Segmented Arbitrage

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Arbitrage Spreads

Violations of the law of one price

Novel idea of this paper: Study many arbitrage spreads jointly to learn about *not just the magnitude* but *the nature of* limits to arbitrage

Paper in a nutshell

Basic model (representative intermediary, single friction) predicts perfect correlation of different arb spreads

- But in the data, correlations (post Lehman, pre COVID) are quite low!

Present two potential explanations of low correlation, and some evidence consistent with each

- Segmented funding markets
- Segmented balance sheets

Segmented Funding

Idea: Combination of two ingredients

- Heterogeneity in availability of different types of funding
- Heterogeneity across arbitrages in mix of funding types required

Evidence:

- Arbitrages more reliant on unsecured funding have spreads more responsive to unsecured funding rates
- MMF reform that reduced unsecured funding
    - Larger increase in spreads on unsecured arbs, relative to secured arbs

Segmented Balance Sheets

Idea

- Different individual institutions matter for different markets
- No representative intermediary
- “Granular Origins of Individual Arbitrage Spreads”

Evidence:

- Event studies: JP Morgan (London whale), Deutsche (exit CDS)
- Suggestive evidence from CFTC (quantities) and hedge fund returns

This discussion

Four parts

1. Highlight real-world use of arb spreads to learn about intermediary constraints

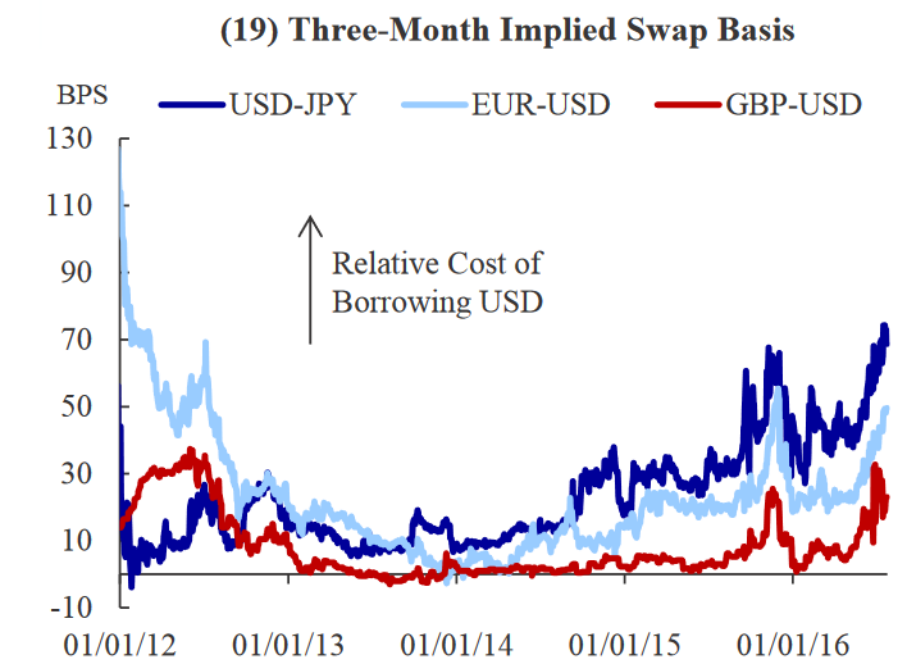
2. Present some additional data including Lehman & COVID
   - Paper uses Jan 2010-Feb 2020 sample
   - What might we learn from a longer sample?

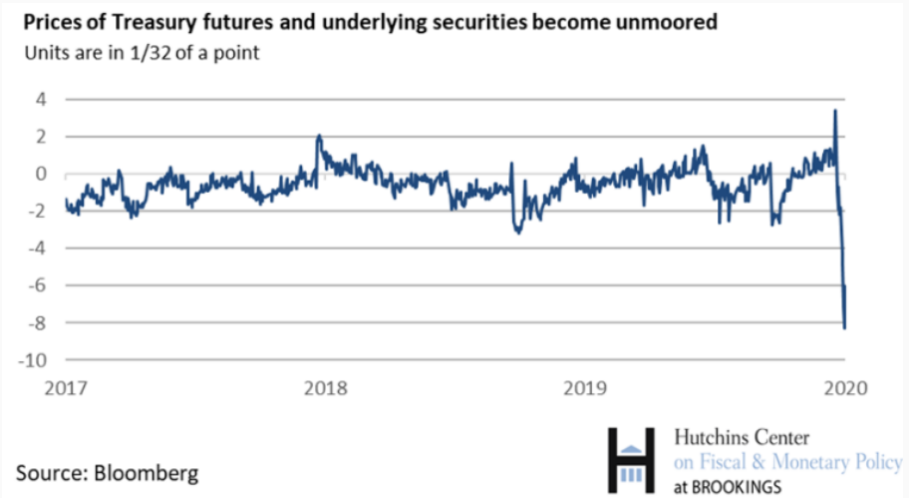
3. Discuss potential omitted variable bias in Funding regressions

4. Discuss mark-to-market risk and liquidity demand

Paper's questions are clearly important

Comment #1: Market participants and policymakers pay close attention to arbitrage spreads





Left: FOMC Briefing July 2016

Right: JP Morgan / Brookings 2020

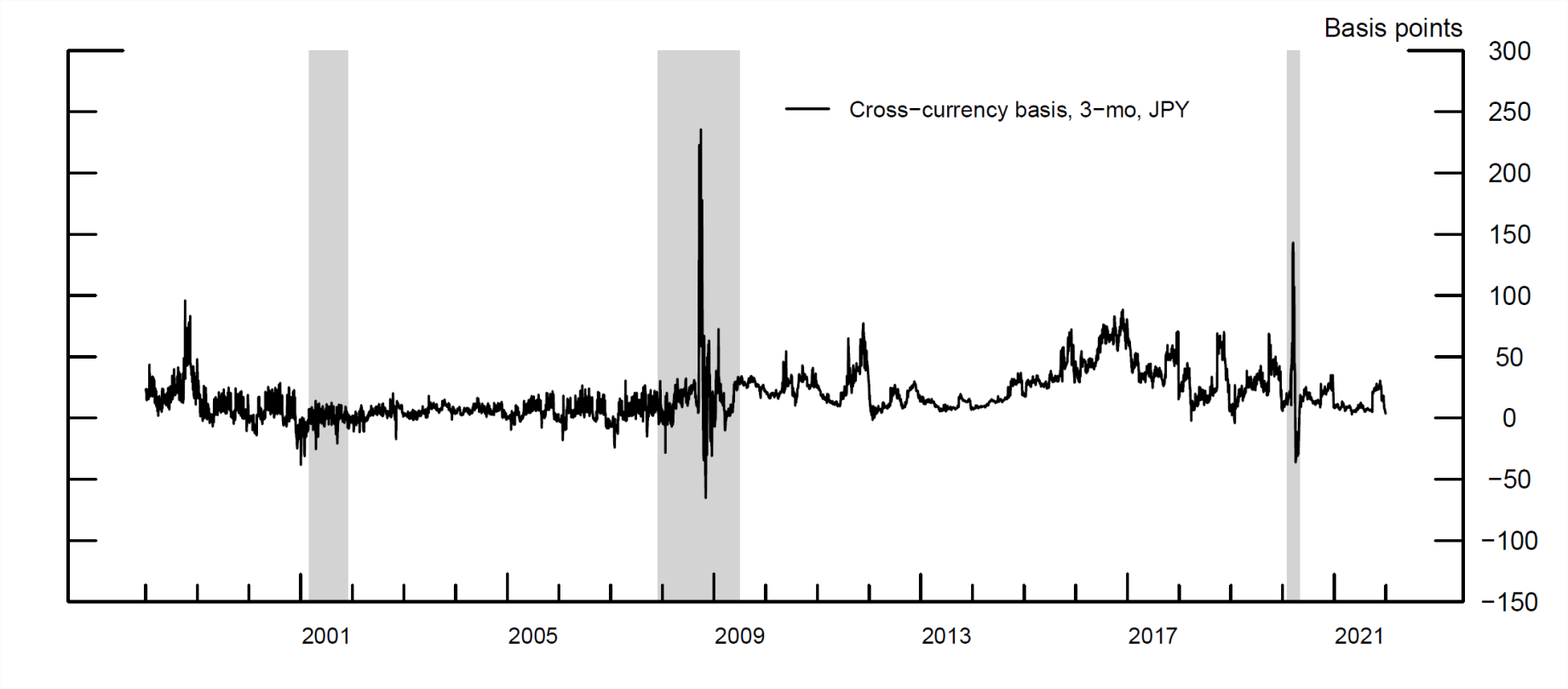
Paper's sample period: Post-financial crisis era, Pre-COVID

January 2010–February 2020

Comment #2: Consider also studying a longer period including crises e.g. Lehman, COVID, possibly even LTCM

- Correlation of arb spreads likely much higher when including crises
  - Even so, there are examples of correlation far from perfect, as I will show soon
- Probably would continue to support idea of many factors driving spreads
- Plenty of methods to deal with unbalanced panel (e.g., Stock and Watson (2002))

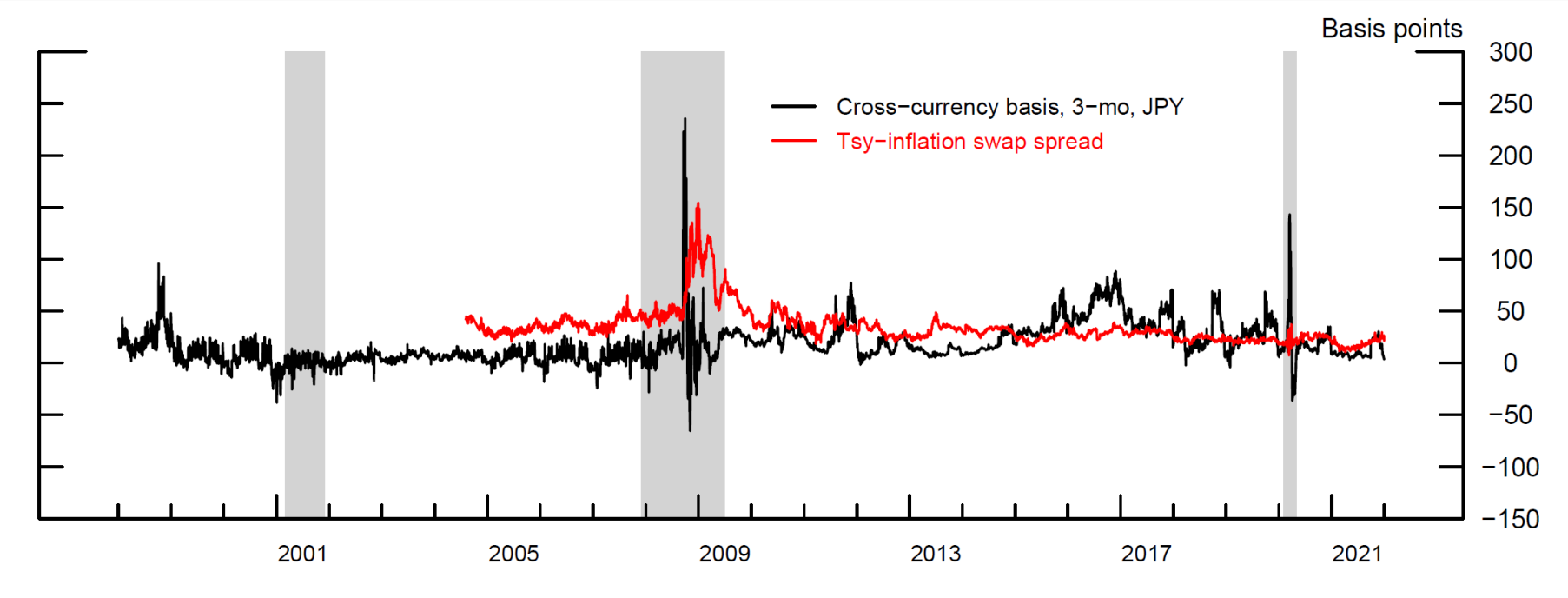
Illustration of imperfect correlation even when including crises



3-mo cross-currency basis (USD/JPY)

- Spikes around LTCM, Lehman, and COVID
- No action in 2001 recession

Illustration of imperfect correlation even when including crises



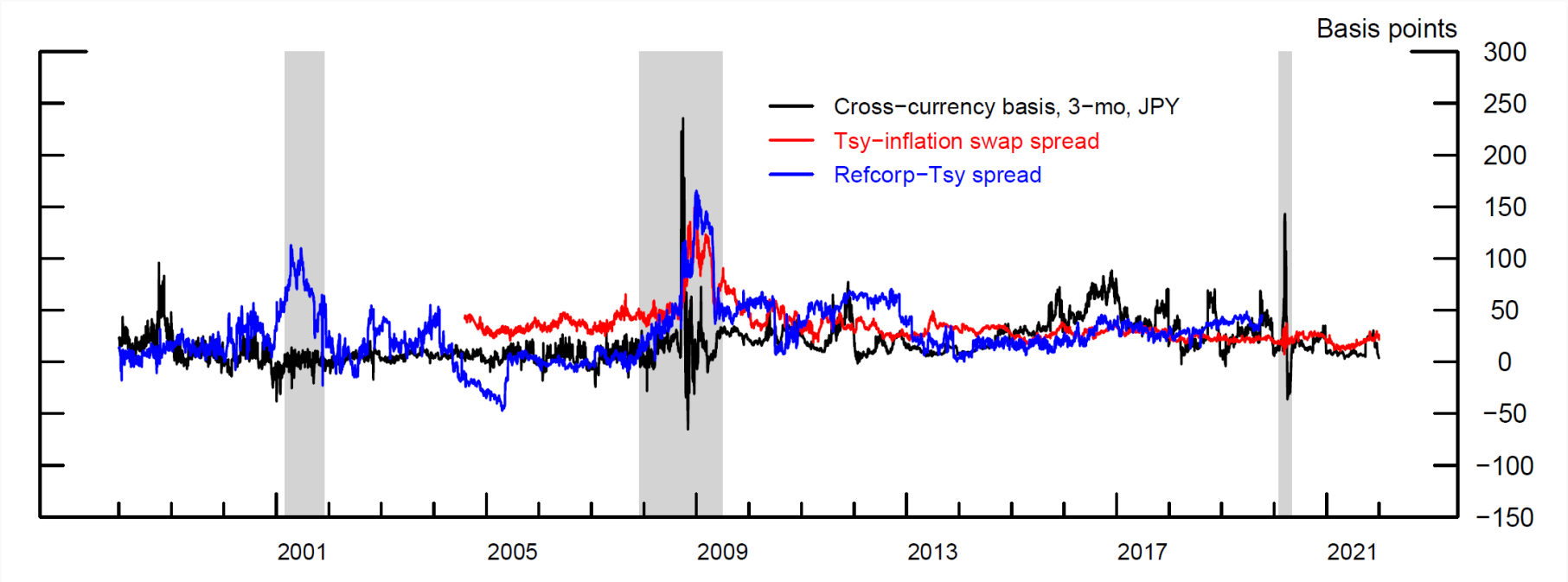
Tsy-inflation swap spread

- Spikes around Lehman (like JPY/USD basis)
- **No action during COVID** (very different than JPY/USD)

Compelling example of paper's "segmented balance sheet" explanation

- Well-known TIPS firesale around Lehman

Illustration of imperfect correlation even when including crises



Refcorp Spread

- Spikes around Lehman (like other spreads)
- **No action during LTCM (unlike JPY/USD)**
- **Spikes during 2001 Recession (unlike JPY/USD)**

Omitted Variable Bias?

Funding Conditions main regression: Regress

- Change in arbitrage spread (daily, expressed as implied risk-free rate)
- On change in maturity-matched Treasury and TED spreads

Coefficient of interest: TED spread. (Unsecured borrowing spread.)

Are arb spreads more reliant on unsecured funding also more sensitive to the unsecured borrowing spread?

Many other drivers of arb spreads—Think of all the drivers of intermediary risk appetite, mark-to-market risk, volatility, ... Many correlated with TED spread

As authors acknowledge, need to think about omitted variable bias

IV strategy could be clarified

Omitted Variable Bias?

Paper's Theoretical Framework

Study N different arbitrages

Each arbitrage requires different mix among L different types of funding

K financial frictions or budget constraints. Each arbitrage uses up different mix of budget resources.

$s_{n,t}$ is the arbitrage spread on arbitrage $n \in \{1, ..., N\}$ at time t

Omitted Variable Bias?

Model of arbitrage spread $s_{n,t}$ on arbitrage $n \in \{1, ..., N\}$

$$s_{n,t} = \sum_{l}^{L} \underbrace{w_{n,l}}_{\text{Margin or haircut}} \cdot \underbrace{f_{l,t}}_{\text{Funding spread}} + \sum_{k=1}^{K} \underbrace{v_{n,k}}_{\text{Balance-sheet cost parameter}} \cdot \underbrace{c_{k,t}}_{\text{Time-varying agency cost or adjustment cost}} \cdot \underbrace{V_{k,t}}_{\text{k-type budget resource used}}$$

Red is balance-sheet, agency, or adjustment cost

Empirical exercise: Theory and margin data suggest $w_{n,TED}$ large for $n \in$ unsecured arbs, relative to $n' \in$ secured arbs. Test this prediction.

Main regression (with s expressed as riskless excess return):

$$\Delta s_{n,t} = \underbrace{w_{Tr}}_{\text{Coefficient}} \cdot \underbrace{\Delta f_{Tr,t}}_{\text{Treasury spread}} + \underbrace{w_{TED}}_{\text{Coefficient}} \cdot \underbrace{\Delta f_{TED,t}}_{\text{TED spread}} + \epsilon_{n,t}$$

Omitted variable bias? $\epsilon_{n,t}$ contains other funding spreads and balance-sheet, agency, adjustment costs

Omitted Variable Bias?

Comment #3: Clarify IV approach used to address omitted variable bias

IV for TED Spread:

$$\Delta\text{MMF Assets}_t \times \%\text{ MMF Assets Invested in Unsecured Lending to Banks}_{t-k}$$

Argument for validity of IV not clear. "Bartik-style" but not exactly a Bartik strategy

Example: When $k = t - 1$ (Table 4b, Columns 5 & 6), is the instrument just a constant times $\Delta\text{MMF Assets}_t$? If so, why a valid IV? How do other k values help?

Liquidity demand

Arbitrage spreads can only arise in the first place when there are imbalances in demand for sets of securities with the same cash flows

In models, these demand imbalances arise from “noise” or “liquidity” traders or security-specific “hedging demand”

In real life, institutional frictions—e.g., foreign banks with foreign deposit franchises wanting to lend in dollars, can drive CIP basis

Time-varying heterogeneity in (volatility of?) hedging demand is a potential explanation of low correlation of arb spreads

Comment #4: In future research, test whether heterogeneous fluctuations in liquidity demand help explain low correlation of arb spreads

Mark-to-market risk

How is mark-to-market risk related to low correlation of arb spreads?

Intermediaries care about short-run returns, not only long-run returns. Not looking to hold arbitrages to maturity, but for spreads to compress.

Comment #5: In future research, compare whether heterogeneous changes in mark-to-market risk help explain low correlation of arb spreads

Thank you!