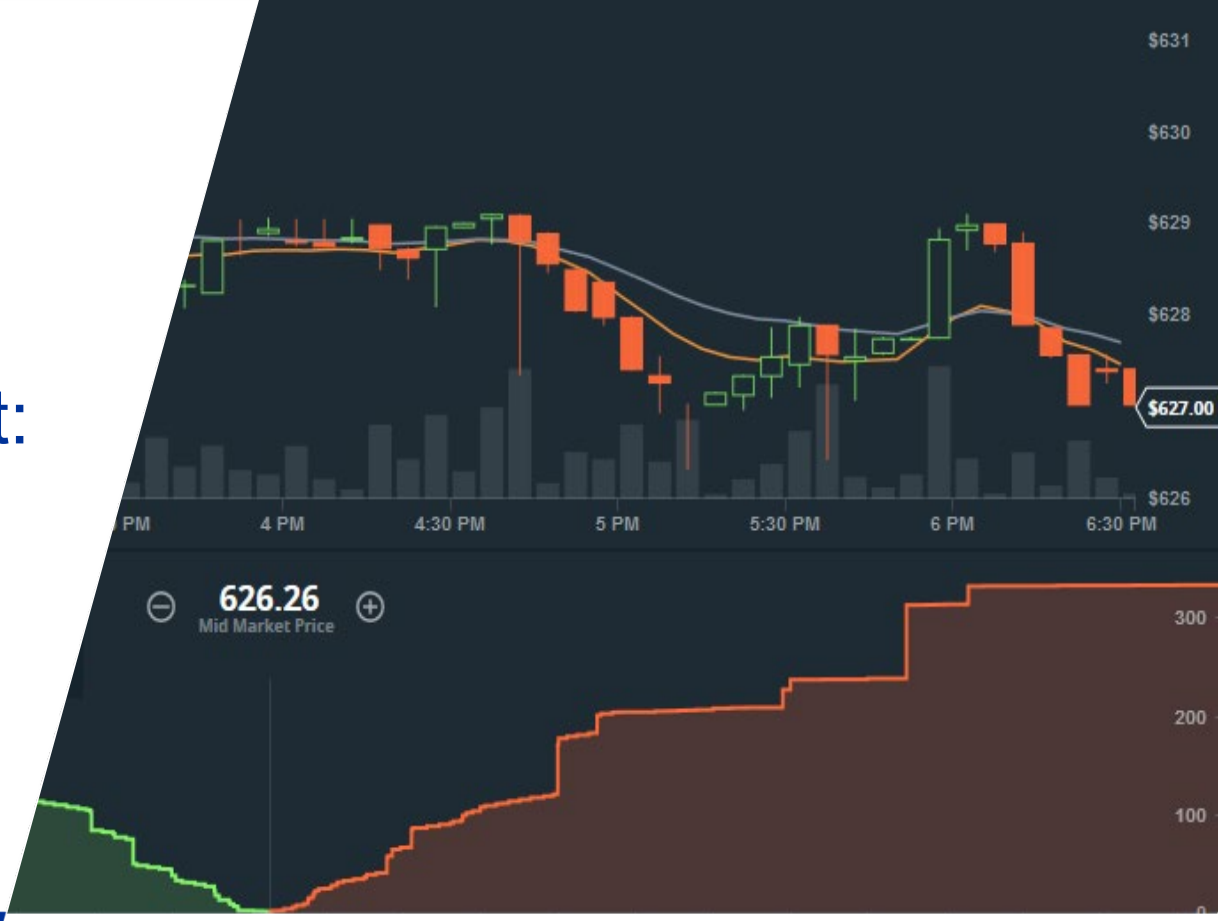
EUROPEAN CENTRAL BANK

EUROSYSTEM

Contagion from market price impact: a price-at-risk perspective

FSB Workshop on systemic risks in NBFI



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Disclaimer

The views expressed in this presentation are those of the authors and do not necessarily represent the views of the European Central Bank and the Eurosystem.

Why do we care?

- Agents' **overlapping portfolios** can provide a channel of *contagion*
- The **risk** stemming from this channel cannot be taken into account by any counterparty in the system: the regulator can capture the full picture
- In crisis situations, modelling of **asset deleveraging** requires a *notion* of **price impact – important for NBFI**

How to model price impact?
Quantile regression

Expanding the standard model: calibrate a wider range of impact severities levels, while keeping the converging nature of the exponential function.

$$R(v)^q = \beta_0^q(1 - \exp(-sV)) + \beta_1^q R_{sys}$$

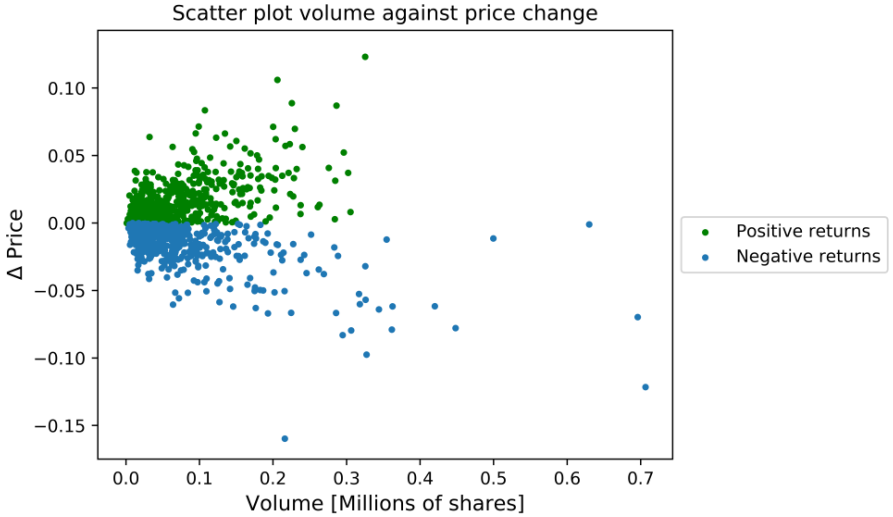
where $s = \frac{\lambda}{\beta_0}$, from which we can derive λ, and q is the estimated quantile.

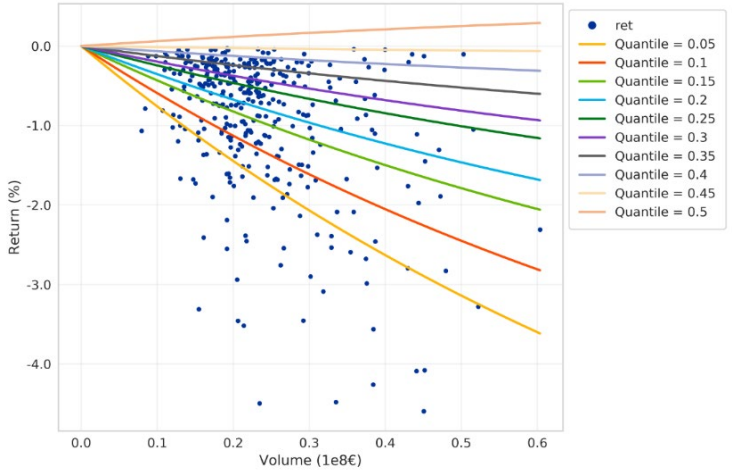
Furthermore, a system-level component R_{sys} has been introduced to account for price changes due to changes in the market.

References: Adrian, Brunnermeier CoVaR (2016), Engle, Manganelli CaViaR (1999).

Visualization of price calibration on empirical data

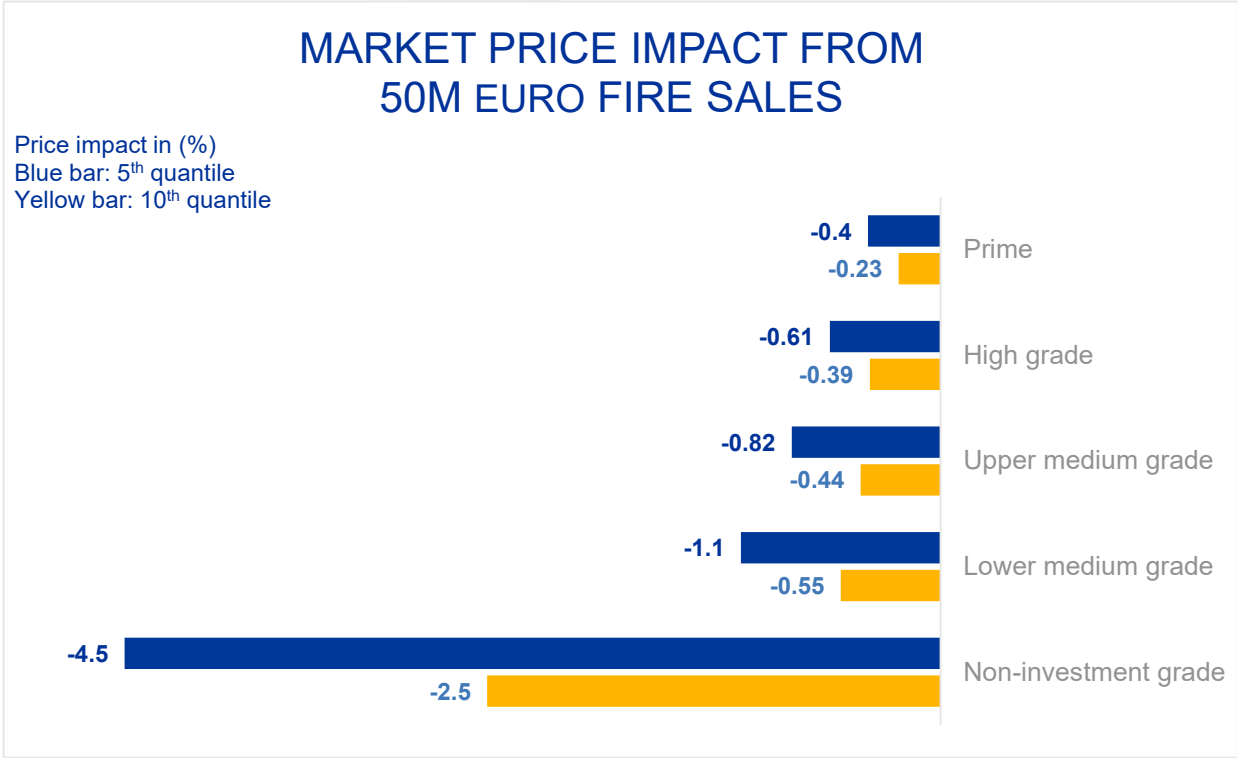
- Empirical data shows that returns diverge as volumes increase (lhs chart).
- A quantile regression approach on the negative impacts allows to evaluate risk at different intensity levels (rhs chart)





Source: Refinitive (Eikon)

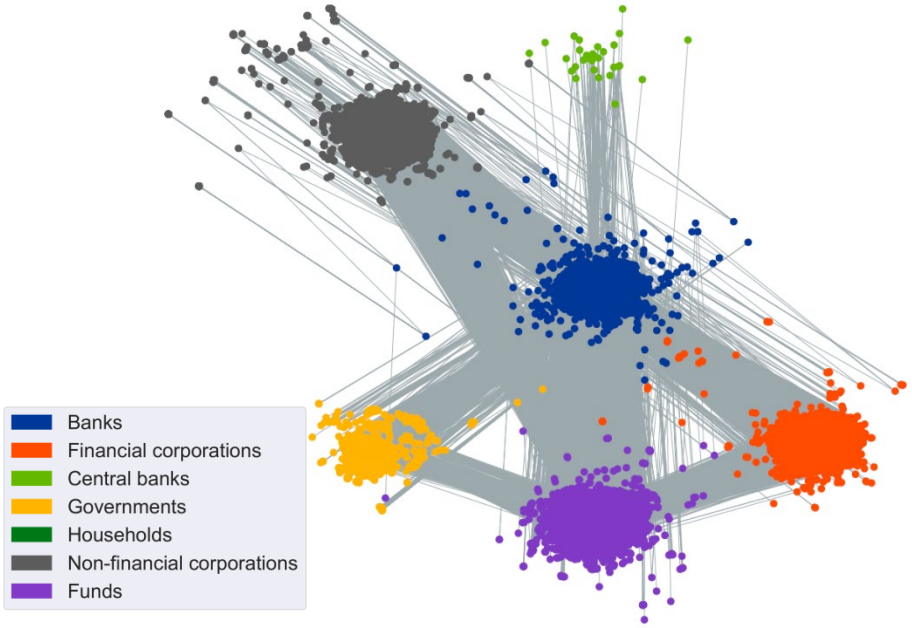
Price-at-risk: Bond-level impact



Fire sale simulations - Overview

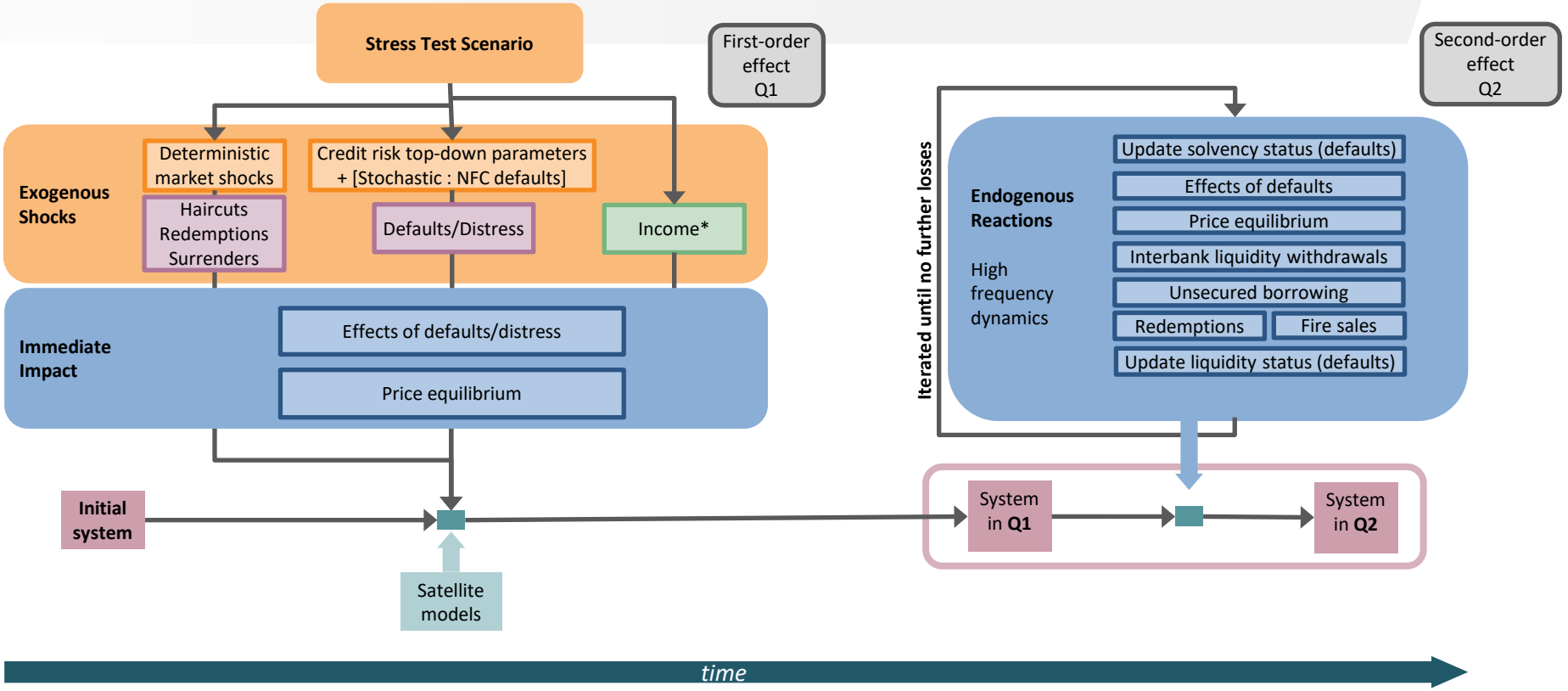
- **Using SWST model** (Sydow et al., 2021) for the system of banks and investment funds
- **Driven by liquidity shortfalls:** banks/funds cover their liquidity shortfalls by selling their tradable assets
- **Pro rata approach:** amounts sold are proportional for all securities held
- **Price equilibrium:** price impacts re-calculated until no further change in market values of holdings

Securities holdings



An edge shows that a bank/fund holds assets issued by another entity in a given sector. Granular securities data are covering 7% of total bank assets.

Fire sale simulations - Modelling framework

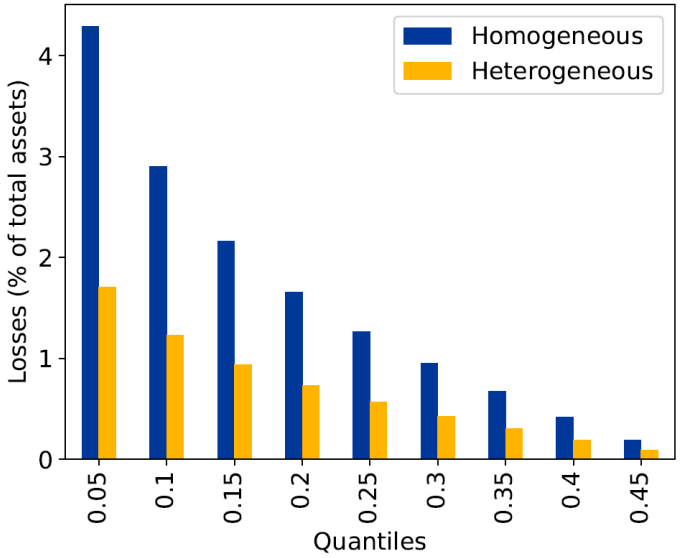


*Income channel is, e.g., approximated from EBA 2021 ST exercise and FINREP data

Fire sale simulations – Heterogeneity matters

- **Redemption shock** for investment funds to trigger fire sales of all securities in their portfolios
- **Banks and funds** suffer fire sale losses upon endogenous price drops
- Fire sale losses **largely depend** on the applied price impact parameters
- Heterogeneous impact parameters reveal **more limited risks** as opposed to homogeneous parameters

Comparison to homogeneous price impacts

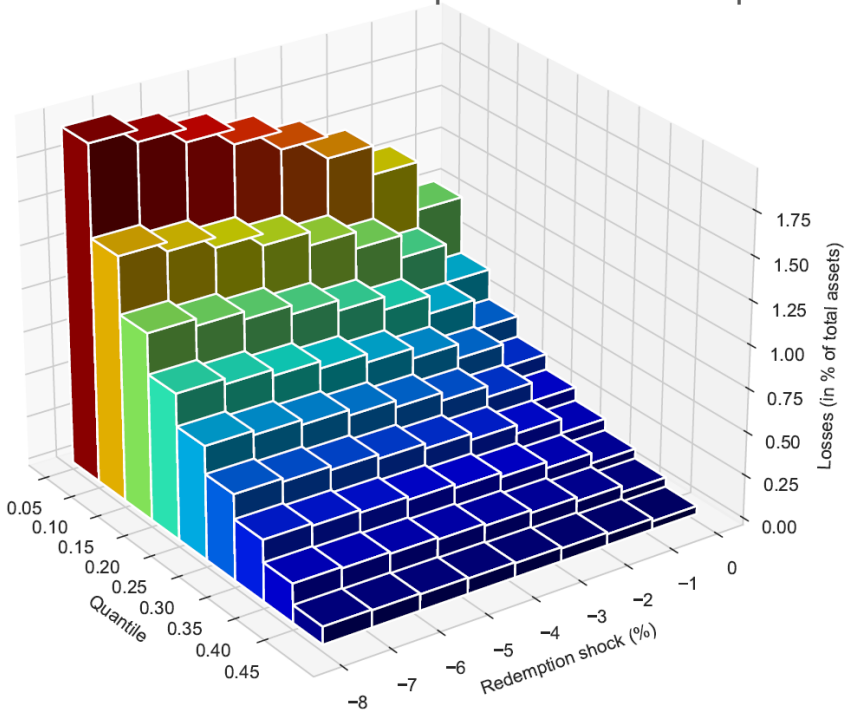


Assumed initial redemption shock for investment funds is -5%.

Fire sale simulations – Sub-linear effects

- **Sensitivity analysis** shows a sub-linear increase in system-level losses with the increase of redemptions

Losses for different redemption shocks and quantiles



Conclusion

- We estimated **security-level price impact** parameters for different, arbitrary amounts sold
- **Price-at-risk** is a useful complement to standard ‘average’ price impact parameters used in the literature
- Taking into account the **heterogeneity** across securities alleviates some of the risks shown by fire sale models that apply **homogenous** price impact parameters
- Historical data cannot explain the future but **former crisis episodes** can provide an **indication of the severity of future price movements** affecting the liquidity of all agents in the financial system
- Scenario-based **multi-sector stress testing frameworks,** based on granular network models, can shed light on possible pockets of vulnerability in the financial system

Thank you!