

# Loan Pricing Uncertainty and the Use of Financial Covenants

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## 0.0 Roadmap

- ▶ 1.0 Uncertainty and Debt Contracts
- ▶ 2.0 Research Question
- ▶ 3.0 The LIBOR-SOFR Transition
- ▶ 4.0 Empirical Approach
- ▶ 5.0 Results in Brief
- ▶ 6.0 Results in Full

## 1.0 Uncertainty and Debt Contracts

*The word “uncertainty” seemed best for distinguishing the **defects of managerial knowledge** from the ordinary “risks” of business activity which can be feasibly reduced if not eliminated by applying the insurance principle...*

- ▶ Frank H. Knight, *Risk, Uncertainty and Profit* (1933, LSE edition)

## 1.1 Uncertainty and Debt Contracts

- ▶ The focus of the debt contracting literature has been on managing the agency costs of debt (e.g., Smith and Warner 1979; Jensen and Meckling 1976; Christensen and Nikolaev 2012; Christensen et al. 2016).
  - ▶ Performance covenants are used to reallocate control when performance changes the agency problem.
  - ▶ Capital covenants are used to prohibit predictable behavior (debt overhang, asset substitution, etc.).
- ▶ A complementary view is that covenants are used to manage “uncertainty”: “lack of contract relevant information.”
  - ▶ This view uses covenants as a way to trigger renegotiation when new information arrives.
  - ▶ We conjecture that performance, rather than capital, covenants should carry this information.

**These explanations are likely to coexist, and are difficult to disentangle.**

## 2.0 Research Question

How are financial covenants used to manage uncertainty?

- ▶ To isolate uncertainty from other factors we consider the LIBOR-SOFR transition: a setting where a policy change introduces uncertainty about the pricing of debt contracts.
- ▶ We are interested in uncertainty in general, but the setting is interesting *per se*.

1. Is the LIBOR-SOFR transition associated with changes in the use of financial covenants?
2. Is this change driven by a change in the use of performance, rather than capital, covenants?

### 3.0 The LIBOR-SOFR Transition

#### Key Facts:

- ▶ Post-GFC three things became clear about LIBOR.
  1. The market it was based on was shrinking. (London Interbank Market)
  2. LIBOR rates were often based on “expert judgment” rather than actual transactions.
  3. LIBOR was being actively manipulated by banks.

### 3.1 The LIBOR-SOFR Transition: Uncertainty

The practitioner discussions and literature indicate that this transition was uncertain in the Knightian sense.

#### Key Factors:

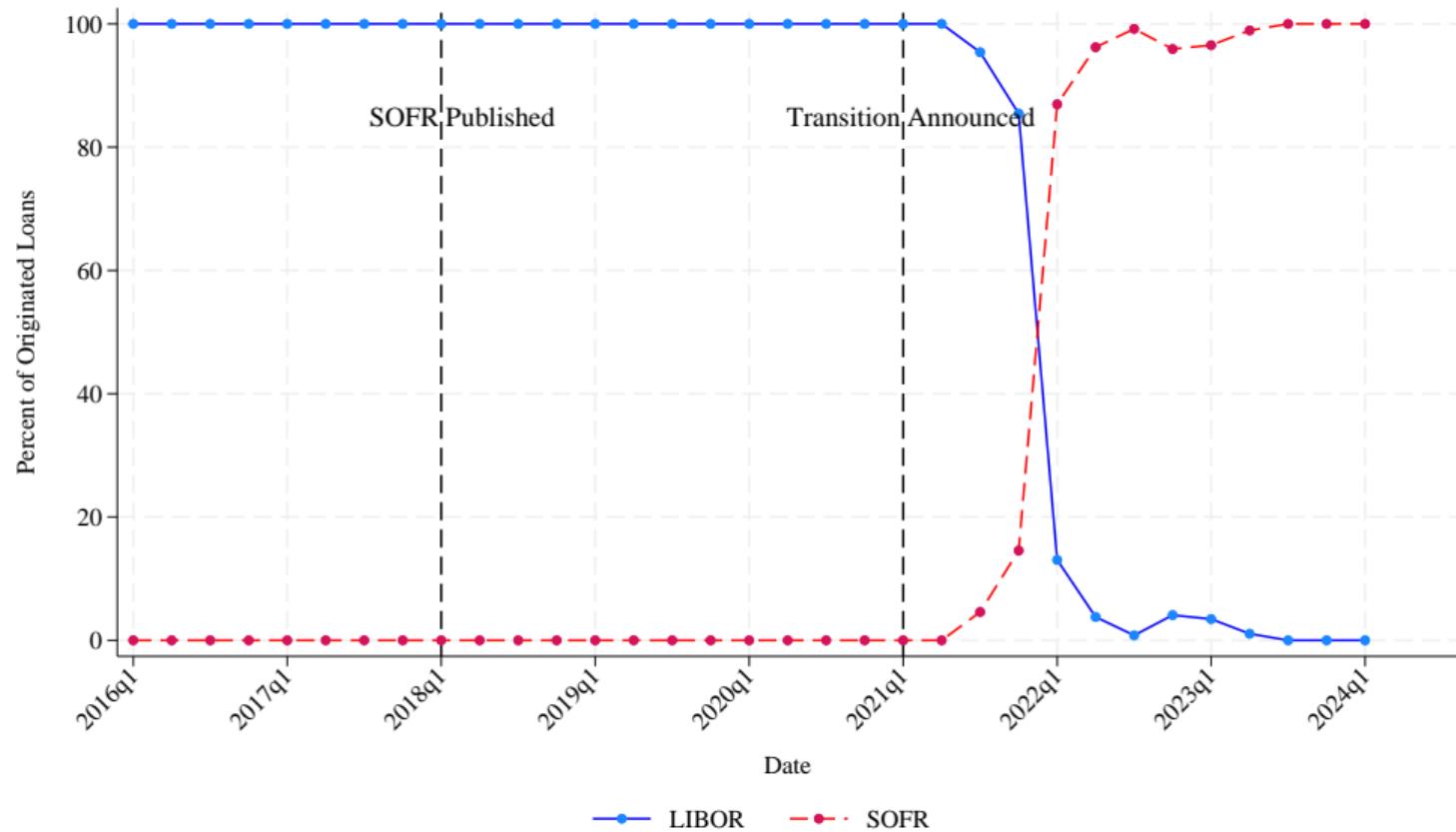
1. SOFR and LIBOR contain different information:
  - ▶ SOFR is the cost of funds borrowed from the Federal Reserve.
  - ▶ LIBOR is the cost of funds borrowed from peer banks.
    - ▶ LIBOR includes the default premium and incorporates more information about the cost of financing than SOFR does.
2. Lack of experience pricing debt relative to the new rate.
  - ▶ Included translating overnight SOFR into relevant term structures (1m, 6m, etc.)
3. Lack of experience negotiating and enforcing the transition to the new base rate.

### 3.2.0 The LIBOR-SOFR Transition: Timeline

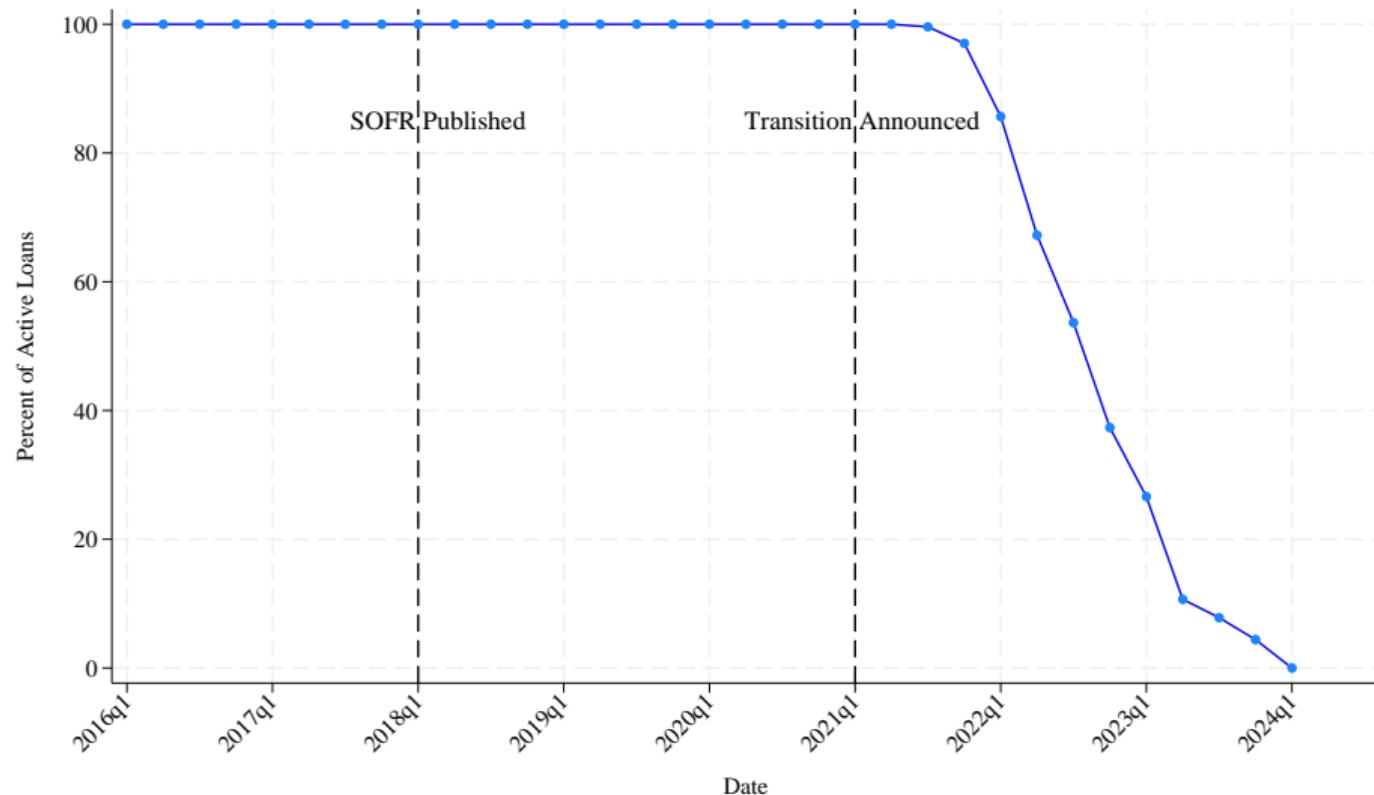
#### Key Dates:

- ▶ In 2014 the US Fed begins to develop an alternative.
- ▶ Begins publishing the “Secured Overnight Financing Rate” (SOFR) in April 2018.
- ▶ LIBOR transition announced January 2021.
- ▶ LIBOR no longer published 30 June 2023.

3.2.1 Figure 1: Percentage of sample loans originated using LIBOR versus SOFR over time.



### 3.2.2 Figure 2: Percentage of active LIBOR-issued loans that retain the LIBOR benchmark.



## 4.0 Empirical Approach

Three groups of loans:

- ▶ Always LIBOR.
- ▶ LIBOR to SOFR switchers. (the observations in Figure 2)
- ▶ Always SOFR. (the red line in Figure 1)

### Staggered Difference-in-Differences

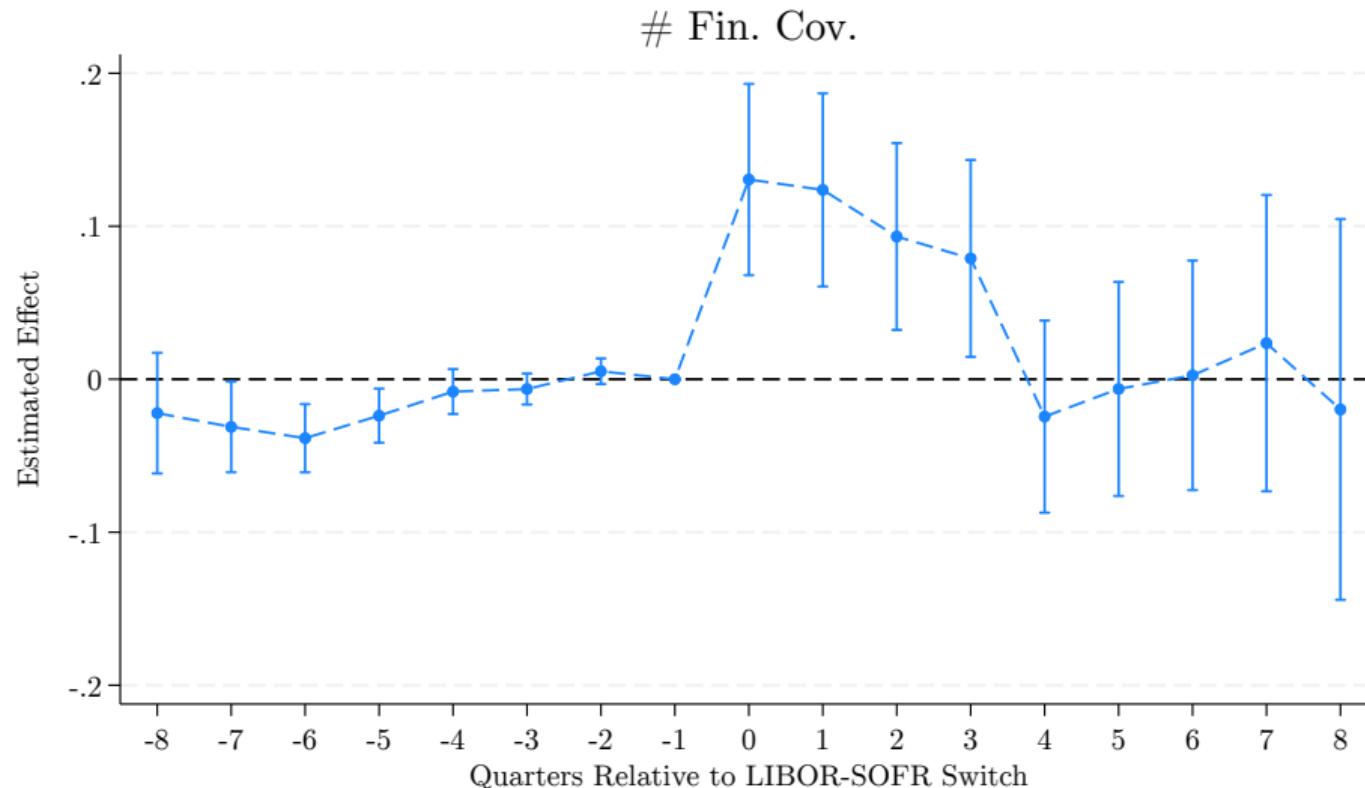
- ▶ We use a loan path panel, where loan attributes and firm fundamentals are observed each quarter from origination to maturity.
- ▶ Main analyses compare LIBOR-SOFR switchers to always LIBOR loans.

## 5.0 Preview of Results

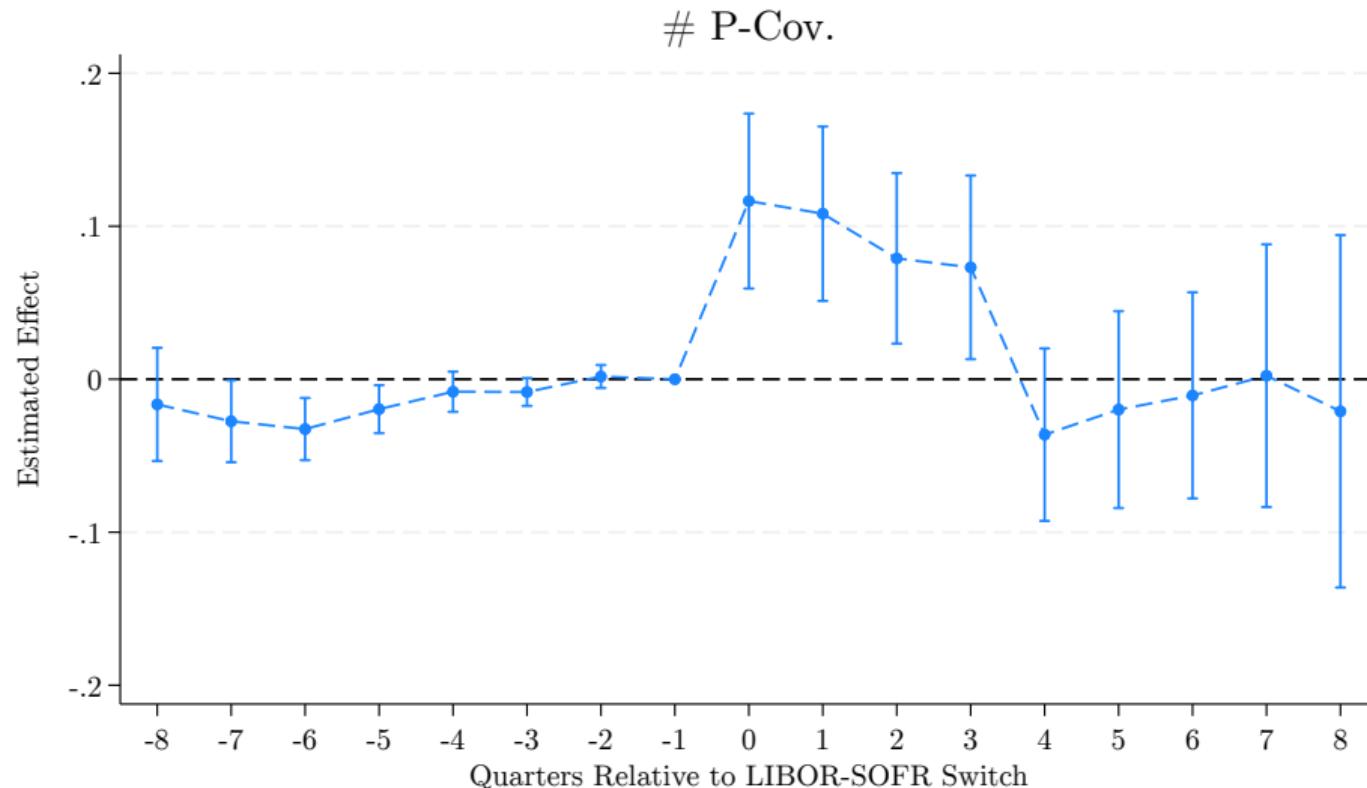
1. Figure 3 Plot 1: Dynamic treatment effects, Financial Covenants
2. Figure 3 Plot 2: Dynamic treatment effects, Performance Covenants
3. Figure 3 Plot 3: Dynamic treatment effects, Capital Covenants

All estimates using `eventstudyinteract` (Sun and Abraham 2021)

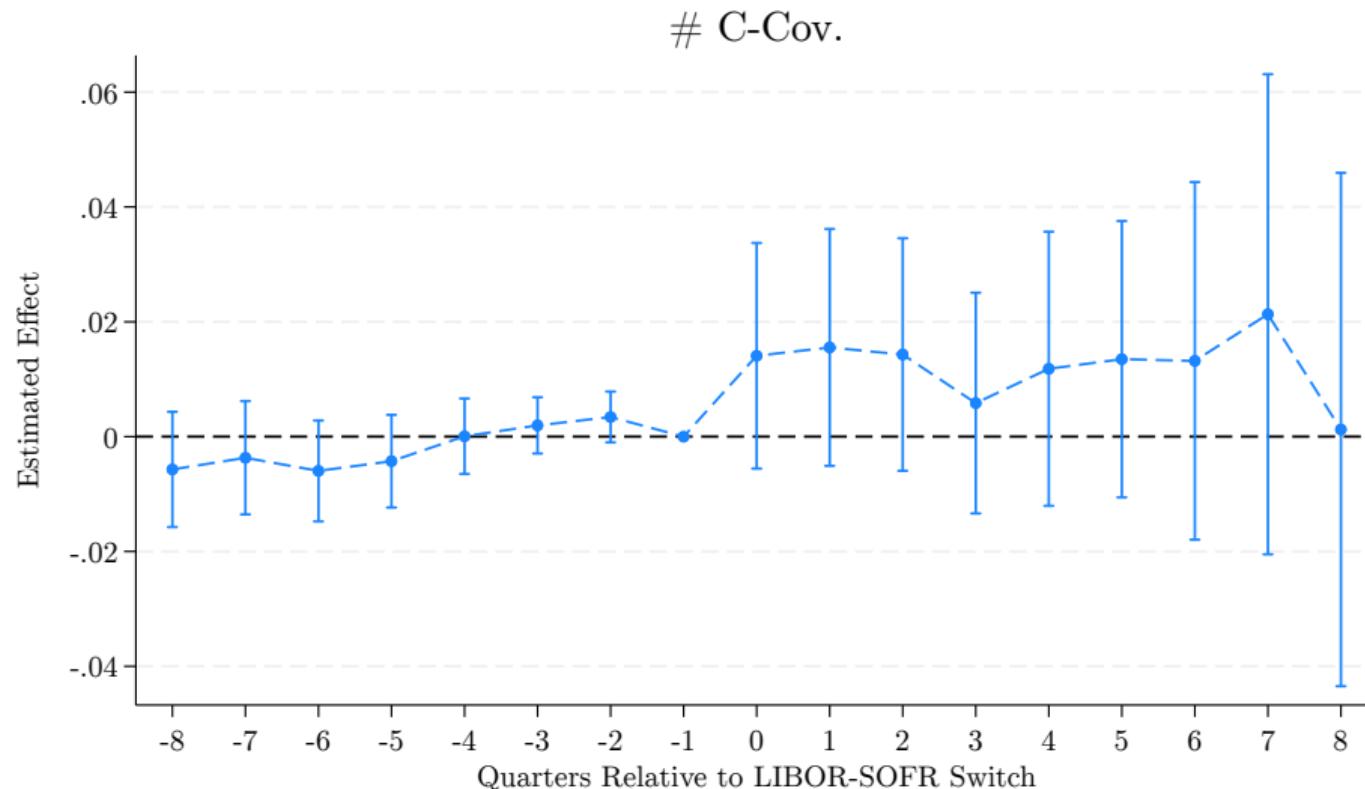
## 5.1 Figure 3 Plot 1: Dynamic treatment effects relative to quarter of LIBOR to SOFR switch



## 5.2 Figure 3 Plot 2: Dynamic treatment effects relative to quarter of LIBOR to SOFR switch



### 5.3 Figure 3 Plot 3: Dynamic treatment effects relative to quarter of LIBOR to SOFR switch



## 5.4 Summary:

1. Financial covenants appear to be used to manage the uncertainty resulting from the LIBOR-SOFR Transition.
2. The effect is **transient** (4 qtrs).
3. The effect is driven by the use of **Performance Covenants**.

## 6.0 Results Roadmap:

1. Key Empirical Concerns
2. Data
3. Model
4. Tables

## 6.1.0 Key Empirical Concerns

1. Staggered Difference-in-Differences
2. Sample Overlap (statistical and conceptual)
3. Is the transition *caused* by a change in credit risk?
4. Why would borrowers agree to this?

## 6.1.1 Staggered Difference-in-Differences

*“when already-treated units act as controls, changes in their treatment effects over time get subtracted from the DD estimate. This does not imply a failure of the design, but it does caution against summarizing time-varying effects with a single-coefficient.” (Goodman-Bacon 2021)*

### Two approaches:

1. This concern is *decreasing* in the proportion of the control group that is *never* treated (Baker et al. 2022).
  - ▶ 87% of the sample in our main analyses is never treated (i.e. Always LIBOR).
2. The negative weights can be estimated and adjusted (Sun and Abraham 2021).
  - ▶ Figure 3 uses `eventstudyinteract` from Sun and Abraham (2021).

## 6.1.2 Sample Overlap

Statistical Overlap: Are there valid controls for all of the treated observations (i.e. SOFR==1)

- ▶ Imbens-Rubin Differences in Means in Table 7a are  $>0.25$  so this is a concern.
- ▶ We address this with Entropy Balancing in Table 7b and Table 8

Conceptual Overlap: LIBOR observations may differ from SOFR observations in fundamental ways not reflected in the covariates.

- ▶ Alternate control group: “Always SOFR”
- ▶ Table 3 & Table 5b show similar results using this control group.

### 6.1.3 Do changes in credit risk drive our results?

1. Table 4: Firm performance is not associated with the LIBOR-SOFR transition.
2. Table 5a: no other terms change (except spread which is mechanical relative to Always LIBOR)
3. Table 5b: no other terms change (including spread, not mechanical relative to Always SOFR)

## 6.1.4 Why would borrowers agree to this?

Anecdotally, BoA (or similar) calls all their clients and says, “When we renegotiate we are switching you to SOFR.” Some threaten to ReFi and pre-pay. When it’s credible BoA agrees.

- ▶ In Table 6 we repeat our analyses splitting on HHI of lenders within borrower industries.
- ▶ Our results only hold when lenders are concentrated (i.e. few outside options)

## 6.2 Data

### Data Sources:

- ▶ **Compustat:** Quarterly borrower fundamentals.
- ▶ **LPC Dealscan:** Loan details (amount, spread, base rate, covenants) at origination, and along the loan path (i.e. as amended until maturity)
- ▶ We limit the sample to loans benchmarked to LIBOR or SOFR, this is >90% of Dealscan Observations (rates of other benchmarks are not impacted by the transition)

### Data Structure:

- ▶ Loan-path panel: quarterly observations of firm fundamentals and loan attributes from origination to maturity.

### Variable of Interest:

- ▶ **SOFR** is an indicator variable equal to 1 if the base rate is SOFR and 0 otherwise (i.e. base rate is LIBOR)

## 6.3 Model

$$\text{Contract Term}_{I,t} = \beta SOFR_{I,t} + \gamma X_{I,t} + \psi Z_{i,t} + \lambda_I + \tau_t + \varepsilon_{I,t} \quad (1)$$

- ▶  $\text{Contract Term}_{I,t}$  is the debt contract term of interest for tranche  $I$  in quarter  $t$ .
- ▶  $SOFR_{I,t}$  is an indicator variable equal to 1 if tranche  $I$  uses SOFR in quarter  $t$ .
- ▶  $X_{I,t}$  is a vector of time-varying loan-level attributes.
- ▶  $Z_{i,t}$  is a vector of time-varying borrower-level attributes.
- ▶  $\lambda_I$  indexes loan-tranche fixed effects.
- ▶  $\tau_t$  indexes year-quarter period fixed effects.

## 6.4 Tables

- ▶ Table 1: Descriptive Statistics for sample of loans issued relative to LIBOR
- ▶ Table 2: LIBOR-SOFR transition on covenant use: Always LIBOR control sample
- ▶ Table 3: LIBOR-SOFR transition on covenant use: Always SOFR control sample
- ▶ Table 4: The determinants of the LIBOR-SOFR transition
- ▶ Table 5a: The effect of the LIBOR-SOFR transition on other contract terms: Always LIBOR control sample
- ▶ Table 5b: The effect of the LIBOR-SOFR transition on other contract terms: Always SOFR control sample
- ▶ Table 6: Cross sectional effect of lending concentration: Always LIBOR control sample
- ▶ Table 7a: Sample Overlap comparing loans that switch from LIBOR to SOFR, to those that use LIBOR.
- ▶ Table 7b: Entropy-Balanced Sample Overlap comparing loans that switch from LIBOR to SOFR, to those that use LIBOR.
- ▶ Table 8: Entropy balancing results - Always LIBOR control sample

6.4 Table 1: Descriptive Statistics for sample of loans issued relative to LIBOR

|               | $N$     | $\mu$ | $\sigma$ | 25 <sup>th</sup> %ile | 50 <sup>th</sup> %ile | 75 <sup>th</sup> %ile |
|---------------|---------|-------|----------|-----------------------|-----------------------|-----------------------|
| # Fin. Cov.   | 123,280 | 0.44  | 0.82     | 0.00                  | 0.00                  | 1.00                  |
| # P-Cov.      | 123,280 | 0.37  | 0.75     | 0.00                  | 0.00                  | 0.00                  |
| # C-Cov.      | 123,280 | 0.07  | 0.30     | 0.00                  | 0.00                  | 0.00                  |
| # Sweeps      | 123,280 | 0.57  | 1.30     | 0.00                  | 0.00                  | 0.00                  |
| # PPPs        | 123,280 | 0.27  | 0.44     | 0.00                  | 0.00                  | 1.00                  |
| ln(Spread)    | 123,280 | 5.25  | 0.52     | 4.83                  | 5.16                  | 5.62                  |
| ln(Loan Size) | 123,280 | 5.80  | 1.34     | 5.01                  | 5.86                  | 6.70                  |
| Maturity      | 123,280 | 55.61 | 25.75    | 48.00                 | 60.00                 | 60.00                 |
| Secured       | 123,280 | 0.47  | 0.50     | 0.00                  | 0.00                  | 1.00                  |
| ln(Size)      | 123,280 | 8.32  | 1.62     | 7.20                  | 8.30                  | 9.38                  |
| Profitability | 123,280 | 0.03  | 0.22     | 0.02                  | 0.03                  | 0.04                  |
| Leverage      | 123,280 | 0.39  | 0.24     | 0.24                  | 0.36                  | 0.50                  |
| Tangibility   | 123,280 | 0.31  | 0.27     | 0.09                  | 0.21                  | 0.48                  |

6.4 Table 2: LIBOR-SOFR transition on covenant use: Always LIBOR control sample

|              | (1)<br># Fin. Cov. | (2)<br># P-Cov.   | (3)<br># C-Cov. |
|--------------|--------------------|-------------------|-----------------|
| SOFR         | 0.11***<br>(3.76)  | 0.09***<br>(3.58) | 0.01<br>(1.52)  |
| Loan Cntrls  | Yes                | Yes               | Yes             |
| Firm Cntrls  | Yes                | Yes               | Yes             |
| Tranche FE   | Yes                | Yes               | Yes             |
| Year-Qtr     | Yes                | Yes               | Yes             |
| Loan Purpose | Yes                | Yes               | Yes             |
| Adj $R^2$    | 0.83               | 0.81              | 0.90            |
| $N$          | 123,280            | 123,280           | 123,280         |

6.4 Table 3: LIBOR-SOFR transition on covenant use: Always SOFR control sample

|              | (1)<br># Fin. Cov. | (2)<br># P-Cov.   | (3)<br># C-Cov. |
|--------------|--------------------|-------------------|-----------------|
| SOFR         | 0.11***<br>(3.54)  | 0.09***<br>(3.25) | 0.02<br>(1.49)  |
| Loan Cntrls  | Yes                | Yes               | Yes             |
| Firm Cntrls  | Yes                | Yes               | Yes             |
| Tranche FE   | Yes                | Yes               | Yes             |
| Year-Qtr     | Yes                | Yes               | Yes             |
| Loan Purpose | Yes                | Yes               | Yes             |
| Adj $R^2$    | 0.58               | 0.56              | 0.72            |
| $N$          | 20,995             | 20,995            | 20,995          |

6.4 Table 4: The determinants of the LIBOR-SOFR transition.

|                    | (1)                                  |
|--------------------|--------------------------------------|
|                    | LIBOR-SOFR Transition <sub>t+1</sub> |
| ln(Size)           | -0.15***<br>(-3.69)                  |
| Profitability      | -0.01<br>(-0.04)                     |
| Leverage           | -0.60***<br>(-2.62)                  |
| Tangibility        | -0.27<br>(-1.57)                     |
| ln(Spread)         | -0.56***<br>(-4.78)                  |
| ln(Loan Size)      | 0.46***<br>(8.79)                    |
| Maturity Remaining | 0.04***<br>(14.00)                   |
| Maturity           | -0.04***<br>(-13.15)                 |
| Secured            | 0.06<br>(0.56)                       |
| Pseudo $R^2$       | 0.05                                 |
| $N$                | 113,890                              |

6.4 Table 5a: The effect of the LIBOR-SOFR transition on other contract terms: Always LIBOR control sample

|              | (1)<br>ln(Spread) | (2)<br># Sweeps  | (3)<br>PPP     | (4)<br>Maturity  |
|--------------|-------------------|------------------|----------------|------------------|
| SOFR         | 0.02**<br>(2.33)  | -0.00<br>(-0.02) | 0.01<br>(0.64) | -0.33<br>(-0.54) |
| Loan Cntrls  | Yes               | Yes              | Yes            | Yes              |
| Firm Cntrls  | Yes               | Yes              | Yes            | Yes              |
| Tranche FE   | Yes               | Yes              | Yes            | Yes              |
| Year-Qtr     | Yes               | Yes              | Yes            | Yes              |
| Loan Purpose | Yes               | Yes              | Yes            | Yes              |
| Adj $R^2$    | 0.97              | 0.97             | 0.81           | 0.95             |
| $N$          | 123,280           | 123,280          | 123,280        | 123,280          |

6.4 Table 5b: The effect of the LIBOR-SOFR transition on other contract terms: Always SOFR control sample

|              | (1)<br>ln(Spread) | (2)<br># Sweeps | (3)<br>PPP       | (4)<br>Maturity  |
|--------------|-------------------|-----------------|------------------|------------------|
| SOFR         | 0.01<br>(1.40)    | 0.01<br>(1.22)  | -0.02<br>(-0.84) | -1.08<br>(-1.53) |
| Loan Cntrls  | Yes               | Yes             | Yes              | Yes              |
| Firm Cntrls  | Yes               | Yes             | Yes              | Yes              |
| Tranche FE   | Yes               | Yes             | Yes              | Yes              |
| Year-Qtr     | Yes               | Yes             | Yes              | Yes              |
| Loan Purpose | Yes               | Yes             | Yes              | Yes              |
| Adj $R^2$    | 0.92              | 0.94            | 0.61             | 0.78             |
| $N$          | 20,995            | 20,995          | 20,995           | 20,995           |

6.4 Table 6: Cross sectional effect of lending concentration: Always LIBOR control sample

|              | # Fin. Cov        |                        | # P-Cov.          |                        | # C-Cov.          |                        |
|--------------|-------------------|------------------------|-------------------|------------------------|-------------------|------------------------|
|              | (1)<br>HHI > 1000 | (2)<br>HHI $\leq$ 1000 | (3)<br>HHI > 1000 | (4)<br>HHI $\leq$ 1000 | (5)<br>HHI > 1000 | (6)<br>HHI $\leq$ 1000 |
| SOFR         | 0.14***<br>(3.31) | -0.01<br>(-0.20)       | 0.10**<br>(2.52)  | 0.03<br>(0.57)         | 0.04***<br>(2.99) | -0.04*<br>(-1.80)      |
| Controls     | Yes               | Yes                    | Yes               | Yes                    | Yes               | Yes                    |
| Tranche FE   | Yes               | Yes                    | Yes               | Yes                    | Yes               | Yes                    |
| Year-Qtr     | Yes               | Yes                    | Yes               | Yes                    | Yes               | Yes                    |
| Loan Purpose | Yes               | Yes                    | Yes               | Yes                    | Yes               | Yes                    |
| Adj $R^2$    | 0.83              | 0.84                   | 0.82              | 0.84                   | 0.90              | 0.86                   |
| $N$          | 39,993            | 33,491                 | 39,993            | 33,491                 | 39,993            | 33,491                 |

## 6.4 Table 7a: Sample Overlap comparing loans that switch from LIBOR to SOFR, to those that use LIBOR.

|               | LIBOR to SOFR |       |          |                       | LIBOR   |       |          |                       | Diff. in<br>Means |
|---------------|---------------|-------|----------|-----------------------|---------|-------|----------|-----------------------|-------------------|
|               | N             | $\mu$ | $\sigma$ | 50 <sup>th</sup> %ile | N       | $\mu$ | $\sigma$ | 50 <sup>th</sup> %ile |                   |
| # Fin. Cov.   | 15,703        | 0.24  | 0.61     | 0.00                  | 107,577 | 0.47  | 0.85     | 0.00                  | 0.31              |
| # P-Cov.      | 15,703        | 0.18  | 0.54     | 0.00                  | 107,577 | 0.39  | 0.77     | 0.00                  | 0.32              |
| # C-Cov.      | 15,703        | 0.06  | 0.25     | 0.00                  | 107,577 | 0.08  | 0.30     | 0.00                  | 0.06              |
| # Sweeps      | 15,703        | 0.34  | 1.01     | 0.00                  | 107,577 | 0.60  | 1.34     | 0.00                  | 0.22              |
| # PPPs        | 15,703        | 0.21  | 0.41     | 0.00                  | 107,577 | 0.27  | 0.45     | 0.00                  | 0.14              |
| ln(Spread)    | 15,703        | 5.02  | 0.38     | 5.01                  | 107,577 | 5.28  | 0.53     | 5.26                  | 0.57              |
| ln(Loan Size) | 15,703        | 6.30  | 1.09     | 6.31                  | 107,577 | 5.73  | 1.35     | 5.81                  | -0.46             |
| Maturity      | 15,703        | 54.84 | 11.88    | 60.00                 | 107,577 | 55.72 | 27.19    | 60.00                 | 0.04              |
| Secured       | 15,703        | 0.38  | 0.48     | 0.00                  | 107,577 | 0.48  | 0.50     | 0.00                  | 0.21              |
| ln(Size)      | 15,703        | 8.55  | 1.49     | 8.43                  | 107,577 | 8.28  | 1.64     | 8.28                  | -0.17             |
| Profitability | 15,703        | 0.03  | 0.02     | 0.03                  | 107,577 | 0.03  | 0.24     | 0.03                  | -0.02             |
| Leverage      | 15,703        | 0.37  | 0.19     | 0.35                  | 107,577 | 0.39  | 0.24     | 0.36                  | 0.06              |
| Tangibility   | 15,703        | 0.32  | 0.26     | 0.24                  | 107,577 | 0.30  | 0.27     | 0.20                  | -0.05             |

6.4 Table 7b: Entropy-Balanced Sample Overlap comparing loans that switch from LIBOR to SOFR, to those that use LIBOR.

|               | LIBOR to SOFR |       |          |                       | LIBOR   |       |          |                       | Diff. in<br>Means |
|---------------|---------------|-------|----------|-----------------------|---------|-------|----------|-----------------------|-------------------|
|               | N             | $\mu$ | $\sigma$ | 50 <sup>th</sup> %ile | N       | $\mu$ | $\sigma$ | 50 <sup>th</sup> %ile |                   |
| # Fin. Cov.   | 15,703        | 0.24  | 0.61     | 0.00                  | 107,577 | 0.43  | 0.81     | 0.00                  | 0.27              |
| # P-Cov.      | 15,703        | 0.18  | 0.54     | 0.00                  | 107,577 | 0.36  | 0.74     | 0.00                  | 0.28              |
| # C-Cov.      | 15,703        | 0.06  | 0.25     | 0.00                  | 107,577 | 0.08  | 0.30     | 0.00                  | 0.06              |
| # Sweeps      | 15,703        | 0.34  | 1.01     | 0.00                  | 107,577 | 0.45  | 1.16     | 0.00                  | 0.10              |
| # PPPs        | 15,703        | 0.21  | 0.41     | 0.00                  | 107,577 | 0.31  | 0.46     | 0.00                  | 0.22              |
| ln(Spread)    | 15,703        | 5.02  | 0.38     | 5.01                  | 107,577 | 5.02  | 0.57     | 5.01                  | 0.00              |
| ln(Loan Size) | 15,703        | 6.30  | 1.09     | 6.31                  | 107,577 | 6.30  | 1.25     | 6.27                  | 0.00              |
| Maturity      | 15,703        | 54.84 | 11.88    | 60.00                 | 107,577 | 54.84 | 30.17    | 60.00                 | 0.00              |
| Secured       | 15,703        | 0.38  | 0.48     | 0.00                  | 107,577 | 0.38  | 0.48     | 0.00                  | 0.00              |
| ln(Size)      | 15,703        | 8.55  | 1.49     | 8.43                  | 107,577 | 8.55  | 1.65     | 8.53                  | 0.00              |
| Profitability | 15,703        | 0.03  | 0.02     | 0.03                  | 107,577 | 0.03  | 0.24     | 0.03                  | 0.00              |
| Leverage      | 15,703        | 0.37  | 0.19     | 0.35                  | 107,577 | 0.37  | 0.27     | 0.34                  | 0.00              |
| Tangibility   | 15,703        | 0.32  | 0.26     | 0.24                  | 107,577 | 0.32  | 0.27     | 0.21                  | 0.00              |

6.4 Table 8: Entropy balancing results - Always LIBOR control sample

|              | (1)               | (2)               | (3)            |
|--------------|-------------------|-------------------|----------------|
|              | # Fin. Cov.       | # P-Cov.          | # C-Cov.       |
| SOFR         | 0.08***<br>(2.94) | 0.07***<br>(2.82) | 0.01<br>(1.00) |
| Loan Cntrls  | Yes               | Yes               | Yes            |
| Firm Cntrls  | Yes               | Yes               | Yes            |
| Tranche FE   | Yes               | Yes               | Yes            |
| Year-Qtr     | Yes               | Yes               | Yes            |
| Loan Purpose | Yes               | Yes               | Yes            |
| Adj $R^2$    | 0.70              | 0.68              | 0.78           |
| $N$          | 123,280           | 123,280           | 123,280        |