Research Diary

COVID-19 and its Impact of Indian Financial Markets

KID: 20200114

The financial markets of India have experienced excessive volatility during the present pandemic period. The Indian stock market index, SENSEX, crashed from 40,000 points to 25,980 during March. Similarly, Indian Rupee depreciated from 72.2 to 75.3 against USD. This is the month in which COVID-19 was announced as a pandemic by the WHO. Due to the increased number of COVID-19 infections in India, the Govt. announced lockdown in the county from March 25th to May 3rd. The foreign exchange market experienced higher volatility, especially in March (Fig.1). This deprecation pressure on Rupee against USD led to the liquidity crunch in the domestic money market, as the interbank lending rate is also experienced higher volatility during March. The RBI intervened in the foreign exchange market by selling USD to stabilize the exchange rate. In this context, the present research addresses various issues related to financial markets in India, such as the stock market volatility, exchange rate volatility, and the role of central bank intervention.

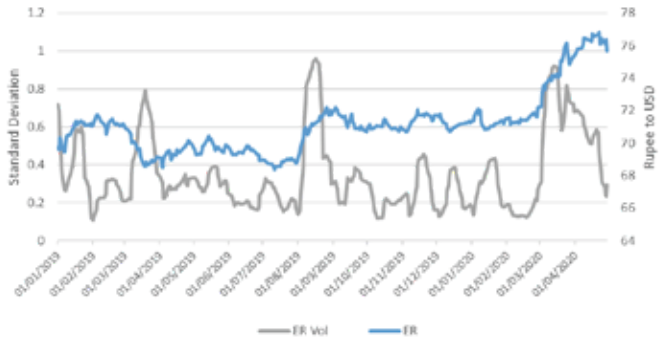

Figure 1. Rupee-USD Exchange rate and its volatility

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In silico engineering of putative epitope peptides from proteins of SARS-CoV-2 on nano-particles to develop potential vaccine candidates

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There are two ways to defeat the current COVID-19 pandemic that the world is facing, one is to get an impeccable drug and second is to emerge with a potent vaccine. Virus-like particles (VLPs) or protein cages are potentially safer vaccine candidates as these multiprotein structures mimic the native viruses but lack the viral genome. These self-assembling protein nanoparticles can effectively be combined with the emerging discipline of structural vaccinology complemented with the design of protein cages. Engineering of protein nanoparticles fused with foreign antigenic epitope is promising and, also emerging vaccine technology against both infectious and non-infectious diseases. Computational approaches have been used to minimize the time and maximize the success of rational engineering of vaccine antigens on protein nanoparticles. Protein nanoparticles engineered with vaccine antigen have advantages over pure vaccine antigen: (a) can simultaneously display diverse and multiple antigens, (b) can present antigen/epitopes in a particular pattern that mimic pathogen surface, for robust immune response. In addition, can tailor immune responses by modifying the nanoparticles.

One of the main limitations of using protein nanoparticles as a vaccine platform is that only a negligible number of foreign peptide or antigenic epitopes can be successfully fused into nanoparticles that can correctly self-assemble. Another major concern is, generation of genetically conjugated nanoparticles with peptide epitopes, and testing their ability to assemble through experimental studies, since its laborious and, also less economically feasible.

Computational tools can be used to predict suitable nanoparticles, site on the particle for antigen insertion and, also to tailor the antigen to fit the region of the nanoparticles. We plan to use computational tools to select the appropriate protein nanoparticles and also to engineer multiple and multivalent peptides antigens of SARS-CoV2 virus on nanoparticles to develop potential vaccine candidates against COVID-19.

Research Diary

Further, we want to genetically engineer these chimeric nanoparticles carrying antigens of SARS-CoV2 virus in E. coli bacteria which will be used as a factory to produce the antigenic protein nanoparticles. Finally, we plan to take the snapshots of chimeric nanoparticles using transmission electron microscopy to know whether these nanoparticles assembled correctly and also whether the antigen of SARS-CoV2 virus got stably assembled on the nanoparticle.

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Developing Smart accessories for control and mitigation of infectious organisms

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A commercially available polymer has been engineered under specific conditions to obtain a particular phase that could be of potential use to control and mitigate infectious bio-organisms under small DC-voltages. The proof of concept clearly shows that it works very well for Staphylococcus aureus a commensal bacteria that affects the upper respiratory tract and skin. The testing of these polymers for their antiviral characteristics using non-pathogenic viral strains are under progress. Further, the films will be potentially tested for their activity against COVID-19 in collaboration with CSIR-CCMB, Hyderabad. The processing used in this work is scalable and suitable for large scale production. This could potentially be used as a personal protective accessory for the frontline health care workers and for patients to prevent/control the spread of infectious organisms. These films could also be used in air purifiers, ACs etc. to mitigate viral load in quarantine zones/isolation wards.

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