TW3421x - An Introduction to Credit Risk Management

Stress Testing

and Scenario Analysis

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Week 7

Lesson 2

Introduction

- A **stress test** is an procedure meant to determine the ability of a given financial institution to cope with an economic crisis.
- The idea is to verify if a bank, or another financial institution, is able to deal with credit risk in case of very **bad economic conditions**.

Questions

- Typical questions a bank has to answer when performing stress testing are for example:
  - **What happens if** interest rates increase by at least $x\%$?
  - **What happens if** recovery rates on a given type of loans decrease by $y\%$?
  - **What happens if** the correlation among defaults increases?
  - **What happens if** systemic risk increases, thus increasing the PD of all counterparties?

Use

- Stress testing has become increasingly important.
- Under **Basel III**, stress testing is a regulatory requirement for large international institutions, which must prove to have **adequate capital allocation levels** to cover potential losses due to extreme - yet plausible - events.
- Stress testing is based on the so-called scenarios.

Scenarios

- A **scenario** is simply a given configuration of parameters and variables, according to the model we are using to assess (credit) risk.

- A scenario typically includes unusual values for macroeconomic quantities such as interest rates, inflation rates, unemployment rates, volatility, etc.

Tools

- Stress testing is performed using computational and statistical tools, such as **Monte Carlo simulations**, **sensitivity analysis** and **extreme value theory**.

Example

- Assume that for estimating the PD of a counterparty (and hence capital requirements under the F-IRB approach) we use Merton's model (Week 5), so that the 1-year probability of default of our counterparty is

$$P(V_1 \leq B) = \bar{\Phi}\left(\frac{\log(V_0) - \log(B) + \left(r - \sigma_V^2/2\right)}{\sigma_V}\right)$$

Example

- Assume today r=0.02, V_0=22, B=16, σ_V=0.2. Then

$$P(V_1 < 16) = \bar{\Phi}\left(\frac{\log(22) - \log(16) + (0.02 - 0.2^2/2)}{0.2}\right) = 0.0557$$

- A simple scenario is to assume that σ_V increases to 0.5, or 0.8, or even 1.0.

Example

- According to these values of σ_V, the PD changes to

$$PD_{\sigma_V=0.5} = 0.3347$$
$$PD_{\sigma_V=0.8} = 0.4908$$
$$PD_{\sigma_V=1} = 0.5642$$

- A bank then decides if it is ready to cope with such extreme cases, by computing the capital requirements under these scenarios.

- The regulator typically decides which scenarios need to be taken into consideration, when determining capital allocations.

More complex scenarios

- Naturally we can also think of more complex scenarios, in which more parameters change.
- This is typically what banks do, using complex computer programs.
- But the intuition is exactly the same.

How are scenarios produced?

- Scenarios may be produced on the basis of:
  - Historical evidence.
  - Expert judgments.
  - Decisions of the regulator.

Stressed Measures

- Another way of performing stress testing is to use the so-called stressed measures of risk.
- These are the same measures of risk we have seen together, but we use them in more “extreme” situations.
- A simple example is the Stressed VaR.

Stressed VaR

- Developed for Market Risk, Stressed VaR (S-VaR) is now increasingly used in Credit Risk as well.
- The computation of S-VaR follows the rules of VaR (Week 3), but we only consider the worst losses, the worst scenarios.

Stressed VaR

- Typically we consider the worst 50% losses (the largest ones), and then we compute a VaR at level α.
- Let's consider a simple example in R.

Thank You