The Impact of Central Clearing on the Interest Rate Swaps Market

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# Introduction

The 2006-2008 financial crisis, the most severe downturn since the Great Depression, led to the passage of the Dodd-Frank Wall Street Reform and Consumer Protection Act (DFA). A key provision of the DFA required certain financial contracts to be cleared through a central counterparty. This study investigates the causal impact of this clearing mandate on prices, volatility and liquidity in the interest rate (IR) swaps market, a major derivatives market used for hedging or speculating on interest rate risk. This is the first examination of the impact of central clearing mandates on this market and contributes to understanding the effects of post-crisis market reforms and informing future regulatory adjustments.

Despite extensive theoretical literature on central clearing, empirical studies are limited. Earlier research focused on the credit default swaps (CDS) market using event studies. Event studies cannot isolate causal impacts due to potential confounding factors. This study addresses the gap in the literature by (1) examining the IR swaps market, which is larger and more widely used than the CDS market and (2) using a difference-in-differences approach to identify causal effects of the clearing mandate. Leveraging the fact that initial central clearing rules targeted IR swaps in the four largest currencies (USD, GBP, EUR, JPY) traded in the US, and did not apply to other currencies or regions, this research identifies the causal impact of the regulation on pricing, liquidity and price volatility in the IR swaps market.

The paper is organized as follows: Section 2 provides background on the IR swaps market, the financial crisis, and the clearing mandate's role in post-crisis market reforms; section 3 explains central clearing and discusses plausible impact of clearing on the market; section 4 develops the theory of prices, price volatility and market size under a clearing mandate; section 5 discusses the identification strategy (including developing a novel info-metrics difference-in-differences estimator); section 6 details our data; section 7 discusses the results and section 8 concludes.

# Background

## Interest Rate Swaps

Interest rate (IR) swaps are financial derivatives used to hedge or speculate on interest rate movements. The three most common types of IR swaps include vanilla fixed-for-floating swaps, basis swaps, and cross-currency basis swaps. Vanilla fixed-for-floating swaps are the most prevalent. In this type of swap, one party exchanges fixed-rate coupon payments for floating-rate payments on a notional principal. Firms use these instruments to convert floating-rate risk to fixed-rate risk, and vice versa. For example, imagine firm A can borrow at the LIBOR rate or a fixed rate of 2.0%, while firm B can borrow at (LIBOR + 0.25%) or a fixed rate of 1.75%. Suppose firm A prefers borrowing at a fixed-rate and firm B prefers borrowing at a floating-rate (this could be because firm A owns assets such as fixed-income securities while firm B owns assets that pay a variable rate such as variable rate notes, and the firms would like to match assets with liabilities). Despite their preferences, firm A has a comparative advantage in borrowing at a floating-rate, and firm B in borrowing at a fixed-rate. To achieve their preferred arrangements, the firms can enter into an IR swap agreement with a $1M notional principal, where firm A receives a floating rate of LIBOR from firm B and pays a fixed rate of 1.75% to firm B. This transforms firm A's floating-rate liability into a fixed-rate one and vice versa for firm B. The IR swaps market allows firms to borrow in the market they have a comparative advantage in and trade for their preferred interest rate arrangement.

IR swaps are usually bespoke contracts, customizable to individual needs. As the largest over-the-counter swaps market, it accounted for $500 trillion of the $650 trillion global OTC swaps market in 2010 (BIS, 2011). Contracts are available in multiple currencies, with specific market conventions for each. The market is dealer-dominated, with dealer-customer and dealer-dealer trades accounting for 80% of notional value. Very few transactions occur bilaterally between customers. Bolandnazar (2020) found that 50% of trades (by notional value) are executed by the largest seven dealers, indicating market concentration among a few dealers. This concentration can impact pricing due to the market power of large dealers and affect market stability, as the failure of a large dealer or its counterparties can easily propagate through the system.

## Central Clearing

When a swap is cleared, the contract between the two initial parties is replaced by two contracts between each party and a central clearinghouse/derivative clearing organization (CCP or DCO). If one party fails to meet their contractual obligation, the clearinghouse can still make sure the other party gets paid. Clearinghouses are large financial institutions that are supposed to exercise prudent risk control measures, thereby lowering risks and mitigating consequences if one party defaults on their contractual obligations (counterparty risk). Clearing transforms trading by mutualizing counterparty risk, enabling netting to reduce collateral demand, and potentially reducing volatility caused by bank runs.

Originally created for members of futures and equities exchanges, clearinghouses became more significant with regulations like the Dodd-Frank Act and European Market Infrastructure Regulation (EMIR) mandating central clearing of derivatives. Mandated clearing may have macro and micro effects on the market. At the macro level, clearing could reduce volatility but also strain the market through collateral demand during volatile or illiquid periods. Large enough losses could threaten clearinghouse solvency, transmitting effects to all members.

At the micro level, central clearing may change the types of trades firms enter, potentially leading to riskier trades due to mutualized default risk (adverse selection) and riskier post-trade activities (moral hazard). Clearing is subject to economies of scale and scope, which could lead to natural monopolies. However, regulators are likely to prevent this through local clearinghouse requirements and antitrust scrutiny. While clearinghouses can reduce default risk and collateral demand, they also require resources for risk management activities, which may increase trading costs.

## Regulatory Background

### US Context

Following the financial crisis, Congress passed the DFA in 2010 to enhance the US financial system's reliability. Since OTC derivatives markets played a crucial role in the crisis, DFA aimed to significantly reform this market. Key objectives included improving trade data availability for regulators and market participants, requiring real-time reporting of certain trade characteristics, and mandating confidential trade data reporting to swaps data repositories and regulators.

To reduce default risk for large swaps dealers, DFA requires registration with the CFTC, adherence to internal business conduct standards, maintaining adequate capital and margin requirements. To enhance liquidity, price discovery and transparency, it encourages trading to take place in centralized Swaps Execution Facilities (SEFs) or Designated Contract Markets (DCMs), reporting swap price information in real time to swaps data repositories (SDRs) and submitting additional data (known as primary economic terms), to SDRs or the CFTC in a timely fashion . Furthermore, the DFA mandates most contracts be centrally cleared (and for uncleared contracts, requires parties to post margin to mitigate default effects). Table 1 summarizes the CFTC key rulemaking in these areas.

Table 1 Major Dodd-Frank Act Rulemaking Areas

|  |  |
| --- | --- |
| Rulemaking Area | Major Rules |
| Swaps Dealers and Major Swaps Participants | * Registration * Internal Business Conduct Standards * Capital and Margin for non-banks * Segregation and Bankruptcy |
| Data Requirements | * Establishment of Swap Data Repositories (SDR) * Data recordkeeping and reporting requirements * Real Time Reporting * Large Swaps Trader Reporting |
| Clearing Requirements | * Establishment of Derivatives Clearing Organizations (DCO/CCP) * Clearing requirement for most common swaps * Margining requirements for uncleared swaps |
| Trading Requirements | * Establishment of Swaps Execution Facilities (SEF) * Made Available for Trade (MAT) designation/requirement |
| Position Limits | * Position Limits and Aggregation of Positions |
| Enforcement | * Anti-Manipulation * Disruptive Trading Practices * Whistleblowers |
| Other | * Investment Adviser Reporting * Volcker Rule * Reliance on Credit Ratings * Fair Credit Reporting Act * Cross-Border Applications |

### International Context

Considering the global nature of the financial system, US regulators collaborated with international counterparts to harmonize regulatory requirements. In Europe, both the UK and EU enacted comprehensive reforms for their respective financial systems. The EU passed the European Market Infrastructure Regulation (EMIR), which shares similar aims with DFA, while the Bank of England issued regulations mandating clearing for most trades involving UK-based entities.

In Asia, the Japanese Financial Services Authority (JFSA) required yen-denominated IR swaps and specific CD swaps contracts to be cleared by the end of 2012. Additionally, the Monetary Authority of Singapore and the Securities and Futures Commission of Hong Kong released consultation papers expressing their intentions to clear swaps denominated in certain Asian currencies. Table 2 summarizes the international context:

Table 2 Summary of Central Clearing Requirements in Major FInancial Centers

|  |  |
| --- | --- |
| Jurisdiction | Relevant Laws and Regulations |
| North America | * DFA (2010) and CFTC and SEC rulemaking requires mandatory clearing of IR swaps contracts denominated in USD, GBP, EUR and JPY LIBOR by September 2013. |
| Europe | * EMIR passed in 2012 requiring clearing of IR swaps contracts. |
| Asia | * JFSA requires yen denominated IR swaps referencing LIBOR to be cleared by end of 2012. * Hong Kong Monetary Authority (HKMA) and the Securities and Futures Commission (SFC) release consultation paper in 2011 on clearing of certain IR swaps denominated in Asian currencies. * Monetary Authority of Singapore (MAS) releases consultation paper in 2011 on plans for clearing of certain Singapore Dollar denominated IR swaps. |
| Australia | * Australian Council of Financial Regulators (CFR) pass legislation requiring mandatory clearing of Australian dollar denominated IR swaps by end of 2012. |

# Theory

## Pricing of Interest Rate Swaps

### Without credit risks

An interest rate swap can be thought of as an exchange of a series of fixed payments by one party for a series of variable (floating) payments by the other party involved in the swap. For the fixed leg, the present value of the payments is given by:

Where: CF is the (fixed) cash flow, is the risk-free rate for period , is the time at which CF will be received and is the tenor (total length of the swap contract)

The present value of the floating leg is:

Where: is the floating leg payment at period , and all the other variables are as defined previously.

The net present value of the contract for the party paying the fixed leg and receiving the floating leg is:

*(The counterparty's value is given by a similar formula, but with the signs reversed on the right-hand side.)*

Floating rate payments are unknown in advance but are usually determined by a relevant yield curve. For instance, if the floating leg payment is based on USD LIBOR, the USD LIBOR curve, constructed by interpolating short-term deposit rates, medium-term Eurodollar futures, and long-term instruments like forward rate agreements and existing swaps, is used. At the outset of the contract, its value is zero. This is achieved by determining the present value of the floating leg using the assumed payments, and then setting the fixed rate payment such that the present values of both legs equal.

### Counterparty Risk and CVA/DVA

The interest rate swap market is dominated by a handful of substantial swap dealers (SDs) and Major Swap Participants (MSPs) rather than many atomistic market participants. These SDs and MSPs offer buy and sell quotes for swaps, potentially finding other participants to balance their swap exposures. Figure 1 depicts a hypothetical network model of such a market.Diagram

Description automatically generated

In the figure, three dealers (D) each engage with their set of clients (C). Note that dealers might engage in interdealer trading (indicated by bi-directional arrows between dealers) and bulk futures markets trading (not shown) for cash flow or risk management purposes. Customers might trade with multiple dealers (indicated by arrows going from C to multiple Ds) or occasionally engage in bilateral trades (indicated by arrows going from C to C) amongst themselves. However, such bilateral trades typically have low volume. It is believed that the dealer-centric network structure lowers search costs compared to a direct customer-to-customer market.

In practice, customers and dealers must account for the risk associated with counterparties defaulting. The "risk-free" present value pricing above needs to be adjusted for this risk.

If *Si*​ represents the survival probability of the counterparty at period , the expected present value of the fixed leg is:

The fixed rate payment needs to account for the modified PV of the floating leg.

(Note that a swap's valuation with counterparty risk requires two adjustments. Only the credit valuation adjustment [CVA] is shown above. However, if a counterparty defaults, this means that the party also does not have to make its obligated payments, which would increase the value of the contact, called a Debit Value Adjustment [DBA]).

### Central Clearing

The structure of a dealer-dominated market means that a dealer's failure (possibly due to inadequate risk management or correlated customer defaults) could affect other dealers and potentially the entire market. To counter this, regulators introduced central counterparties (clearinghouses). These clearinghouses void (novate) the initial swap contract and establish two new contracts, mirroring the original, with each counterparty. Now participants only need to be concerned about the clearinghouse's potential default, rather than their counterparties. Owing to their robust capitalization, regulation, and sound risk management, clearinghouses are perceived to decrease default and contagion risks. Figure 2 visualizes a hypothetical market structure with mandated central clearing.

Diagram, text, letter

Description automatically generated

If clearinghouses can reduce or eliminate counterparty risk, swaps values should be closer to the risk-free case rather than the case with counterparty risk. Even if clearinghouses are successful at eliminating counterparty risk, additional cost of compliance (such as clearing fees and margin requirements) could keep swaps prices from reaching the risk-free valuation.

## Model of Bid-Ask Prices

### With No Counterparty Risk

I adapt the model from Biais (1993) for centralized trading where all market participants can observe the bids, asks and market orders of their market participants. The model is a sequential game. In the first stage, two competing dealers (liquidity providers) receive a random inventory position in the risky asset between [-R, R]. In stage 2, the dealers set their bid and ask prices. In the next stage there is a liquidity shock with probability . If there is a liquidity shock, a liquidity trader (liquidity demander) receives an inventory of quantity with probability (or market sell order of size with the same probability). He then decides the size of the optimal market order, which is executed at the best bid or ask price posted by the dealers. If there is no liquidity shock, no trade takes place. In the final stage, the price of the risky asset is realized, and players receive their utility.

I assume that the two dealers are identical except for their inventory positions. All market participants have constant relative risk aversion (CRRA) utility . If there is a liquidity shock, the liquidity trader observes the market prices and selects the quantity (size) of the market order. The final price of the risky asset is , where .

I analyze the case where the liquidity trader receives a liquidity shock (the case where the liquidity trader receives a shock will be analogous). At the end of the game, once the asset price is realized, this trader receives wealth:

Where is the net position of the trader in the risky asset at the end of the game and is the cash from selling units of the risky asset at the best (highest) bid price. The liquidity trader will maximize his expected utility . The optimal quantity is:

Where I have used the fact that

I analyze the case of the reservation quote for dealer 1, competing over a market buy order. If he has the best price, he receives the order flow and has wealth:

Where: is the bid price set by dealer 1, is the size of the market order and is his random inventory position (a number between ). If he does not have the best price, he receives:

Dealer 1 is indifferent between trading and not trading when the expected utility from both actions are the same. This happens when:

Where the price is subscripted with to emphasize it is the reservation price. A similar analysis holds for the ask price:

And in general, for dealer , the reservation prices are:

I analyze the case of the optimal bid quote for dealer 1, assuming competing dealers do not observe the other’s inventory levels, but both assume that the others inventory is drawn uniformly from . By increasing his bid quote, a dealer increases his probability of winning the order flow, but he must balance this against the fact that he pays more for each unit acquired. He would not like to increase his quote beyond his reservation price. The optimal bid quote is:

Similarly, the optimal ask quote is:

And in general, the optimal bid and ask quotes for dealer are:

The observed bid ask spread is:

NB: Under competition with many dealers, the second term on the RHS of the above equation is , which approaches as , and the bid ask quotes become the reservation quotes.

### With counterparty risk

Under the scenario where there is counterparty risk, if the counterparty defaults the value of the asset is impaired (the holder of the non-defaulting leg no longer receives expected cash flows). However, for the defaulter, the value of the asset is enhanced (as he no longer needs to make payments). I model this as an additional shock to the realized value of the asset: . The analysis remains essentially the same, but the optimal market order size, reservation prices, and optimal quotes now become:

## Models of Price Volatility

### Markets without Counterparty Risk

I develop an original model of price volatility. There are two sets of agents: market-makers who post bid and ask prices, and liquidity traders who post market orders. Assume that order-flow (net market-buy or market-sell orders) in one period are i.i.d Normal with variance :

Market-makers adjust their next period price based on the current period’s observed order-flow:

Where: is a parameter for the market-makers sensitivity to order-flow.

The expression for the volatility in this case is:

### Price Volatility in Markets with Counterparty Risk

I modify the above model to include additional order-flow dynamics related to counterparty risk. Assume that when the current period’s order-flow is negative, there is additional sell-off of the risky asset in the next period due to (perceived) additional counterparty risk, and when the current period’s order flow is positive, there is additional buying of the risky asset in the next period due to (perceived) reduction in counterparty risk. The order-flow dynamics are now given by:

Where:

The expression for the price chance becomes:

Where I have used the fact on the 3rd line and that .

# Identification Strategy

## Pricing

I investigate the impact of the central clearing mandate on the interest rate swap prices by comparing the premium (the difference between the fair rate and the actual quoted fixed rate) on USD denominated swaps versus CAD denominated swaps before and after the mandate. To achieve this, I employ a difference-in-differences (DiD) identification strategy, which allows me to isolate the causal effect of the mandate on the swap premiums by exploiting the variation in the timing of the policy implementation.

I begin by selecting a sample of interest rate swaps denominated in both USD and CAD with similar characteristics, such as contract maturity and credit quality, from the ten trading days before and after the central clearing mandate was implemented. My main data source is transaction-level data from the Depository Trust & Clearing Corp. Swaps Data Repository (DTCC SDR), and market data from financial information providers such as Bloomberg (see data section). Additionally, I collect data on macroeconomic indicators, central bank policies, and other relevant factors that could potentially affect swap premiums.

I create two groups based on the currency of denomination: (1) the treatment group, consisting of USD denominated swaps that were affected by the central clearing mandate, and (2) the control group, consisting of CAD denominated swaps that were not subject to the mandate during the same period. By comparing the swap premiums between these two groups before and after the mandate, I can identify the causal effect of the policy on swap premiums if both groups would have followed parallel trends in the absence of the policy intervention.

To estimate the causal effect of the central clearing mandate on swap premiums, I employ a DiD regression model, which takes the following form:

Where is the swap premium for swap at time , is an indicator variable equal to 1 if the swap is denominated in USD (treatment group) and 0 otherwise (control group), is an indicator variable equal to 1 for the period after the mandate was implemented, and is a vector of control variables. The coefficient of interest is δ, which captures the causal effect of the central clearing mandate on swap premiums.

To ensure the validity of the identification strategy, I first test the parallel trends assumption by visually inspecting the pre-treatment trends of swap premiums for both treatment and control groups and conducting placebo tests. Additionally, I perform several robustness checks, such as using alternative control groups, applying different sample selection criteria, and employing alternative econometric techniques, such as propensity score matching and synthetic control methods.

## Liquidity

Identification of liquidity strategy goes here.

## Volatility

Identification strategy for price volatility goes here.

# Data

The Commodity Futures Trading Commission's (CFTC) clearing mandate on interest rate (IR) swaps became effective on March 11, 2013. The regulation was implemented in three phases. Phase 1 mandated clearing for certain IR swaps involving swap dealers (SD), major swap participants (MSP), or active funds. Phase 2 extended the mandate to additional entities, while Phase 3 covered all remaining entities (unless exempted). The IR swaps covered by the mandate were the largest group by volume, denominated in USD, EUR, GBP, and JPY.

I compare prices, price volatility, and liquidity before in each of the three phases, comparing USD and CAD denominated swaps – the largest regulated and unregulated markets, respectively. To minimize the impact of interest rate policy and other macroeconomic variables, I analyze ten trading days before (Feb 25, 2013 – Mar 8, 2013, May 27, 2013 – June 7, 2013 and August 26, 2013 – September 6, 2013) and after (Mar 11 – Mar 22, 2013, June 10, 2013 – June 21, 2013 and September 9, 2013 to September 20, 2013) the regulation's effective date in each phase.

To calculate the fair price of IR swaps, I forecast future floating rate payments and discount the payments using the appropriate yield curve. I use a single curve method, the prevalent pricing method during the study period. For USD swaps, I obtain the USD semiannual fixed-floating rate curve for each trading day from Bloomberg. For CAD denominated swaps, I obtain the Canadian yield curve from the Bloomberg Terminal. I use the QuantLib-python library to construct a piecewise linear forward curve.

I acquire trading data from the DTCC SDR. The data elements include swap currency, trade date and time, effective date, maturity date, fixed rate, payment frequencies, clearing status, notional value, and capped notional indicator. For USD swaps, USD LIBOR is the floating rate index for 98% of swaps, while for CAD swaps, CDOR is the index for 99% of swaps. I exclude certain swaps such as those that make a single payment at maturity (i.e., payment frequency is 1T). Table 3 shows the notional value and number of trades captured in my data.

Table 3 Number of trades and notional value of USD and CAD denominated IR swaps

(Pre-Phase 1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Currency** | **Floating Leg** | **Cleared (Count)** | **Cleared (Notional Value)** | **Uncleared (Count)** | **Uncleared (Notional Value)** | **Percent Cleared** |
| **USD** | **LIBOR** | 3,518 | 203,345.90 | 3,071 | 131,242.01 | 61% |
|  | USD-Federal Funds-H.15 | 0 | 0.0 | 16 | 2,183.00 | 0% |
|  | USD-PRIME-H.15 | 0 | 0.0 | 2 | 6.00 | 0% |
|  | USD-PRIME-H15 | 0 | 0.0 | 2 | 4.00 | 0% |
|  | USD SPRDL MANUAL | 0 | 0.0 | 1 | 100.00 | 0% |
|  | USD-AAA\_MUNI- | 0 | 0.0 | 4 | 31.00 | 0% |
|  | USD-OIS-3 | 0 | 0.0 | 1 | 6.00 | 0% |
|  | IBR | 0 | 0.0 | 2 | 200.00 | 0% |
|  | CLICP | 0 | 0.0 | 1 | 100.00 | 0% |
|  | TIS | 0 | 0.0 | 1 | 1.00 | 0% |
|  | USD-USPSA-BLOOMBERG | 0 | 0.0 | 1 | 4.00 | 0% |
| **CAD** | **CAD-BA-CDOR** | 225 | 18,811.40 | 308 | 20,363.10 | 48% |
|  | CAD-REPO-CORRA | 0 | 0.00 | 3 | 410.00 | 0% |

(Post Phase 1)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Currency** | **Floating Leg** | **Cleared (Count)** | **Cleared (Notional Value)** | **Uncleared (Count)** | **Uncleared (Notional Value)** | **Percent Cleared** |
| **USD** | **LIBOR** | 4,342 | 262,257.70 | 2,125 | 76,649.65 | 77% |
|  | USD-Federal Funds-H.15 | 0 | 0.00 | 24 | 3,353.00 | 0% |
|  | IBR | 0 | 0.00 | 6 | 1,050.00 | 0% |
|  | USD-SIFMA Municipal Swap Index | 0 | 0.00 | 6 | 60.00 | 0% |
|  | USD-PRIME-H.15 | 0 | 0.00 | 2 | 6.00 | 0% |
|  | USD-PRIME-H15 | 0 | 0.00 | 2 | 3.00 | 0% |
|  | USD-Prime-H.15 | 0 | 0.00 | 1 | 2.00 | 0% |
|  | USD-USPSA-BLOOMBERG | 0 | 0.00 | 2 | 20.00 | 0% |
|  | CLICP | 0 | 0.00 | 3 | 450.00 | 0% |
|  | USD-AAA\_MUNI- | 0 | 0.00 | 2 | 25.00 | 0% |
|  | USD-BMA Municipal Swap Index | 0 | 0.00 | 2 | 6.52 | 0% |
| **CAD** | **CAD-BA-CDOR** | 126 | 9,578.00 | 140 | 11,137.31 | 46% |
|  | CAD-REPO-CORRA | 0 | 0.00 | 3 | 780.00 | 0% |
|  | CDOR | 0 | 0.00 | 5 | 105.60 | 0% |

(Pre-Phase 2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Currency** | **Floating Leg** | **Cleared (Count)** | **Cleared (Notional Value)** | **Uncleared (Count)** | **Uncleared (Notional Value)** | **Percent Cleared** |
| **USD** | **LIBOR** | 6,870 | 426,753.26 | 2,954 | 118,388.28 | 78% |
|  | USD-Federal Funds-H.15 | 0 | 0.00 | 29 | 4,463.00 | 0% |
|  | COOVIBR | 0 | 0.00 | 9 | 1,800.00 | 0% |
|  | CLP-TNA | 0 | 0.00 | 6 | 1,200.00 | 0% |
|  | USD FORM 3750 | 0 | 0.00 | 1 | 100.00 | 0% |
|  | USD-AAA\_MUNI- | 0 | 0.00 | 2 | 13.00 | 0% |
|  | USD-BMA Municipal Swap Index | 0 | 0.00 | 1 | 7.00 | 0% |
|  | USD-PRIME-H.15 | 0 | 0.00 | 12 | 62.90 | 0% |
| **CAD** | **CAD-BA-CDOR** | 180 | 14,726.00 | 169 | 14,290.70 | 51% |

(Post Phase 2)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Currency** | **Floating Leg** | **Cleared (Count)** | **Cleared (Notional Value)** | **Uncleared (Count)** | **Uncleared (Notional Value)** | **Percent Cleared** |
| USD | **LIBOR** | 7,975.00 | 461,124.51 | 1,449.00 | 53,548.33 | 90% |
|  | USD-Federal Funds-H.15 | 0.00 | 0.00 | 33.00 | 5,068.00 | 0% |
|  | USD-PRIME-H.15 | 0.00 | 0.00 | 5.00 | 26.00 | 0% |
|  | USD-PRIME-H15 | 0.00 | 0.00 | 1.00 | 9.00 | 0% |
|  | USD-Prime-H.15 | 0.00 | 0.00 | 1.00 | 2.00 | 0% |
|  | COOVIBR | 0.00 | 0.00 | 21.00 | 3,750.00 | 0% |
|  | CLP-TNA | 0.00 | 0.00 | 7.00 | 700.00 | 0% |
|  | USD BMA MANUAL | 0.00 | 0.00 | 1.00 | 45.00 | 0% |
|  | USD-AAA\_MUNI- | 0.00 | 0.00 | 3.00 | 20.00 | 0% |
|  | USD-BMA Municipal Swap Index | 0.00 | 0.00 | 2.00 | 10.00 | 0% |
| CAD | **CAD-BA-CDOR** | 176.00 | 11,322.08 | 174.00 | 7,969.50 | 59% |

(Pre-Phase 3)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Currency** | **Floating Leg** | **Cleared (Count)** | **Cleared (Notional value)** | **Uncleared (Count)** | **Uncleared (Notional Value)** | **Percent Cleared** |
| **USD** | **LIBOR** | 6,112.00 | 396,744.28 | 1,398.00 | 47,355.82 | 89% |
|  | USD-Federal Funds-H.15 | 0.00 | 0.00 | 36.00 | 4,539.00 | 0% |
|  | USD-PRIME-WEIGHTED-AVERAGE | 0.00 | 0.00 | 2.00 | 200.00 | 0% |
|  | USD-PRIME-H.15 | 0.00 | 0.00 | 5.00 | 7.00 | 0% |
|  | USD-PRIME-H15 | 0.00 | 0.00 | 8.00 | 35.56 | 0% |
|  | USD-AAA\_MUNI- | 0.00 | 0.00 | 1.00 | 10.00 | 0% |
|  | USD-SIFMA Municipal Swap Index | 0.00 | 0.00 | 1.00 | 5.00 | 0% |
| **CAD** | **CAD-BA-CDOR** | 128.00 | 9,697.20 | 134.00 | 7,487.11 | 56% |
|  | CAD-REPO-CORRA | 0.00 | 0.00 | 1.00 | 35.00 | 0% |

(Post Phase 3)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Currency** | **Floating Leg** | **Cleared (Count)** | **Cleared (Notional Value)** | **Uncleared (Count)** | **Uncleared (Notional Value)** | **Percent Cleared** |
| **USD** | **LIBOR** | 7,481 | 485,507.61 | 1,461 | 58,912.20 | 89% |
|  | USD-Federal Funds-H.15 | 0 | 0.00 | 19 | 3,606.00 | 0% |
|  | TREASURY\_DTCC\_GCF\_REPO\_INDEX | 0 | 0.00 | 4 | 850.00 | 0% |
|  | USD FORM 3750 | 0 | 0.00 | 1 | 30.00 | 0% |
|  | USD-AAA\_MUNI- | 0 | 0.00 | 9 | 56.00 | 0% |
|  | USD-BMA Municipal Swap Index | 0 | 0.00 | 3 | 13.00 | 0% |
|  | USD-BMA-BMA | 0 | 0.00 | 1 | 22.00 | 0% |
|  | USD-BMA-REFB | 0 | 0.00 | 2 | 12.75 | 0% |
|  | USD-PRIME-H.15 | 0 | 0.00 | 7 | 17.00 | 0% |
|  | USD-PRIME-H15 | 0 | 0.00 | 7 | 64.00 | 0% |
|  | USD-Prime-H.15 | 0 | 0.00 | 1 | 1.00 | 0% |
|  | USD-SIFMA Municipal Swap Index | 0 | 0.00 | 5 | 52.75 | 0% |
| **CAD** | **CAD-BA-CDOR** | 210 | 14,099.00 | 354 | 15,561.41 | 48% |
|  | CDOR | 0 | 0.00 | 1 | 5.00 | 0% |
|  | CDOR.CAD | 0 | 0.00 | 4 | 106.00 | 0% |

Note that before the regulation is passed, (voluntary) clearing in USD-denominated swaps is a little less than 61%. After phase 1 implementation, clearing increases to around 78%. After phase 2 implementation, clearing jumps to 89% and remains at that level after phase 3. The CAD-denominated market is much smaller (both in number of trades, and notional value). Clearing in Canadian IR swaps hovers around 48% prior to Phase 1. It reaches a high of around 56% in phase 2 and diminishes back to 48% after phase 3. Note that clearing in CAD denominated swaps is voluntary.

# Results

## Prices

For analyzing the impact of the clearing mandate on prices, I compare the USD LIBOR denominated contracts against the BA-CDOR contracts. The USD LIBOR contracts are subject to the CFTC clearing mandate (note that USD denominated contracts using another floating rate index such as the Federal Funds Rate is not subject to the clearing mandate, but these contracts can be voluntarily cleared.

Table 4 lists the basic DiD results for prices (or premia over fair price described in the theory section). Column 1 shows the basic results without any other controls. The clearing mandate causes a ~12 bps rise in premia. As expected, reducing the riskiness of the contract increases its price. Column 2 shows the effects additional controls, such as the notional value of the contract, day and period of trading and whether the notional value was “capped” (i.e. the exact value was not reported to the trade repo). The results are robust to such controls.

Table 5 shows the result of running the simple model on each phase of the data separately. In phase 1, there is no effect of the clearing mandate on the premium. Note that phase 1 only applied the clearing mandate to swap dealers, major swap participants and active funds. Clearing went from ~61% before phase 1 into effect to ~ 77% after phase 1. Phase 2 added a broader set of market participants (commodity pools, private funds, banks and other financial institutions) to the clearing requirement and clearing went from ~78% of the market to ~90% of the market. Phase 3 applied the mandate to all entities not specifically exempt from the clearing requirement (such as companies that primarily use IR swaps to hedge against commercial risk). Phase 3 did not have a large impact on clearing and it remained around ~89% of the market. Phase 1 does not seem to have had an effect on perceptions of riskiness of IR swaps, but phase 2 and phase 3 results are consistent with expectations.

Table 4 Difference-in-Difference Result



Table 5 By Phase DiD Results



(Robustness Checks Here)

## Liquidity

Liquidity Results Here

## Price Volatility

Price Volatility Results Here

# Conclusion