The Impact of Central Clearing on the Interest Rate Swaps Market

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# Introduction

The 2006-2008 financial crisis was the most severe economic downturn since the Great Depression. In the wake of the crisis, Congress passed the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd Frank Act, DFA) to reform the financial system. Among the most important changes to the financial system mandated by the Act was the requirement that certain financial contracts be cleared through a central counterparty. Exploiting a difference-in-differences approach, I examine the causal impact of this clearing mandate on the size, pricing, and price volatility in the interest rate (IR) swaps market. The IR swaps market is one of the largest and most important derivatives markets in existence. It is used by many firms and individuals to hedge or speculate on interest rates. This is the first study to comprehensively look at the impact of the clearing mandate on this market. This paper contributes to the large theoretical literature on central clearing by adding empirical evidence. According to regulators, central clearing is the most important among the set of market reforms proposed after the financial crisis. Understanding its impact on a large, influential market will be important as regulators tweak existing regulations or design new ones.

Although there is a rich literature on the theory of central clearing, empirical work in this area is mostly missing. Several event studies following the enactment of the clearing mandate examined its effects on the credit default (CD) swaps market. Since the turmoil in CD swaps market was associated with the financial crisis, initial research concentrated on this area. However, the IR swaps market is many times larger than the CD swaps market and used by many more firms and individuals to hedge or speculate on interest rate risk. To date, there has been no study of the clearing mandate on the IR swaps market. In addition, existing studies on the CD swaps market utilize an event study framework. Event studies suffer from the weakness that one cannot plausibly isolate the causal impact of a regulation on variables of interest due to the other contemporaneous changes that might impact those variables. Using the fact that the initial central clearing rules targeted IR swaps denominated in the four largest currencies (USD, GBP, EUR, JPY) but did not apply to swaps denominated in other currencies, I am able to identify the causal impact of the regulation on pricing, price volatility and market size of the IR swaps market. I also use the fact that no similar regulation existed in Europe and Asia at the time (thus leaving a period where some contracts traded in the US was centrally cleared, but similar contracts traded in Europe and Asia were not) to check the robustness of these conclusions.

The rest of the paper is organized as follows: section II explores the background of the interest rate swaps market and the financial crisis and locates the clearing mandate in the broader context of market reforms following the 2006-2008 crisis. Section III explains the mechanics of central clearing and discusses plausible impact of mandatory clearing on the IR swaps market. Section IV develops the theory of prices, price volatility and market size under a clearing mandate. Section V discusses the identification strategy (including developing a novel info-metrics difference-in-differences estimator). Section VI details our data. Section VII discusses the results and section VIII concludes.

# Background

## Interest Rate Swaps

Interest rate swaps are financial derivative products used to hedge against or speculate on interest rate movements. There are several types of such swaps commonly traded on the market: “vanilla” fixed-for-floating swaps, basis swaps and cross currency basis swaps. Of these, the vanilla fixed-for-floating swap is the most common. In such a swap, one party makes periodic fixed-rate coupon payments in exchange for receiving floating-rate payments on an underlying “notional” principal. Firms can use these instruments to transform floating-rate risk to fixed-rate risk and vice versa.

Consider the following example: firm A can borrow in the market at the LIBOR rate or can borrow at a fixed rate of 2.0%; firm B can borrow in the market at (LIBOR + 0.25%) or at the fixed rate of 1.75%. Due to business considerations, suppose firm A would prefer to borrow in the fixed rate market and firm B would prefer to borrow in the floating rate market. However, firm A has a comparative advantage in borrowing in the floating rate market and firm B has a comparative advantage in borrowing in the fixed rate market. The firms can agree to the following set of transactions to transform their liabilities into a more preferred arrangement: firm A borrows $1M in the floating rate market at LIBOR and firm B borrows $1M in the fixed rate market at 1.75%. They simultaneously enter into an IR swap agreement with a notional principal of $1M where firm A agrees to receive floating rate of LIBOR from firm B and pay a fixed rate of 1.75% to firm B. These two sets of transactions transform firm A’s floating-rate liability into a fixed-rate liability at 1.75% and firm B’s fixed-rate liability into a floating-rate liability. Thus, the IR swaps market allows each firm to borrow in the market (fixed or floating) they have a comparative advantage in and trade for the type of interest rate arrangement they would prefer.

IR swaps are usually bespoke contracts, where the underlying notional principal, tenor, payment frequency, reference rates etc. are customized to match the needs of individual firms or persons trying to hedge their interest rate risk. It is the largest over-the-counter swaps market in existence, accounting for $500 trillion of the $650 trillion global OTC swaps market in 2010 (BIS, 2011). Contracts are available in multiple currencies including USD, EUR, GBP and JPY (the most common currencies). Various market conventions exist for each of these currencies. For example, for contracts denominated in USD, the effective date (i.e. when interest begins accumulating) is usually two days after the trade date; the fixed rate payments follow a 30I/360 day count convention, with semiannual payments; floating leg payments are usually indexed to the 3 month USD LIBOR with quarterly payments (payments made 2 days after LIBOR fixing). However, as stated earlier, contracts can be customized to meet the needs of the customers. Different conventions exist for other currencies (for example, for CAD swaps, interest starts accumulating from the trade date).

The IR swaps market is a dealer-dominated market. Dealer-customer and dealer-dealer trades accounted for 80% of notional value (cite). Very few transactions are traded bilaterally between customers. Bolandnazar (2020) finds that 50% of trades (by notional value) are executed by the largest seven dealers. Thus, there is some evidence that market is relatively concentrated among few dealers. This can have an impact on pricing (due to market power of large dealers), as well as the stability of the market, where 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 parties is replaced (novated) by a contract between each party and a central clearinghouse (also called a Central Counter Party [CCP] or Derivates Clearing Organization [DCO]). The clearinghouse becomes the buyer to the original seller and seller to the original buyer. A clearing mandate requires almost all[[1]](#footnote-2) contracts to be cleared through a clearinghouse. The clearing process transforms counterparty risk (the risk that one of the parties will default on its obligations) with a risk between each party and the clearinghouse. Since clearinghouses are large financial institutions that are required to practice prudent risk control measures (such as monitoring trading positions and trading activities of members, collecting margin/collateral from members, having a guarantee fund to cover losses in case of a member’s default and having other sources of funding if margin/collateral and the guarantee fund are not enough to cover losses), they should be less prone to crashes in the case of the default of one party.

Clearing transforms trading in several ways. Firstly, it mutualizes counterparty risk, as contracts between individual counterparties are replaced by contracts with a large, well-regulated central clearinghouse owned by the trading members. Secondly, clearinghouses can net trades, which lowers collateral demand. Consider the following example of netting: Firm A owes Firm B $1 million in collateral and Firm C owes Firm A $1 million in collateral. If these trades are cleared through a clearinghouse, Firm A’s collateral obligation can be netted out. If a clearinghouse clears multiple types of products (say credit and interest rate products), it can also net across products. For example, if Firm A had $1 million in collateral obligations from credit products and was owed $1 million in collateral from interest rate products, the clearinghouse could net out the collateral obligations between the two products. Thirdly, by mitigating counterparty risk, central clearing can reduce volatility from “run on the bank” type trading.

Clearinghouses were originally created by members of futures exchanges to serve the members’ interests (i.e., to reduce collateral demand through netting and protect members in the case of one party’s default). Regulations such as Dodd-Frank Act and European Market Infrastructure Regulation (EMIR) mandate central clearing of derivatives, expanding the use and importance of these financial entities. Mandated clearing is likely to have both market-wide (macro) and individual trade (micro) level effects. On the macro level, clearing *could* reduce volatility by mitigating the effects of the failure of a single large trading firm. However, collateral demand (margin calls) by the clearinghouse can put additional strain on the market. Margin calls are likely to occur precisely when the markets are volatile or illiquid. If firms then need to sell into this illiquid market in order to pay up, it is likely to further destabilize the market. In addition, large enough losses could threaten the solvency of the clearinghouse, which could then transmit the effect to all members who have business with the clearinghouse.

At the micro level, central clearing could change the type of trades that firms enter. As stated earlier, central clearing mutualizes the risk of default. Thus, when clearing is mandated, firms might be more inclined to enter riskier trades, since they do not bear all the costs of default (i.e., adverse selection). In addition, firms could engage in riskier activities after entering a trade (i.e., moral hazard), since, again, they do not bear the full cost of default. Central clearing is also subject to economies of scale and scope, which would lead to natural monopolies in the market. However, regulators are likely to require that trades be cleared through their “local” clearinghouse, and to scrutinize mergers in the industry for antitrust reasons, preventing the realization of such economies. These are real costs to traders who cannot benefit from the netting effects of one large entity handling all clearing. Clearinghouses also require resources to engage in their risk management activities (such as setting and collecting margin, monitoring members’ financial conditions and trading positions, and mitigating funding and liquidity risk). Thus, it is likely to raise the costs of trading in this respect (although it might lower overall cost by reducing default risk and collateral demand).

## Regulatory Background

### US context

Congress passed the DFA in 2010 following the financial crisis to improve the reliability of the US financial system. Since OTC derivatives markets played a crucial role in the crisis, the Act sought to significantly reform this market. Firstly, it aimed to enhance the availability of trade data to both regulators and market participants. The Act requires real time reporting of certain trade characteristics (such as price and quantity) to the public. In addition, more confidential trade data must be reported to swaps data repositories and regulators. In order to reduce the risk of default for large swaps dealers, the Act requires such entities to be registered with the CFTC and practice some internal business conduct standards (including maintaining adequate capital and margin requirements). It encourages trading of derivatives contracts in a central swaps execution facility (SEF) or designated contract market (DCM), which can enhance liquidity and price discovery. Finally, it requires most contracts be centrally cleared, and for those contracts that are not cleared, for parties to post margin in order to mitigate the effects of default. Table 1 summarized CFTC rule-making in each of these areas.

Table Major Dodd-Frank Act Rulemaking Areas

|  |  |
| --- | --- |
| Rulemaking Area | Major Rules |
| Data | * Establishment of Swap Data Repositories * Data Recordkeeping and Reporting Requirements * Real Time Reporting * Large Swaps Trader Reporting |
| Clearing | * Establishment of Derivatives Clearing Organizations * Clearing Requirement * Margining Requirement |
| Trading | * Establishment of Swaps Execution Facilities * Made Available for Trade (MAT) designation/requirement |
| Swaps Dealers and Swaps Participants | * Registration * Internal Business Conduct Standards * Capital and Margin for non-banks * Segregation and Bankruptcy |
| Position Limits | * Position Limits and Aggregation of Positions |
| Enforcement | * Anti-Manipulation * Disruptive Trading Practices * Whistleblowers |
| Particular Products | * Agricultural Swaps * Commodity * Commodity Options * Foreign Currency |
| Other | * Investment Adviser Reporting * Volcker Rule * Reliance on Credit Ratings * Fair Credit Reporting Act * Cross-Border Applications |

### International Context

Given the global nature of the financial system, US regulators coordinated with counterparts internationally to harmonize regulatory requirements. In this regard, in Europe, both the UK and EU passed comprehensive reforms of their part of the international financial system. The EU passed the European Market Infrastructure Regulation (EMIR) with similar aims as the Dodd-Frank Act, while Bank of England promulgated regulations requiring clearing of most trades involving UK based entities. In Asia, the Japanese Financial Services Authority (JFSA) published rules requiring yen denominated IR swaps and certain CD swaps contracts be cleared by the end of 2012. The Monetary Authority of Singapore and the Securities and Futures Commission of Hong Kong both also issued consultation papers on their intention to clear swaps denominated in certain Asian currencies. Table 2 summarizes the international context:

Table Summary of Central Clearing Requirements in Major FInancial Centers

|  |  |
| --- | --- |
|  |  |
| North America | * Dodd-Frank Act and CFTC and SEC rulemaking requires mandatory clearing of IR swaps contracts by September 2013 |
| Europe | * European Market Infrastructure Regulation (EMIR) passed in 2012 |
| Asia | * Japan Financial Services Authority requires yen denominated IR swaps referencing LIBOR to be cleared by end of 2012. * Hong Kong Monetary Authority and the Securities and Futures Commission 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 in 2012 announcing plans to pass legislation requiring mandatory clearing of Australian Dollar denominated IR swaps by end of 2012. |

# Theory

(Add theory section here)

# Identification Strategy

(Add identification strategy here)

# Data

The Commodity Futures Trading Commission’s (CFTC) clearing mandate on IR swaps became effective on March 11, 2013. The regulation was implemented in phases: in phase 1, which became effective on March 11, certain IR swaps[[2]](#footnote-3) involving swaps dealers (SD), major swap participants (MSP), or active funds needed to be cleared. In phase 2, which became effective after 90 days, IR swaps involving certain additional entities including commodity pool operators, private funds and persons predominantly engaged in activities that are in the business of banking, or in other activities that are financial in nature also needed to be cleared. In phase 3, which became effective after 180 days, IR swaps of all other entities (unless covered by some exemption) needed to be cleared. The IR swaps covered by the mandate were fixed-to-floating rate swaps denominated in US Dollar (USD), Euro (EUR), Sterling (GBP) and Yen (JPY) with a tenor of 28 days to 50 years (30 years for JPY), and floating legs based on the USD LIBOR, EURIBOR, GBP LIBOR and JPY LIBOR floating rate indexes, with no optionality, dual currency or conditional notional amounts. These are the largest group (by volume) of IR swaps traded in the market. During a “request for comments”, the commission also considered IR swaps denominated in other currencies such as the Australian Dollars (AUD), Canadian Dollars (CAD), Swiss Francs (CHF), Swedish Krone (SEK), Czech Koruna (CZK), Danish Krone (DKK), Hong Kong Dollar (HKD), Hungarian Forint (HUF), Norwegian Krone (NOK), New Zealand Dollar (NZD), Polish Zloty (PLN), Singapore Dollar (SGD), and South African Rand (ZAR). However, it did not mandate clearing for IR swaps denominated in those currencies.

This paper compares prices, price volatility and market size for the period before and after phase 1 of the trading mandate becomes effective[[3]](#footnote-4). I compare relevant metrics (the counterparty risk discount/premium, the gross notional market size and the daily coefficient of variation) for USD denominated swaps against CAD denominated swaps, which are the largest regulated and unregulated markets, respectively[[4]](#footnote-5). In order to minimize the effects of interest rate policy and other macroeconomic variables, I consider the ten trading days prior to (Feb 25 2013 – Mar 8, 2013) and after (Mar 11 – Mar 22, 3013) the regulation becomes effective, a short enough period where macroeconomic variables should be stable.

In order to calculate the fair price of an IR swaps, I need to forecast future floating rate payments and discount the payments (both fixed and floating) using the correct yield curve. I use a “single curve” method to both forecast future payments and discount the payments. The single curve method was the prevalent pricing method on the IR swaps market during the time frame of the study. Following some instability in the financial markets and the LIBOR manipulation scandal, the market moved to “dual curve discounting”. Since this was not the prevalent method of calculating fair prices at the time of the study, it is not considered in this paper. For USD swaps, I obtain the USD semiannual fixed-floating rate curve for each trading day from Bloomberg. The curve consists of three segments (legs): the short leg is the rate on 3M USD LIBOR (deposit rate), the medium leg is the price of Eurodollar futures from 6M – 18M (a convexity adjustment is made to account for differences in payoffs between futures and forward/swaps contracts) and the long leg is the rate on actively traded forward rate agreements. For CAD denominated swaps, I obtain the relevant Canadian yield curve from the Bloomberg Terminal. For the CAD curve, the short leg consists of deposit rates (Canadian Call Loan Rate [CLLR] and Canadian Dollar Offered rate [CDOR]) between 1D – 3M); the medium leg consists of Canadian Banker’s Acceptance (BAX) futures ranging from 6M – 21M; the long end of the curve consists of FRA between 2Y – 30Y. I obtain the underlying prices/quotes of the above instruments for each trading day from Bloomberg and use the QuantLib-python library to construct a piecewise linear forward curve.

I obtain trading data from the Depository Trust & Clearing Corporation (DTCC) Data Repository (DDR). During the trading period considered in this study, it was the only Swaps Data Repository (SDR) in operation and contained trade data for most IR swaps. It excludes swaps exempted from DFA reporting requirements and any swaps that neither involve USD nor have a US registered firm as a counterparty. The data elements include: the swap currency, the date and time of the trade, the effective date (when the swaps contract comes into effect), the maturity date (when the swaps contract terminates), the fixed rate, the fixed rate payment frequency, the floating rate index, the floating rate payment frequency, the clearing status, the notional value, capped notional indicator. For USD swaps, USD LIBOR is the floating rate index for 98% of swaps. I exclude IR swaps using other indices such as the Fed Funds Rate or the Muni Rate. For CAD swaps, CDOR is the floating rate index for 99% of swaps. I exclude swaps that make a single payment at maturity (i.e., payment frequency is 1T). Table 1 shows the notional value and number of trades captured in my data:

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Pre-Regulation: Feb 25, 2013 - Mar 8, 2013 | | Post Regulation: Mar 11, 2013 - Mar 22, 2013 | |
|  | N | Notional Value (billions) | N | Notional Value (billions) |
| CAD | 468 | CAD 39,280.10 | 259 | CAD 20,605.31 |
| USD | 5,969 | USD 317,474.51 | 5,751 | USD 313,917.10 |

I note that the CAD swaps market is much smaller (both in dollar and ticket volume). Table 2 lists the notional values, floating leg index and average tenor of USD and CAD swaps in our dataset.

Table Some characteristics of USD and CAD swaps

|  |  |  |
| --- | --- | --- |
|  | USD | |
|  | Pre | Post |
| Average Notional Value | USD 53.2M | USD 54.6M |
| Floating Leg Reference Rate |  |  |
| USD Libor BBA | 98.00% | 98.00% |
| Fed Funds | 1.00% | 1.00% |
| Other | 1.00% | 1.00% |
|  | CAD | |
| Average Notional Value | CAD 53.2M | CAD 54.6M |
| Reference Rate |  |  |
| BA-CDOR | 99.00% | 99.00% |
| Other | 1.00% | 1.00% |

# Results

## Prices

The GME regression results for the price premium is described in Table 3. We are chiefly interested in the coefficient of the interaction variable , which takes on a value of 1 if the observation is in the regulated market (USD) after March 11, and zero otherwise. In model 1, only the variables Currency (1 for USD, 0 for CAD), Period (1 for on or after, March 11 and 0 for before March 11) and the interaction variable Currency \* Period are included. In the full model, other controls such as the natural log of the underlying notional amount, the tenor, payment frequency, trade day, trade time and late effective indicators are also included.

Regulation (the coefficient of the interaction variable) is associated with a 1.180 bps increase in the premium (1.176 bps in the full model). The increase is statistically significant. Among the control variables, payment frequency is the most important and associated with a 5 to 10 bps increase in the premium (compared to the baseline of a quarterly-semi-annual contract). Contracts with a larger notional value is associated with a smaller premium (a 1% increase in the notional value is associated with a 0.04 bps reduction in the premium. Trades completed after hours is associated with a 0.3 bps increase in the premium (compared to mid-day trading) and the trading day is associated with a 1 to 2 bps increase in the premium (baseline is Wednesday trading). Contracts that become effective after March 31 is associated with a 0.3 bps increase in the premium (ordinarily, a contract becomes effective 2 days after the trade is executed in the USD market and on the day of the trade in the CAD market).

Table Generalized Maximum Entropy Regression Results for Premium

|  |  |  |
| --- | --- | --- |
|  | Model 1 | Model 2 |
| Currency: USD | 1.07 (0.224) \*\*\* | 1.111 (0.284) \*\*\* |
| Period: Post | -0.239 (0.360) | -0.336 (0.303) |
| Currency\*Period | 1.180 (0.370) \*\*\* | 1.176 (0.307) \*\*\* |
| Ln(notional) |  | -0.046 (0.033) |
| Tenor (months) |  | 0.0157 (0.001) \*\*\* |
| Payment Frequency[[5]](#footnote-6)  1M-1M  1M-6M  3M-3M  3M-6M  3M-1Y  6M-1M  6M-3M  6M-6M  6M-1Y  12M-3M  1Y-3M  1Y-6M  1Y-1Y |  | 7.354 (1.866) \*\*\*  5.255 (2.069) \*\*  9.353 (1.881) \*\*\*  8.796 (1.824) \*\*\*  6.908 (1.834) \*\*\*  4.905 (1.936) \*\*  8.550 (1.824) \*\*\*  9.560 (1.840) \*\*\*  7.569 (2.575) \*\*\*  7.483 (1.949) \*\*\*  6.796 (1.880) \*\*\*  7.567 (2.351) \*\*\*  5.624 (3.171) \* |
| Trade Time[[6]](#footnote-7)  After Hours (After 5:00 PM)  Afternoon (2:00 PM – 4:59 PM)  Morning (8:00 AM – 10:59 AM) |  | 0.274 (0.117) \*\*  0.201 (0.135)  0.079 (0.115) |
| Trade Day[[7]](#footnote-8)  Fri  Mon  Wed  Tue  Wed |  | 1.741 (0.110) \*\*\*  0.855 (0.110) \*\*\*  1.467 (0.102) \*\*\*  0.862 (0.104) \*\*\*  x.xxx (y.yyy) |
| Late Effective[[8]](#footnote-9) |  | 0.277 (0.088) \*\*\* |
| Constant |  | -9.399 (1.960) \*\*\* |

# Conclusion

1. The current regulations in the US allow commercial users (non-financial entities that use swaps for risk management) to continue to trade swaps without clearing. [↑](#footnote-ref-2)
2. The regulation also covered other interest rate derivatives products such as forward rate agreements and overnight index swaps, but these are not examined in this paper. [↑](#footnote-ref-3)
3. Since trading between SD/MSP is the largest volume, the body of this paper focuses on this period. In an appendix, I examine the effect of phase 2 implementation and phase 3 implementation on trading. In another appendix, I also examine the impact of the implementation of EMIR on swaps prices. Note that the US is the largest venue for swaps trading. [↑](#footnote-ref-4)
4. In another appendix, I compare the other currencies (GBP, EUR and JPY) against other unregulated currencies (MXN, AUD, KRW). [↑](#footnote-ref-5)
5. Base level is 3M – 6M, where the first number indicates payment frequency of the fixed leg, and the second number indicates the payment frequency of the floating leg [↑](#footnote-ref-6)
6. Base level is Mid-Day (11:00 AM – 1:59 PM). All times Eastern. [↑](#footnote-ref-7)
7. Base level is Thursday [↑](#footnote-ref-8)
8. If the effective date of the contract is more than 30 days after the trade date [↑](#footnote-ref-9)