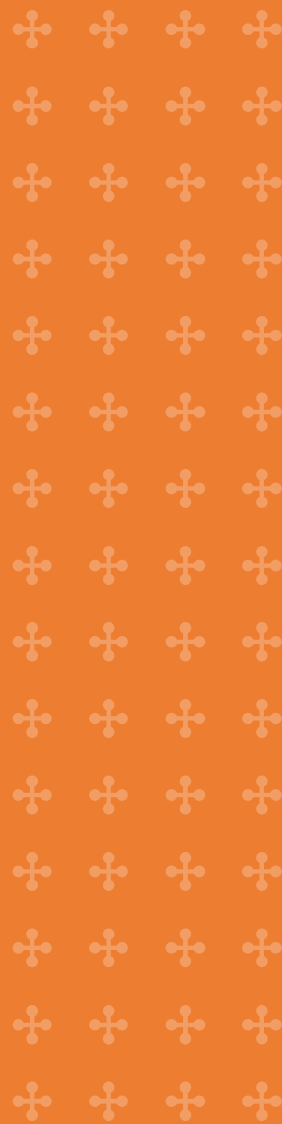# Contagion from Market Price Impact

A Price-at-Risk Perspective

Gabor Fukker, Michiel Kaijser, Luca Mingarelli, Matthias Sydow

Discussant: Giovanni Covi, Senior Research Economist

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Highlights

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❖ **WHY:** Interconnectedness within the euro area financial system of banks and investment funds may lead to rise in Systemic risk Spillovers

❖ **WHAT:** Estimate *Indirect Contagion Spillovers* between individual institutions' portfolios holdings under a severe stress scenario

❖ **HOW:** Assess the market price impact security-by-security basis from historical daily traded volumes and price returns

Key Results:

1. Homogeneous estimation techniques overestimate losses more than twice as **heterogeneous estimation techniques** (price impact parameters)

2. System-level losses at the tail (tail market price) can be **three times higher** than average losses (average market price) using the same scenario.

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❖ Huge Amount of Work on Data Collection (Big Granular ISIN-based Dataset)

❖ Many Interesting Insights on Price Dynamics by:

  ❖ Type of Stress (Median vs Tail and various Quantiles)

  ❖ Volume of Assets Sold (10m, 50m and 100m)

  ❖ Asset Classes (Bond and Equity)

  ❖ Sectors

    ▪ Small & BIG Cap
    ▪ Credit Ratings

  ❖ Derived Price-Impact Function by Liquidation Horizon

➢ Results are very policy-relevant for quantifying indirect contagion via Fire-Sales Spillovers and very valuable for other research papers

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Comments

Comment (1) - Methodology

❖ Price Impact is grounded on an exponential specification (Schnabel and Shin 2002, Cifuentes et al. 2005, and Cont and Schaanning 2017) - Convex Hull Price Impact Function

❖ Quantile regression with Non-Linear dynamics between volume and price changes

   ▪ $s_\phi V_{\phi,t}$ Scaled traded volume of security ø at time t

❖ Plus a Systematic component

$$\hat{R}^q_{\phi,t} = \hat{\beta}^q_0 \left(1 - \exp(-s_\phi V_{\phi,t})\right) + \hat{\beta}^q_1 R_{\text{sys},t}.$$

   ▪ $R_{sys,t}$ the system return (correlation of prices) defined as the weighted average of returns country/sector and country-sector/residual maturity buckets.

   ▪ β^q_0 can be interpreted as a bound on the price change from initiated trade volumes

➤ Added Value: System return can be treated as a variable from a macro-financial scenario, therefore the endogenous price impacts are independent from the scenario and depend only on the quantile chosen ex-ante(Explain how it is nested into your contagion-simulation approach).

➤ Estimates are based on security-level price changes and, thus, cannot be applied to less granular portfolios (Value-added, but also Limitation).

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Comment (2) – Data

❖ Banks and investment funds combined hold EUR 19 trillion, corresponding to several millions of securities.

❖ The distribution of the securities, based on their observed value, follows a **power law**. This means that a small number of securities cover a large portion of the total observed amount.

❖ In order to optimize the trade-off between maximum coverage and best computational performance, a sample of the largest **10,000 securities** (by observed value) is selected, containing an aggregated market value of EUR 5,62 trillion. This accounts for **30% of the observed valuation** covered in the SHS-S dataset.

❖ FOCUS: Part of your results "Homogeneous estimation techniques overestimate losses more than twice as **heterogeneous estimation techniques** (price impact parameters)" may be due to the chosen sample of securities (most common corporates, most traded).

➢ Underestimation of Losses given a very liquid sample of securities?

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Comment (3) – Empirical Estimation – Bond Sensitivity

Calibration based on bond characteristics such as SECTOR (NFC,FC,GG); MATURITY (2Y, 5Y, 10Y); CREDIT RATING (prime, high grade, etc).

❖ Decrease in the impact severity for securities with a shorter residual maturity and by selling pressure.

  ▪ E.g. The direct impact for short-term NFC bonds ranges from -0.5% to -0.75% when selling 10 and 100 Mln euro, respectively. An impact that gets roughly 2.5 times larger for long-term bonds (-1.25% to -1.75%).

    o The Amount Sold should be benchmarked in relative terms (%) with market depth

❖ Impact severity similar across sectors at the median, large differences in the tail of the distribution.

  ▪ Bond impacts in the tail can be at least 5 times larger compared to the 25th quantile

➢ Suggestion: differentiating between Held for Trading Instruments vs Held to Maturity (price impact may differ). This is relevant for assessing which assets are chosen for deleveraging and to better quantifying mark-to-market losses.

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Comment (4) – Empirical Estimation – Equity Sensitivity

❖ Equity-based price impact much larger compared to bond from the same sector.

▪ Equity can reach impact coefficients up to 0.5 for NFC equities, compared to the 0.01 for NFC bonds.

❖ Equity price impact for NFCs could experience a decrease larger than 40%

▪ For large companies doesn't exceed 12%.

➢ Could be interesting to check the amount of floating shares outstanding (market depth adjusted), since market capitalization does not reflect traded shares.

➢ Price Dynamics may differ with low or high volumes. Sensitivity of results by adding a dummy capturing the effects for low volumes days in order to capture a depurated effect for high-volume fire-sales effects.

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Comment (5) – FireSales Contagion Analysis

❖ STEP 1 - Shock about 5% redemption from all funds

❖ STEP 2 - Funds react to this liquidity shock by selling their securities in a pro rata manner.

❖ STEP 3 - the usage of homogeneous price impact parameters over-estimates fire sale losses up to a factor of more than two.

❖ STEP 4 – Sensitivity analysis for price-impact quantiles and redemption shock.

1. Question: How do you choose the quantile of the price-impact function to assess fire-sales spillovers?
   ▪ Different Quantiles across asset classes? E.g. an equity stress scenario (tail quantile of the price-impact function) might be associated with a flight-to-quality behaviour (positive impact on bond prices)
2. The selected quantile could be a function of the redemption shock, meaning that grey area may not realize.

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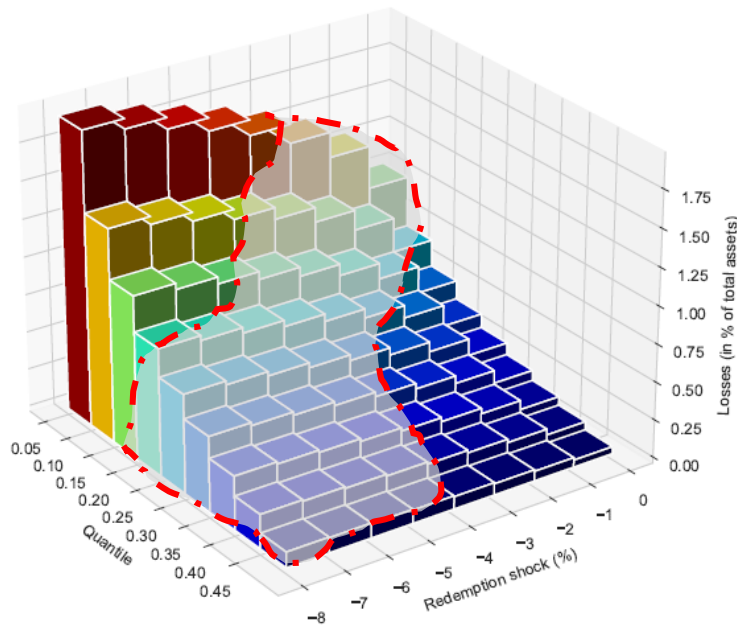
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Comment (6) – Various Thoughts & Robustness

1. Provide some educated guess on the deleveraging strategy
   - To minimize losses, funds may choose to sell equities from large cap vs small caps? Or to liquidate Government bonds with low maturity vs long maturity, instead of low grade corporate bonds?
   - How would results change?
2. Non-linear price-impact across quantiles with daily data from 2018 up to the last quarter of 2020.
   - Specific sample period, and your tail strongly reflects Covid-19 dynamics. It would be useful to extend the sample in order to check robustness in your results.
   - For instance 2010-2012 Sovereign debt crisis? Government Bond Price Impact function in the Tail quantile may look very different.
3. Your sample captures 10K of securities which captures 30% of the banks and funds' holdings. Power-law distribution, very concentrated sample, probably capturing large corporate issuers.
   - You may tend to overestimate market depth and instrument liquidity and so underestimate the price-impact function
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