## Virtual seminar on Stress testing in COVID times

## Opening Remarks
**Stress Testing in COVID Times**
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- Welcome to the Seminar on Stress testing in COVID times that CEMLA co-organizes with the Financial Stability Institute (FSI). It is always a pleasure to collaborate with the Bank for International Settlements (BIS).

- First, I would like to thank Patrizia Baudino and her team from the FSI for their kind collaboration in organizing this seminar. Ms. Baudino's expertise and reputation in the field contributed immensely to form a comprehensive program. Allow me also to thank Carola Müller and Serafín Martínez Jaramillo from CEMLA, who worked very hard on this endeavour.

- Given the excellence of today's and tomorrow's speakers, I am confident that we will have a fruitful exchange of ideas and knowledge. As co-organizers, we at CEMLA are indebted to our invited speakers for the time and effort they have invested on this event. I therefore would like to thank our colleagues Ms. Pamela Cardozo from the Banco de la República in Colombia, Fabrizio Lopez Gallo Dey from Banco de México, and Juan Francisco Martínez from the Banco Central de Chile for their support. Also, our external guests, Mr. Burgess, Mr. Kok, Mr. Monzon and Mr. Guerrieri. Thank you very much for taking the time!

- CEMLA sees stress testing as an **extremely important** topic for our Membership. That is why stress testing recurrently appears on our agenda, such as the X Meeting of the Heads of Financial Stability held online in September 2020 and the II Course on Financial Stability, which was also held online in November of 2020. Furthermore, we will continue to promote initiatives in the coming years, possibly, involving future research projects.

**Stress test in COVID times**

- Please let me share some thoughts about the seminar's topic: Stress tests in COVID times.

- Stress tests are a useful tool to inform policy makers about the resilience of the financial system to shocks. As we know, the worst shock since the Global Financial Crisis (GFC) has materialized. The COVID-19 pandemic has put much of economic activity on hold around the world, with detrimental consequences for individuals, firms and small businesses that are reaching out to the public sector for help. The course of the pandemic has been hard to predict and, even now, with vaccines arriving in many countries, new strains of the virus threaten the outlook for a return to normal, if we can ever talk about normality again.

- So far, it seems that the financial sector, with the support from governments and central banks, has played a mitigating role in softening the eminent threats to businesses and households. Banks were able to continue lending and liquidity did not dry up despite the mounting uncertainty in financial markets, especially in the first few months of 2020. It must be emphasized that the financial sector was able to maintain this positive influence mainly due to prompt and powerful policy measures.

- Besides the implementation of needed fiscal policies in many countries that have helped the real economy, central bank monetary and macroprudential policies have been crucial to keep the financial system afloat. Emergency liquidity provision measures, as well as regulatory forbearance, considerably eased conditions in financial and lending markets. In addition, the improvement of macroprudential frameworks in the last decade, including the implementation of much higher capital buffers and liquidity standards and of stress tests, prepared financial institutions to weather crises much better than before the Global Financial Crisis.

- However, the COVID-19 crisis is far from over. Hence, the jury is still out on this. Medium-term consequences of extraordinarily loose monetary policy, forbearance measures and deteriorating quality in loan books are but a few of the topics that will deserve careful attention in the coming months and probably years.

- The harsh realities of the crisis so far have already proven to be much worse than many adverse scenarios that policymakers could have foreseen and asked their banks to prepare for through stress testing.

- Now, as stress test methodologies have developed significantly in the last few years, we believe that **they can now be very useful**. Among the many macroprudential tools, stress tests might be the only one to shed some light on the pressing question for financial stability: Will the financial system be resilient to the evolving COVID crisis?

- We all know that, based on certain scenarios, stress tests help quantify the ensuing **risk**. However, it is fair to say, **uncertainty** remains and cannot be easily resolved. We are all familiar with the Knightian distinction[1] between uncertainty and risk, but its implications for stress testing seldom receive the attention it deserves, that is, until a crisis such as the present one erupts. This is particularly relevant today, as central banks and other financial authorities will need to analyze and think through possibly fundamental and/or structural changes to the economy, the labor market, inflation and the financial system.

- The forward-looking nature of stress tests gives them unique value in the macroprudential policy mix. Nevertheless, the usefulness of its findings is subject to the credibility of the different inputs it uses. In this context, the choice of the adverse scenarios with which to stress the system is crucial.

- And this is where, I think, things get a little tricky. Usually, the different stress testing models or methodologies take certain macro scenarios as given, possibly resulting from some structural

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[1] Frank Knight (1885–1972), economist from the University of Chicago and one of the founders of the Chicago School, distinguishes risk as "a measurable uncertainty" from "true uncertainty" in his work "*Risk, Uncertainty, and Profit*" (1921).

macroeconomic and/or VAR models. That is, the sets of macro scenarios/assumptions are coherent forecasts or simulations resulting from a certain view of how the economy functions and how it responds to shocks, that is, for a certain structure of the economy, the one embedded in the macro model. Once these assumptions are made available, they serve as inputs for the stress tests.

- Ideally, the complete exercise should be run simultaneously, that is, both the macro and the stress testing models should be part of a single, comprehensive general equilibrium model, where the response of financial institutions should feed back into the macro model.

- Merging a macroeconomic model with a detailed model of the financial system can be very complicated, as models can become intractable very quickly and it becomes difficult to understand what is going on and, thus, difficult to use for policy purposes.

- But this is not where it becomes tricky, as I referred to earlier. Let us concentrate first on the macro side. It is highly probable, as most of you have already thought it through, that the structure of economies will change in important ways as a result of the pandemic. There will probably be significant market reallocations, resulting from changes in relative prices. Indeed, some sectors that previous to the pandemic were profitable, won´t be so anymore, as well as some that weren´t, might very well turn out to be so. Take the oft cited case of the hospitality industry.

- Not only will there be a reallocation of resources among sectors, there will also be a reallocation in some markets across the board. Take the labor market, where it is highly probable that home office working, as well as automation, will become much more prevalent.

- Finally, there will also be a need by many firms and households for balance sheet repair. In particular, firms will be behaving differently than in normal times while this process of financial healing takes place.

- This takes me to the other part of stress testing, modelling the financial system. With an important need for resource reallocation, as well as for balance sheet repair, it is also probable that there will be changes in the way financial institutions respond to various shocks. Think of financial risk assessment and management.

- When the economy finds itself at a certain state, let´s call it equilibrium, that is, if it is operating under a certain structure, then how financial institutions react to shocks would not vary much through time. But when the structure of the economy and the labor market, as well as the response of financial institutions to certain shocks is changing, that can be very challenging for stress testing.

- In effect, in order to assess the resilience of the financial system, one of the biggest challenges now is not necessarily exploring tail events for the design of base and adverse scenarios that come from a certain view of how the economy operates, think of it as a particular, high-dimensional joint density function. The main challenge comes from, I believe, the fact that such joint density function is changing and that, in some cases, it´s changing in ways that are hard to foresee.

- Consequently, **scenario design** has moved back into the spot light of policymakers' attention. Therefore, **our first session** focuses on the challenges to design Covid-19-related economic stress events, setting out from a model of an economy that is significantly changing.

- In this context, forecasts or simulations of the main macro variables to be used as inputs in stress tests have to be taken with careful consideration, especially for forecasts further out into the future. Indeed, this should be so not only because of the usual reasons that forecast variance increases with the forecast horizon, but because there is a higher degree of uncertainty related to the workings of the economy the further out in time we want to conceive scenarios for.

- For their part, central bankers and academics have worked very hard on ingenious solutions to working with (or around) a high degree of uncertainty. This has led to promising new approaches for stress test related scenario design that go in that direction, of which I will name here three:

  - ✓ First, new computational methods and models have paved the way for efficient algorithms that solve risk models for a myriad of scenarios at once. These methods allow automated **reverse stress testing**[2] (Flood and Koreko, 2015; Baes and Schaanning, 2020; among others). Reverse stress tests systematically search for scenarios with severe impact that yet are based on plausible joint risk factor distributions. For example, the Bank of England implemented a reverse stress test to gauge the resilience of UK banks to the COVID crisis last August (FPC Financial Stability Report, August 2020).

  - ✓ Second, new advances in forecasting methodologies that emphasize the forecast density open doors for the calibration of scenarios that lean on **forecast distribution tails**. Among these, the concept of Growth at Risk developed by Adrian, Boyarchenko, and Giannone (2019) stands out as one that incorporates macro-financial linkages. Alternative approaches use multivariate copulas (Bassanin and Rancoita, 2019), or structural VAR models (Antolín-Díaz, Petrella, and Rubio-Ramírez, 2020).

  - ✓ Third, the immense uncertainty during the COVID crisis has spurred innovation in nowcasting with a focus on **nowcasting tail risks** (Carriero, Clark, and Marcellino, 2020; Schorfheide and Song, 2020). Nowcasting proved important not only for policy decisions, but also for designing stress test scenarios "on the fly", as many central banks conducted stress tests under considerable time constraints in the last months.

- All in all, I believe that there is a need to incorporate robustness into scenario design for stress testing purposes. In my view, robustness aspects in stress testing haven't been fully explored, with the exception of Bidder & McKenna (2015). The research on this field is still incipient. In

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[2] In reverse stress tests, the analysis begins at banks' exposures and tries to find those scenarios to which a bank is most vulnerable.

their work, the authors use robust forecasting to design adverse scenarios that are built from a pessimistic version of a benchmark forecasting model.

- The above scenario design methods are developed with the common aim of finding systematic and reasonable ways to address uncertainty. **Knowing, understanding, and advancing these approaches is important for policymakers, since being aware of uncertainty is crucial for policymaking**.

- In effect, hand in hand with robust scenario design should come robust policymaking. That is, even though, by definition, it is very difficult to address uncertainty directly, policy making has to incorporate or acknowledge that it is present (and perhaps in various ways).

- A key question is, thus, how could stress test results be used for macroprudential policies? In effect, when faced with a high degree of uncertainty, we -as policymakers- have to ask ourselves, how much trust should we have in our own calculations?

- The answer depends, for me, largely, on three points:

    ❖ First, on the confidence put in the underlying scenarios and numbers, that is, on a subjective component that can never fully be eliminated from our beliefs about the future.

    ❖ Second, on the understanding of the methods and processes that produce the results. A solid knowledge about the potential, as well as limitations, of certain methodologies is essential to formulate a confident policy stance. For example, in the former case, advances in computational techniques and modelling allow for a more comprehensive and exhaustive exploration of future scenarios; namely, through agent-based models, contagion models, and integrated frameworks for solvency and liquidity stress tests (Martínez-Jaramillo et al, 2010; Cont et al., 2020; Bjørland and Kockerols, 2020).

    ❖ Thirdly, as I mentioned previously, in times such as the present ones, robust scenario design and robust policy making should be considered.

- Before concluding I would like to comment on a very interesting initiative developed at the Centre for Risk Studies from the University of Cambridge Judge Business School. I am referring to the Scenario Suite, which comprises scenarios of business risks that can be used on stress testing.

- Among the many types of risks presented there, I found interesting the following ones: disruption of business activities from extreme weather, cloud outage, global property price crash, Middle East conflict, contagious malware infestation, *highly infectious virus outbreak*, large data exfiltration, animal epidemic in supply chain, rapid consumer shift to online shopping, Eurozone meltdown, fake news and negative media, consumer shift to sustainable products, to name just a few.

- Perhaps, we as central banks should be looking at such taxonomy of risks, regardless of their probability, severity or hardness to map their relationship with the financial sector and the broad economy. I would even say that, after the pandemic, some of such risks look less distant now than they use to be.

- **Tomorrow's session** will focus on stress testing methodologies. Especially, it is important to debate what kind of adjustments have to be made to stress testing in order to capture the unique impact of the COVID crisis. I expect the discussions in this seminar will contribute to our understanding of stress testing in COVID times and help respond to the uncertainty we face in a sensible way.

**Concluding Remarks**

- I will now conclude by wishing you a constructive and interactive seminar. It goes without saying that you should feel free to approach us as we will be willing to accompany you on stress test related projects. Thank you very much.

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