention regarding climate change and macroeconomic policy.