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Capturing the Climatic Effects of El Nino and La Nina on the Economy of Pakistan

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Weather Outlook for Pakistan, December 2018

The prevailing global climate forcing, El Nino Southern Oscillation (ENSO) and Indian Ocean Dipole (IOD) are likely to stay in positive phase, whereas North Atlantic Oscillation (NAO) is expected to remain negative during the month. Westerlies are moving on their normal track. Weather outlook for December 2018, has been prepared based upon regional and global climatic conditions incorporating the climate system dynamics and analysis of the statistically downscaled General Circulation Models. Following are the main features of weather in December 2018:

- Normal to slightly above normal rainfall is expected in most parts of the country. One spell of rainfall over upper half is expected during first half of the month. Whereas two to three spells of rainfall with light to moderate intensity are likely to occur all over the country during the second half of December, 2018. However, periodical episode of snowfall may occur on higher altitudes of Gilgit-Baltistan, Chitral and AJK.

- The fall in temperatures and intrusion of cold waves may cause foggy conditions in the plain areas of Punjab and upper Sindh. Smog with various intensity may be formed occasionally in urban areas of central Punjab and Sind.

- The prevailing drought conditions in southern Balochistan and Sind may transform into drought of moderate to severe intensity. The disaster risk management authorities are required to take necessary measure for mitigation.

Note: The outlook is based upon recent climate data. The outlook will be updated on monthly basis during the first week of each month..

Spokesperson

Introduction/Background

- **El-Nino**: Anomalous rise of sea surface temperature of the equatorial Pacific Ocean causing changes the atmospheric pressure and consequently affecting global weather parameters. El Nino is known to cause drought like conditions to the South Asian region.

- **La-Nina**: The opposite condition causing Central and Eastern Pacific Sea surface temperatures to go unusually cooler. The area of warm surface waters contracts towards the western Pacific causing lower than normal air pressure which brings increased rainfall in that region (Philander, 1989)

Overview

- **ENSO** stands for El-Nino Southern Oscillation
- ENSO accounts for about 10 to 20 percent variation in world GDP growth and consumer price indices (Brenner, 2002)
- ENSO events have caused some of the world's greatest human disasters in the form of floods and droughts, which leave deep economic impacts.
- Geographically large countries may be less affected during ENSO events due to diversity and area advantage.

Summary of Literature Review

- Schoonmaker (1997) observed relationship between El Nino and unemployment in the U.S. Gas Industry. Gas demand dropped due to unusually warm weather and industry shed off employees.
- Mjelde, Hill, & Griffiths (1998) state that using ENSO information, meteorologists can collaborate with agriculture community to help determine which types of crops to select. Cotton sowing is advised for drier years whereas rice recommended for rainy years.
- Chen & McCarl (2000) compare the effects of ENSO phase information with no ENSO phase information on U.S. agriculture. The results show that about 6 to 15 % shifts occur in U.S. production and trade due to ENSO phase information. Use of ENSO information decreases world prices due to better planned production.

Summary of Literature Review

- Brenner (2002) examined the effects of ENSO on CPI and GDP growth rate of G-7 countries using Granger Causality Tests. Results show that 1 unit positive change in ENSO causes about 3.5% rise in CPI. The results further show that about 10 to 20% variation in GDP growth rate is explained by ENSO.
- Selover (2008) studied the relationship between ENSO and CPI and GDP growth rate for a sample of 22 countries of different regions. The results show a weak relationship between El Nino events and GDP growth rate for majority of sample countries. Effects of El Nino are small for countries with small agriculture share in GDP.
- Cashin, Mohaddes & Raissi (2015) study the macroeconomic effects of El Nino on 21 countries. The results show that El Nino causes a decline in the GDP of India, New Zealand, Australia, South Africa and Chile, while China, European Countries and U.S. receive positive effects from El Nino shocks. El Nino causes short run inflation in most of observed economies.

Justification

While ENSO significantly affects global weather patterns, studies have been conducted to capture its economic effects on various countries, even in neighboring countries such as India and China. However, no significant study has been conducted for Pakistan. The current study attempts to establish empirical relationship between ENSO fluctuations and CPI and GDP growth rate of Pakistan.

Southern Oscillation Index **SOI** is an index based on positive and negative variation in ENSO

Research Hypotheses

1. There is no relationship between SOI and CPI of Pakistan

2. There is no relationship between SOI and GDP growth rate of Pakistan

Data Types and Sources

- SOI is published by Australian Bureau of Meteorology on monthly basis. Current study uses SOI data of 55 years from 1961 to 2016.

- Likewise, data on CPI and GDP growth rate of Pakistan has been obtained from The World Bank website for the corresponding years.

Methodology

In first model, we test the relationship between SOI and CPI of Pakistan using Granger Causality with the following model:

$$\Delta \mathrm{CPI}_t = \alpha + \beta \mathrm{CPI}_{t-1} + \gamma \mathrm{SOI}_{t-1} + \varepsilon_t$$

In second model, we test the relationship between SOI and GDP growth rate of Pakistan using Granger Causality with the following model:

$$\Delta \mathrm{GDPgrw}_t = \alpha + \beta \mathrm{GDPgrw}_{t-1} + \gamma \mathrm{SOI}_{t-1} + \varepsilon_t$$

Results and Discussions

The first thing to be kept in mind while discussing the results is that we are trying to establish relationship between weather and economic indicators *keeping all other factors constant* which otherwise directly affect economic activity. Therefore, theoretically, we are ignoring the effect of some significant variables hence we should not expect strong relationships.

However, we need to identify whether the currently studied weather indicator (SOI) significantly links to economic variables, or not.

Results and Discussions

Relationship between SOI and CPI of Pakistan for the years 1961-2016

- Granger Causality (1 lag) P-Value: 0.001
- Correlation Coefficient: 0.297

Source: World Meteorological Organization

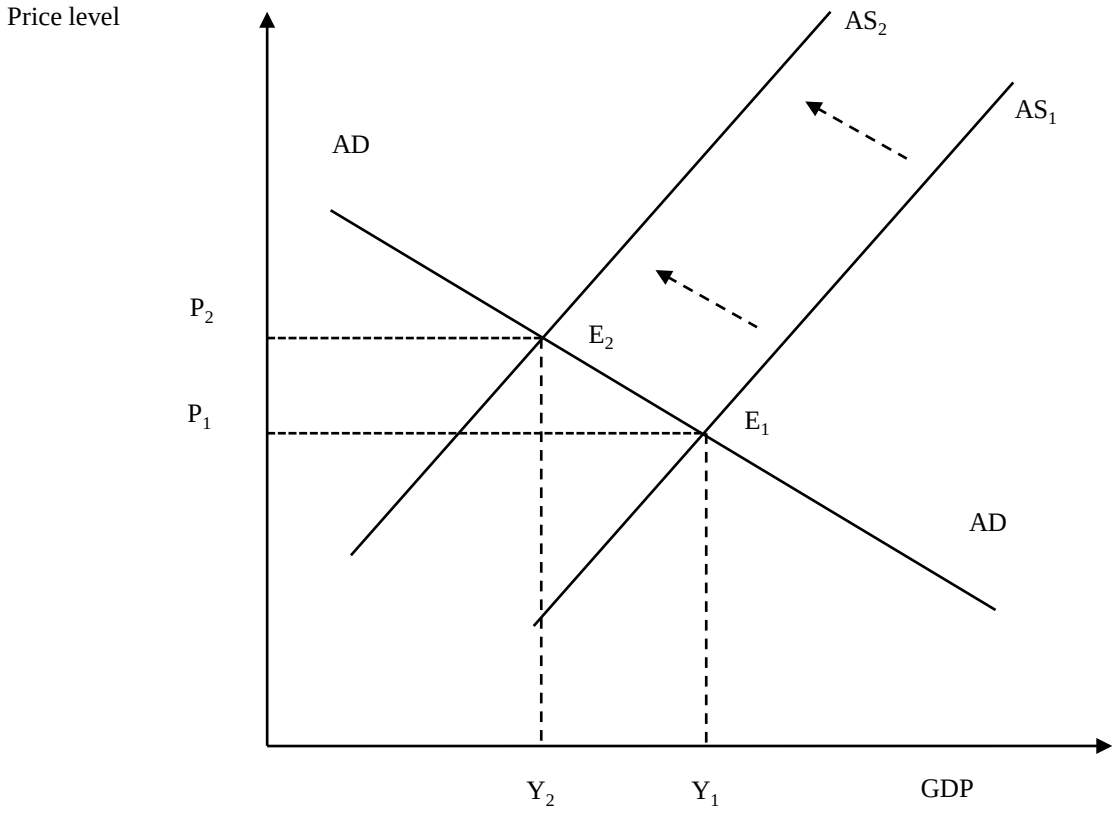
Results and Discussions

Relationship between SOI and GDP Growth Rate of Pakistan for the years 1961-2016

- Granger Causality (1 lag) P-Value: 0.021
- Correlation Coefficient: -0.139

Source: World Meteorological Organization

Results and Discussions



Results and Discussion

The study empirically establishes relationship between ENSO & CPI and ENSO & GDP growth rate of Pakistan. Results show that In short run, La Nina events cause increase in general price level of Pakistan due to cost push inflation. Crops, sensitive to rain and moisture, are damaged and hence their supply is discontinued. Production of manufacturing goods is also halted. Poor road infrastructure further causes discontinued supply of even essential goods, such as food and fuel. International trade gets effected due to discontinued flights. All of these disasters cause a contraction in aggregate supply leading to increased prices and retarded GDP.

Conclusions

In the light of results, we are bound to believe that dryer El Nino weather is favorable to our economy. However, if we carefully watch the calamities related to La Nina weather, we will be able to mitigate its adverse effects on our economy and eventually take advantage with the following measures:

- Forecasting ENSO information to agriculture community could lead to better crop selection and hence better yield.

- Broadcasting ENSO forecasts to all important sectors of economy may lead to desired objectives

Conclusions

- Construction of big water reservoirs is essential to prevent flooding events and cater for water needs during drought like conditions.

- Better infrastructure to cope with notorious weather events, to ensure smooth supply of goods and services

- ENSO may be included as a variable while modelling major policies of the country, especially economic policies.

Future Research Recommendations

- To study relationship between ENSO and major crops production in Pakistan
- To compare the effect of ENSO information with no-ENSO information on crop selection
- To compare the effect of ENSO amongst neighboring countries of Pakistan


Thank You

Feel free to contact:

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