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Cross-currency swap market through the lens of OTC derivative transaction data – impact of Covid-19 and subsequent recovery[1]

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[1] This contribution was prepared for the workshop. The views expressed are those of the authors and do not necessarily reflect the views of the Bank of Italy, the BIS, the IFC or the other central banks and institutions represented at the event.

Cross-Currency Swap Market through the Lens of OTC Derivative Transaction Data

Impact of COVID-19 and Subsequent Recovery

Kazuaki Washimi and Rinto Maruyama

Abstract

Cross-currency swaps are one of the major US dollar funding tools for non-US banks. While their developments have attracted international attention, data for gauging transaction details are limited since these swaps are over-the-counter transactions, not trades on an exchange. This report provides an overview of the Japan's cross-currency swap market with over-the-counter derivative transaction data collected in Japan. Then it briefly reviews the impact of the COVID-19 crisis on these transactions around the spring of 2020. A data analysis indicates that major banks continued transactions as a market maker by breaking trades into smaller blocks and diversifying the counterparties, while smaller banks who do not actively engage in normal times were found to have participated in trading.

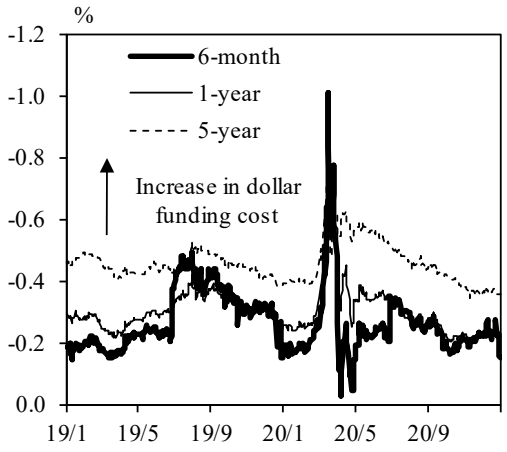
Keywords: Cross-currency swaps; Trade repository; Market structure

JEL classification: F31; G15

1. Introduction

In recent years, foreign currency funding by banks, especially the US dollar funding, has attracted international attention as cross-border claims have been on an increasing trend. In particular, the spring of 2020, when the market was in turmoil due to the spread of COVID-19, saw a sharp increase in the dollar funding cost (Chart 1). While cross-currency swaps are one of the major US dollar funding tools, concern over its resiliency in the wake of shocks has been pointed out.[1] Increasing understanding of the market structure of the cross-currency swap market will be key for assessing the stability of foreign currency funding going forward.

Cross-Currency Basis (USD/JPY) Chart 1



[1] As of December 31, 2020.

Sources: Bloomberg

Up until now, there has been little available data for gauging transaction details, since cross-currency swap transactions are over-the-counter (OTC) transactions rather than on-exchange trades. Previous studies have largely relied on the cross-currency basis which represents the dollar funding premium. It has been pointed out that more data would be needed to gauge market liquidity and functioning in the cross-currency swap market.[2] In relation to this, the Japanese authorities have collected the OTC derivative transaction data as part of a global initiative to expand the data.[3]

1 For instance, these points are raised in Chapter 5 of the IMF Global Financial Stability Report (October 2019).

2 In BIS (2020) "US dollar funding: an international perspective," CGFS Papers No. 65, data collection and information sharing by country authorities are listed as challenges ahead in US dollar funding. In particular, it is expected that data analysis will be deepened to enhance transparency in OTC derivative transaction data.

3 As discussed later, the Financial Services Agency in Japan started to collect the OTC derivative transaction data in April 2013. The following webpage releases the outstanding amounts (notional amount basis) as of March each year.

https://www.fsa.go.jp/status/otcreport/index.html

This report provides stylized facts on the cross-currency swap market in Japan with OTC derivative transaction data. Then it briefly reviews the impact of the COVID-19 crisis on the transactions around the spring of 2020. The focus is placed on cross-currency swaps, given that the OTC derivative transaction data in Japan do not cover FX swaps.[4]

2. What Are Cross-Currency Swaps?

A cross-currency swap is a contract in which one party exchanges one currency for a second currency (e.g., US dollar for Japanese yen) with another party for a certain term typically longer than one year. Though there are various types of contracts in cross-currency swaps, the basis swaps for USD/JPY—known as typical interbank transactions—involve the exchange of principal and interest. In this case, the swap exchanges floating interest in the form of "USD three-month reference rate" and "JPY three-month reference rate plus cross-currency basis (alpha)".[5] In the latter, "cross-currency basis" indicates the US dollar funding premium, where a negative value (alpha) means a relatively strong demand for the US dollar from a demand-supply perspective.

According to the BIS triennial survey on the global turnover,[6] the Japanese yen has the largest cross-currency swap transaction volume against the US dollar, followed by the Euro, UK pound, and Australian dollar (Chart 2). Taking a look at cross-currency basis by currency pair (Chart 3), while those of the Australian dollar and New Zealand dollar hovered in positive territory, those of the Japanese yen and European currencies stayed negative. It has been pointed out that US dollar demand

[4] With respect to the main difference from cross-currency swap, FX swaps are centered on the short-to-medium term, less than one year. That said, as the paper below pointed out, there is an arbitrage between them since the two can be considered to be transactions which have similar economic impacts.

Yasuaki Amatatsu and Naohiko Baba (2007) "Price Discovery from Cross-Currency and FX Swaps: A Structural Analysis," Bank of Japan Working Paper Series No. 07-E-12

In Japan, OTC derivative transaction data do not cover FX forwards and FX swaps as they are not classified as OTC derivatives in the Financial Instruments and Exchange Act. As mentioned later, the country authorities have collected the OTC derivative transaction data since the global financial crisis as a global initiative. That said, the data coverage varies across countries and regions. For instance, FX forwards and FX swaps are covered in Europe.

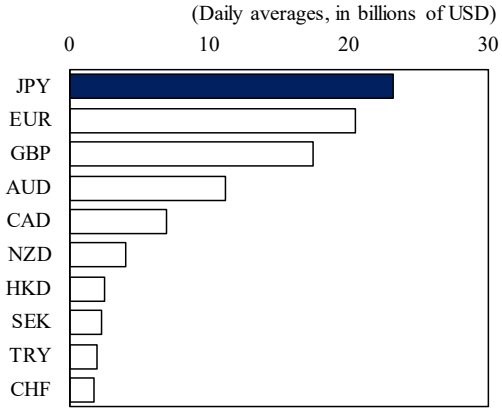
[5] While Libor has been used as a reference rate, risk-free rates are expected to gradually replace it, reflecting the interest rate benchmark reform.

[6] The BIS, in cooperation with the world's central banks, conducts the *Triennial Central Bank Survey of Foreign Exchange and Over-the-counter Derivatives Markets*. It collects data from major financial institutions around the world (called "reporting dealers") covering comprehensive topics consistent with international protocols.

varies across currencies depending on the direction of monetary policy and hedging needs[7] of banks and institutional investors. [8]

Cross-Currency Swap Turnover (against USD, 2019)

Chart 2

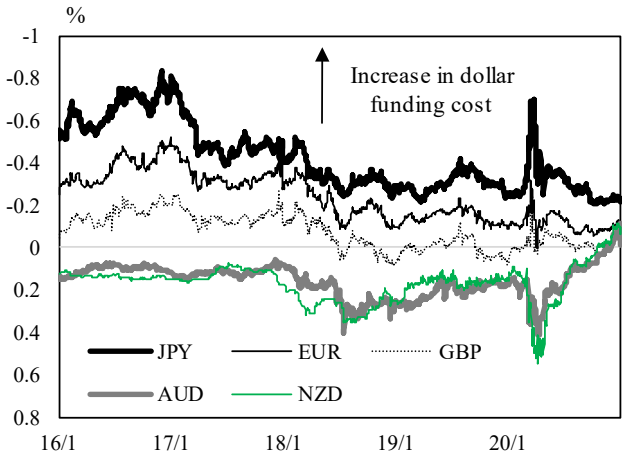


[1] As of April 2019. The same applies to charts below.

Sources: BIS "Triennial Central Bank Survey of Foreign Exchange and Over-the-counter (OTC) Derivatives Markets"

Cross-Currency Basis (against USD)

Chart 3



[1] A one-year term. As at December 31, 2020.

Sources: Bloomberg

[7] For instance, Japanese institutional investors such as life insurers use cross-currency swaps and FX swaps to hedge their foreign currency denominated investments.

[8] The aforementioned BIS report pointed out, for instance, that Australian banks are US dollar providers in the cross-currency swap market on a net basis. The following report discusses the reasons for the rise in the US dollar funding premium in recent years.

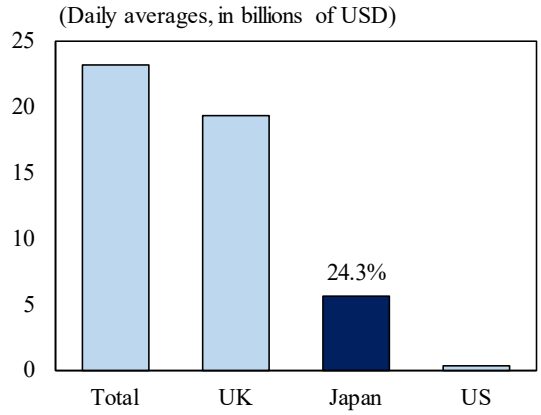
Fumihiko Arai, Yoshibumi Makabe, Yasunori Okawara, and Teppei Nagano (2016) "Recent Trends in Cross-currency Basis," Bank of Japan Review Series 2016 -E-7

3. Trends in Japan's Cross-Currency Swap Market

Market Structure from BIS Triennial Survey

According to the BIS triennial survey, Japan accounts for about a quarter of trading volume in cross-currency swaps for USD/JPY[9], being second only to the UK (Chart 4). A breakdown by counterparty shows that financial institutions account for the majority of transactions in Japan, while it also points to a certain presence of institutional investors and hedge funds, etc., globally (Chart 5).

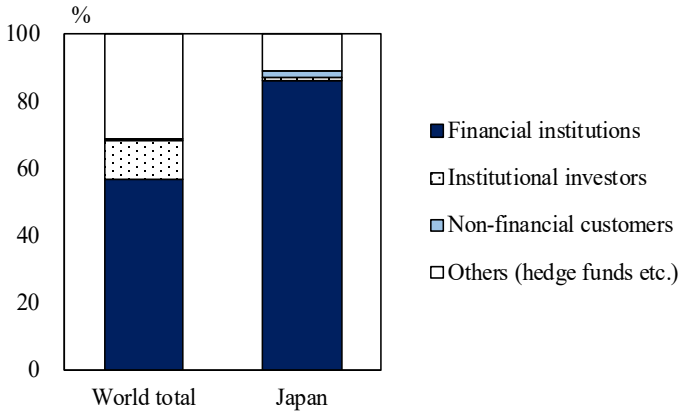
Cross-Currency Swap Turnover by Country (USD/JPY, 2019) Chart 4



[1] Total does not match the sum of country breakdowns as it excludes the double-counting of transactions between local and cross-border dealers.

Sources: BIS "Triennial Central Bank Survey of Foreign Exchange and Over-the-counter (OTC) Derivatives Markets"

Cross-Currency Swap Turnover by Counterparty (USD/JPY, 2019) Chart 5



[1] Share by counterparty from the viewpoint of reporting dealers.

Sources: BIS "Triennial Central Bank Survey of Foreign Exchange and Over-the-counter (OTC) Derivatives Markets"

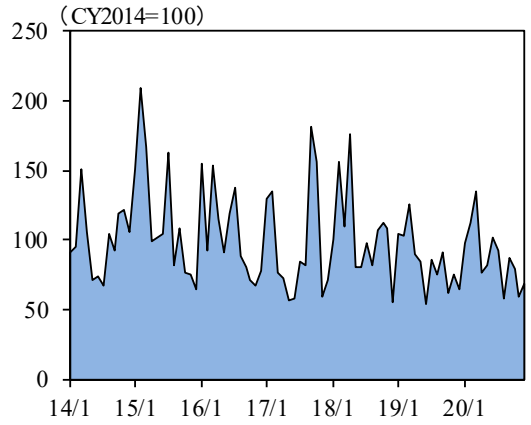
[9] This report focuses on USD/JPY, since USD/JPY constitutes about 95 percent of cross-currency swap transactions against the yen according to the BIS turnover survey (2019) in Japan.

Stylized Facts from Granular Data

This section is aimed at providing more detailed observations using the OTC derivative transaction data. The OTC derivative transaction data in this report are transaction-by-transaction data based on the reporting from trade repository and financial institutions in Japan. The data cover the transactions where at least one of the parties is Japanese financial institutions or foreign financial institutions based in Japan.[10] The country authorities (Financial Services Agency in Japan) have collected transaction data for gauging systemic risk and improving transparency in the OTC derivative market in light of the lessons from the global financial crisis. Nonetheless, there have not been a large number of analyses globally,[11] given that the confidentiality of each transaction should be safeguarded and that data cleansing needs substantial time and cost.

Aggregating the new transactions on a monthly basis, the trading volume in cross-currency swap market for USD/JPY has stayed more or less the same albeit with fluctuations, showing no signs of extreme swings in recent months (Chart 6). Trade counts have been mostly in a range of 300 and 600 per month[12] (Chart 7), except for a spike in March 2020 (which will be discussed later).

Cross-Currency Swap Turnover in Japan (USD/JPY) Chart 6



[1] As at December 2020. The same applies to charts below.

Sources: OTC Derivative Transaction Data

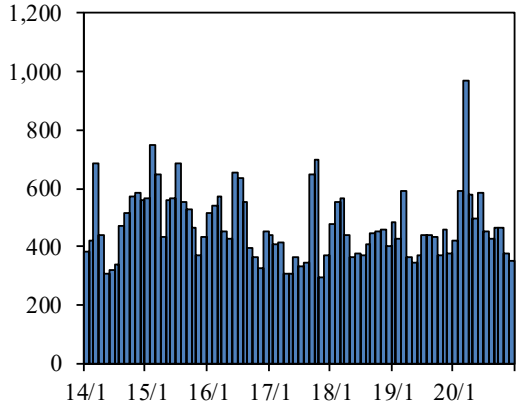
[10] The precise scope of reporting entities is defined by Article 6 of the "Cabinet Office Ordinance on the Regulation of Over-the-Counter Derivatives Transactions." Specifically, the data cover the transactions where either or both of the parties are a Financial Instruments Business Operator that conducts Type I Financial Instruments Business, a bank, Shoko Chukin Bank, Ltd., Development Bank of Japan Inc., a federation of Shinkin banks (the district of which is the entire nation) or Norinchukin Bank or an insurance company.

[11] In relation to US dollar funding, for instance, the following paper presents breakdowns of FX forwards (and the forward leg of FX swaps) by currency and by maturity using trade repository data in Europe.

Cielinska et al. (2017) "Gauging Market Dynamics using Trade Repository Data: The Case of the Swiss Franc De-pegging," Bank of England Financial Stability Papers, 41

[12] In terms of trade amount and counts, no distinct seasonality was observed, whereas transactions for a relatively long tenor tended to increase at the end of the fiscal year (March).

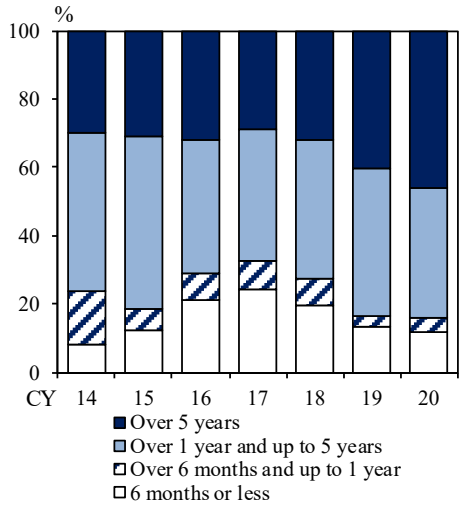
Cross-Currency Swap Trade Counts in Japan (USD/JPY) Chart 7



Sources: OTC Derivative Transaction Data

Breaking down the trading amount by maturity, there is no significant change in the term structure except for a slight increase in transactions for longer than five years recently (Chart 8). By type of counterparty[13], foreign banks and securities companies (including foreign securities companies) are major dollar providers, while major banks[14] are the main dollar takers (Charts 9 and 10).

Share of Trading Amounts by Maturity Chart 8

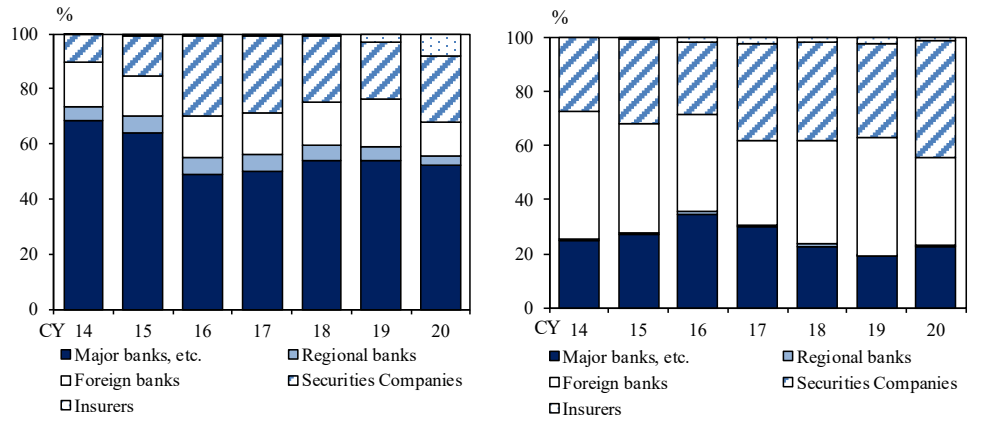


Sources: OTC Derivative Transaction Data

[13] The transactions by non-financial corporates and others are excluded from the aggregation by type of counterparty.

[14] Major banks. etc. include major banks, Shokochukin Bank, Development Bank of Japan, Shinkin Central Bank and Norinchukin Bank.

US Dollar Taker and Provider by Sector — Chart 9 and 10

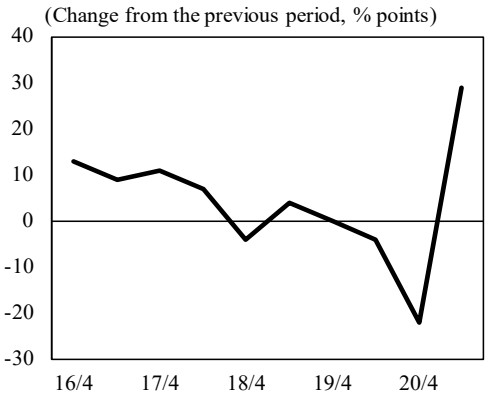


Sources: OTC Derivative Transaction Data

Evolution around the Time of COVID-19 Crisis

This section summarizes the market developments of cross-currency swaps around the spring of 2020, when the dollar funding conditions remarkably deteriorated, using the OTC derivative transaction data. The existing data suggest a sharp increase in the dollar funding cost in mid-March, as mentioned above (Chart 1). Various surveys indicate a notable deterioration in the swap market functioning in the spring of 2020 (Chart 11). Another survey suggests that market participants coped with the strains in the dollar funding market by breaking trades into smaller blocks and diversifying counterparties (Chart 12).

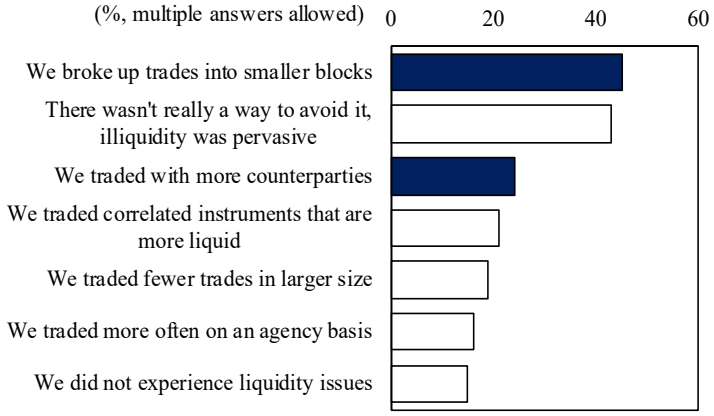
Diffusion Index on Functioning in Swap Market — Chart 11



[1] Covers FX swaps and cross-currency swaps. As of April and October for each year. Diffusion index is calculated as percentage share of those responding "high" minus percentage share of those responding "low".

Sources: Tokyo Foreign Exchange Market Committee "Turnover Survey of Tokyo Foreign Exchange Market"

Response to Liquidity Shortage during COVID-19 Crisis Chart 12



[1] Questionnaire survey on liquidity in overall swap markets. Survey respondents are 172 market participants globally.

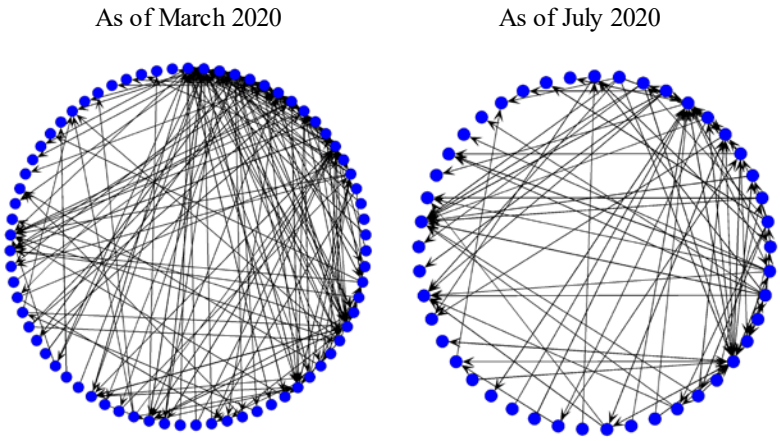
Sources: ISDA/Greenwich Associates 2020 COVID Crisis Swaps Liquidity Survey

Nevertheless, the quote prices for currency basis and these surveys do not reveal what entity traded and in what terms (amounts, rates) the transactions were made. The OTC derivative transaction data can be used to assess the behavior of market participants by comparing before and after the spring of 2020 based on the network measures and the spreads between the reference rates and contract rates.

Network analysis is known as a method for visualizing the interconnectedness of financial market transactions. It can check on the changes of trading behavior by quantifying and showing how each entity is connected to other entities though transactions. For instance, the network topology indicates that the transactions were interconnected in a more complicated manner in March 2020 relative to July 2020 when the market had recovered to a certain degree (Chart 13).[15]

[15] The attributes such as the name and type of each entity are not shown in order to maintain confidentiality.

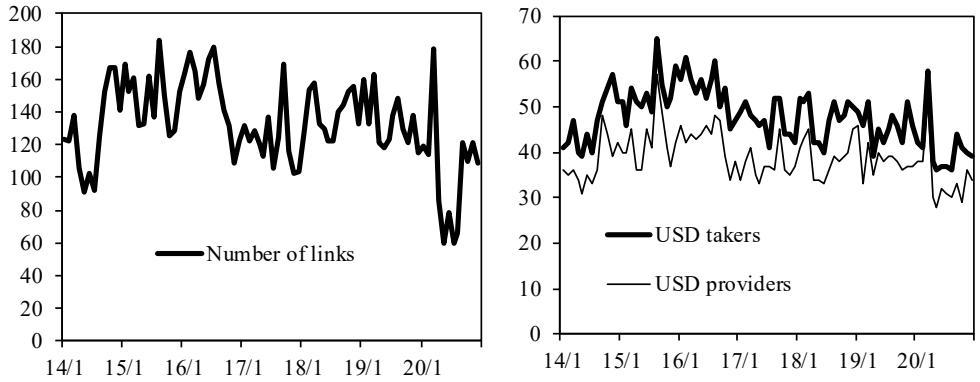
Comparison of Network Topology Chart 13



[1] Covers new transactions of cross-currency swaps for USD/JPY (The same applies to the charts below). The circles indicate the players, while the arrows represent the dollar flows.

Sources: OTC Derivative Transaction Data

Number of Transaction Links, US Dollar Taker and Provider Chart 14 and 15



Sources: OTC Derivative Transaction Data

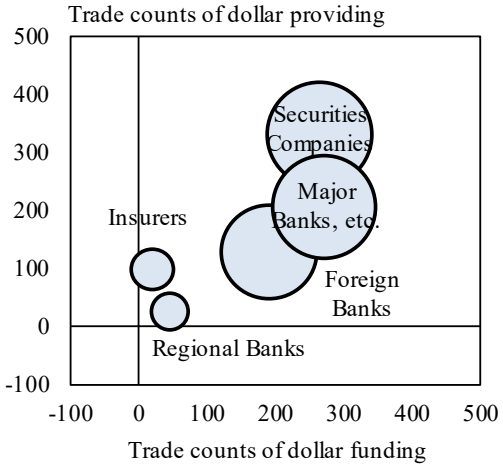
The number of links in the network can capture how many counterparties each player is connected to in order to see the changes over a relatively long period.[16] They increased sharply in March 2020, and stayed at relatively low levels in April after the first declaration of a state of emergency, and then recovered to some degree in June afterwards with the emergency declaration lifted (Chart 14). Moreover, the

[16] For instance, the following study shows an increase in the number of links in the Japanese Government Bond market in the wake of a sharp increase in interest rates.

Toshiyuki Sakiyama and Tetsuya Yamada (2016) "Market Liquidity and Systemic Risk in Government Bond Markets: A Network Analysis and Agent-Based Model Approach," IMES Discussion Paper Series No. 2016-E-13

numbers of dollar providers and takers[17] show similar trends (Chart 15). Meanwhile, trade counts increased in March 2020, while there was no remarkable change in trading amount, suggesting that the average size of trades became smaller (Charts 6 and 7). By type of financial institution, major banks and securities companies recorded large trade counts on both the funding and supply sides, which indicates that they functioned as market makers (Chart 16).[18]

Trade Counts of Dollar Funding and Provision (March 2020) Chart 16



[1] The size of bubbles represents the centrality of each player within the transaction network based on PageRank measure.

Sources: OTC Derivative Transaction Data

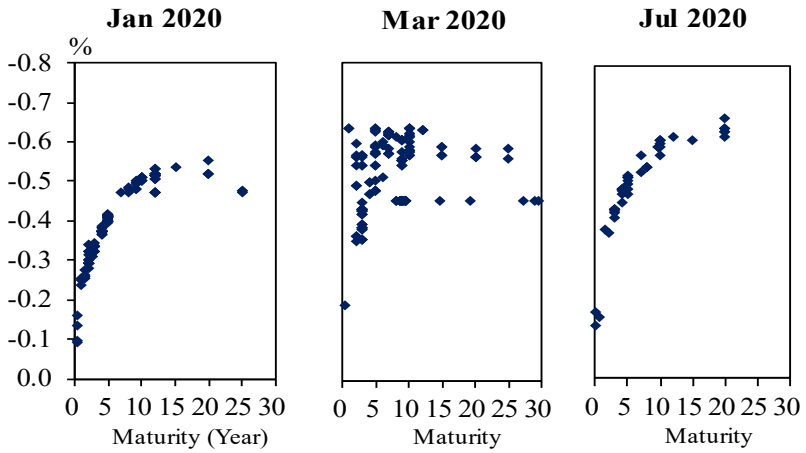
These data suggest that major banks continued transactions as a market maker by breaking trades into smaller blocks and diversifying the counterparties, while smaller banks who do not actively engage in normal times participated in trading amid the deteriorating dollar funding conditions in March 2020. Simultaneously, the distribution of the spreads between the reference rates and contract rates by maturity shows a temporary widening of spreads for the short-to-medium term in March 2020 and a gradual recovery entering the summer as a result of an expansion of dollar swap lines among the central banks (Chart 17).[19]

17 The network analysis in the report uses entity-based aggregation. It should be noted that the numbers of dollar providers, takers and links could vary depending on the aggregation method or data cleansing.

18 They are considered to play the role of market makers as the trade counts of major banks and securities companies for both dollar funding and supply are high in normal times.

19 The spreads point to a similar trend even after the counterparty risks (characteristics of the counterparty) are taken into account.

Spreads Between Reference Rates and Contract Rates Chart 17



[1] Covers new transactions. It should be noted that there are some missing data and discrepancies in units (some are reported in percent while others are reported in level). Spreads (currency basis) are calculated as reference rates (e.g., LIBOR) minus contracted rates. A negative value indicates an increase in dollar funding cost.

Sources: OTC Derivative Transaction Data

Concluding Remarks

This report provides stylized facts on the cross-currency swap market in Japan with OTC derivative transaction data and reviews the developments around the time of the COVID-19 crisis using network analysis.

The following are the two main implications. First, transaction-level data can be used to visualize the characteristics of the cross-currency swap market in Japan including dollar funding and supply structure by type of market participant that are not necessarily covered in the existing data. Second, the use of timely and high-frequency data could make it possible to examine the market liquidity and the changes in the trading behavior of market participants in a more timely and detailed manner compared to the existing data.[20] Continued use of these transaction-level data together with market intelligence would help assess the foreign currency funding markets more carefully.

A potential caveat is that the report captures only a part of the various US dollar funding activities (and is limited to transactions in Japan). Therefore, it is expected that future research would analyze the FX swap market from different angles not covered by Japan's OTC derivative transaction data.

Going forward, accumulating data together with improving data cleansing could help increase transparency in the OTC derivative markets. International discussion including that by the Financial Stability Board (FSB) has expressed an expectation of

[20] For the trading volume in the cross-currency swap market, the Tokyo Foreign Exchange Market Committee publishes a turnover survey twice a year, in addition to the aforementioned BIS turnover survey. The Bank of Japan releases Regular Derivatives Market Statistics in Japan twice a year for the outstanding data.

further progress in data development and analyses to gauge the global picture.[21] In this respect, the Bank of Japan (BOJ) has actively engaged in strict data management and transaction-level data analysis to gauge market liquidity and functioning, as well as setting up the Financial Market Data Planning Group in March 2018. Regarding the OTC derivative markets, the BOJ has released an analysis on FX options and will continue to pursue such initiatives.[22]

[21] These are also mentioned in FSB (2019) "OTC Derivative Market Reforms 2019 Progress Report on Implementation."

[22] For instance, see the following.

Kazuaki Washimi (2020) "Revisiting Determinants of Investor Sentiment in the FX Option Market by Machine Learning Approaches," Proceedings of 2020 IEEE Symposium Series on Computational Intelligence (SSCI)

In addition, the BOJ has released the FSB repo data (including cross-currency repo) since 2020. For instance, see the following.

SASAMOTO Kana, NAKAMURA Atsushi, FUJII Takanori, SEMBA Takashi, SUZUKI Kazuya, and SHINOZAKI Kimiaki (2020) "New Initiatives to Improve the Transparency of Securities Financing Markets in Japan: Publication of Statistics on Securities Financing Transactions in Japan," Bank of Japan Review Series 2020-E-1

Cross-Currency Swap Market through the Lens of OTC Derivative Transaction Data: Impact of COVID-19 and Subsequent Recovery

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※ The views expressed in the presentation are those of the author and do not necessarily represent those of the Bank of Japan.

Motivation

- Use of OTC derivatives data at a transaction level
- Gauging US dollar funding activities by banks
  - ✓ Attracting international attention, but data are limited
  - ✓ Conditions deteriorated in the wake of COVID-19

A) Fact finding using transaction-level data

B) Network analysis on trading behavior

Overview of OTC Derivative Data

Aggregate

Category	Outstanding (Tril. Yen)
Interest Swaps	4,640
FX	87
Credit	28
Equity	20

Transaction-Level

ID	Player 1	Player 2	Contract Date	Maturity Date	Notional Amount	…
1	A	B	2018/1/6	2019/1/6	X bill. Yen	
2	A	C	2018/3/2	2018/9/2	X bill. Yen	
3						
4						
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6						
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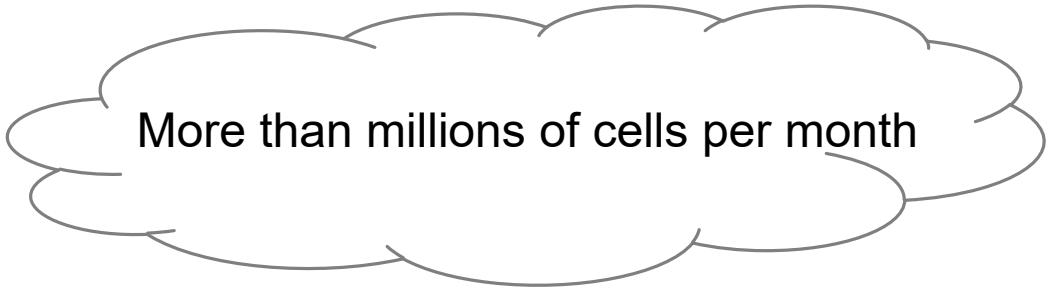
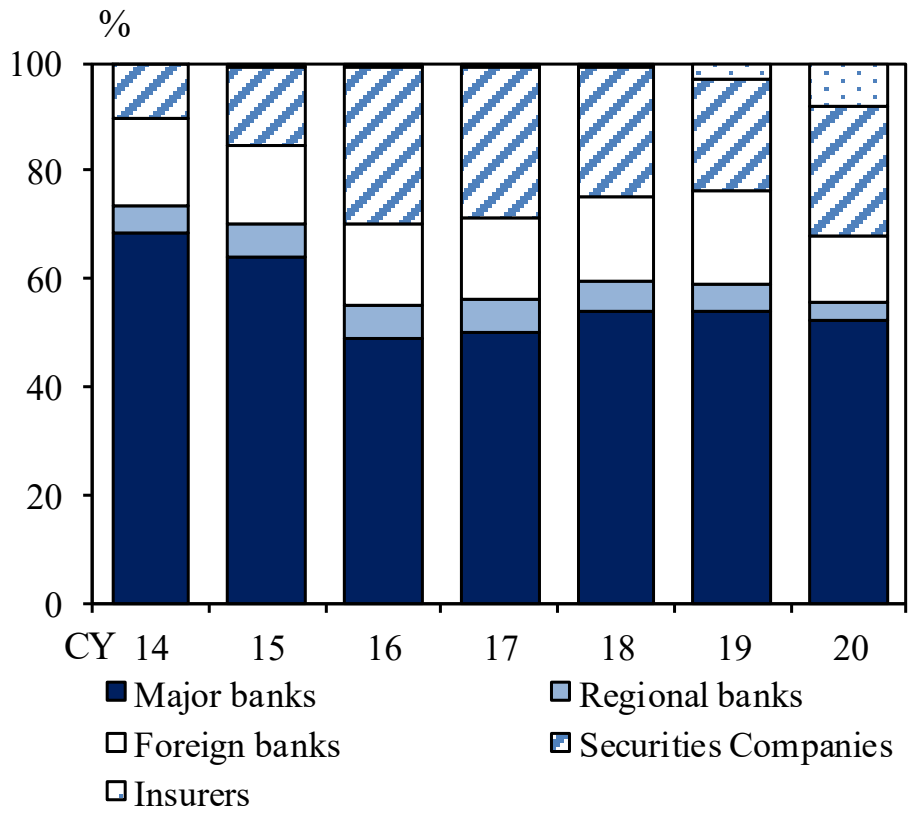


Safeguard confidentiality, massive data cleansing needs

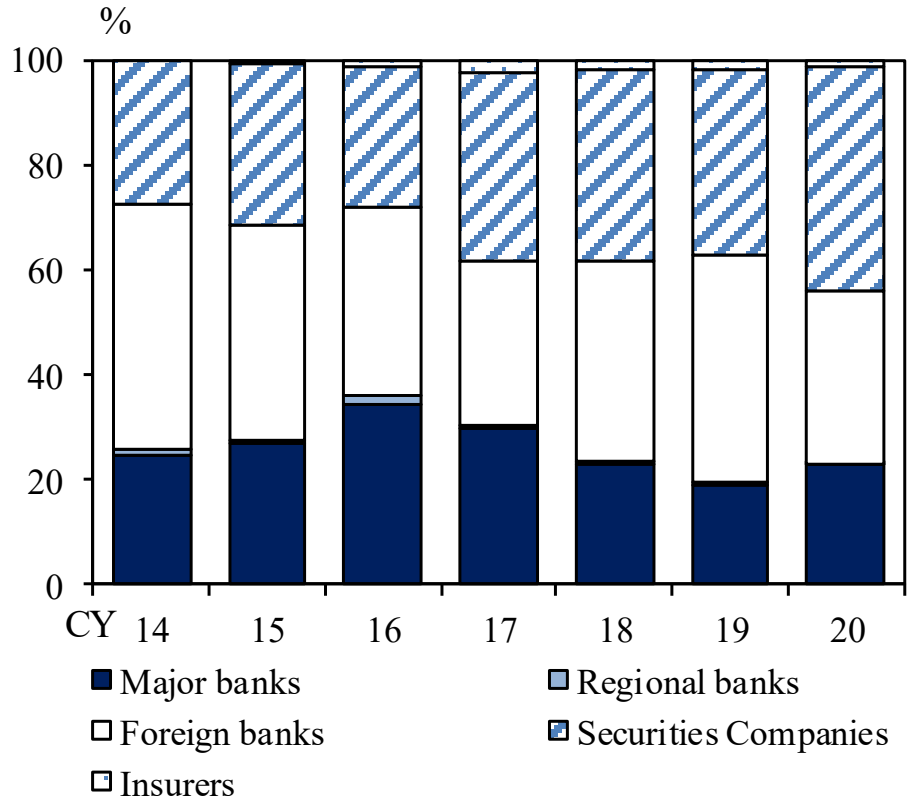
- Room for further improvement for transparency

US Dollar Taker/Provider by Sector

US Dollar Taker by Sector



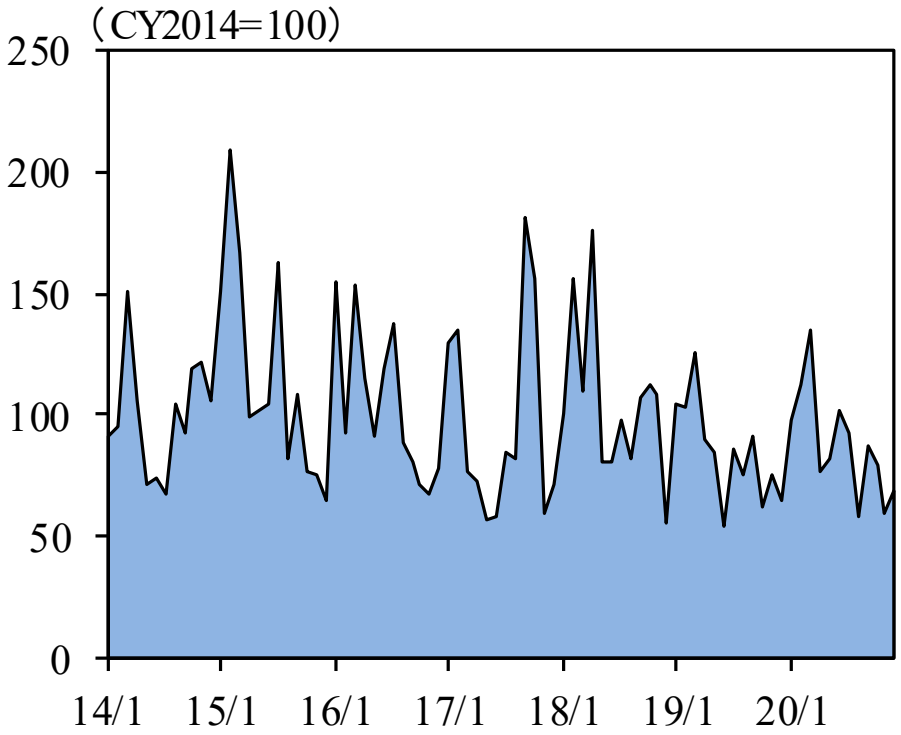
US Dollar Provider by Sector



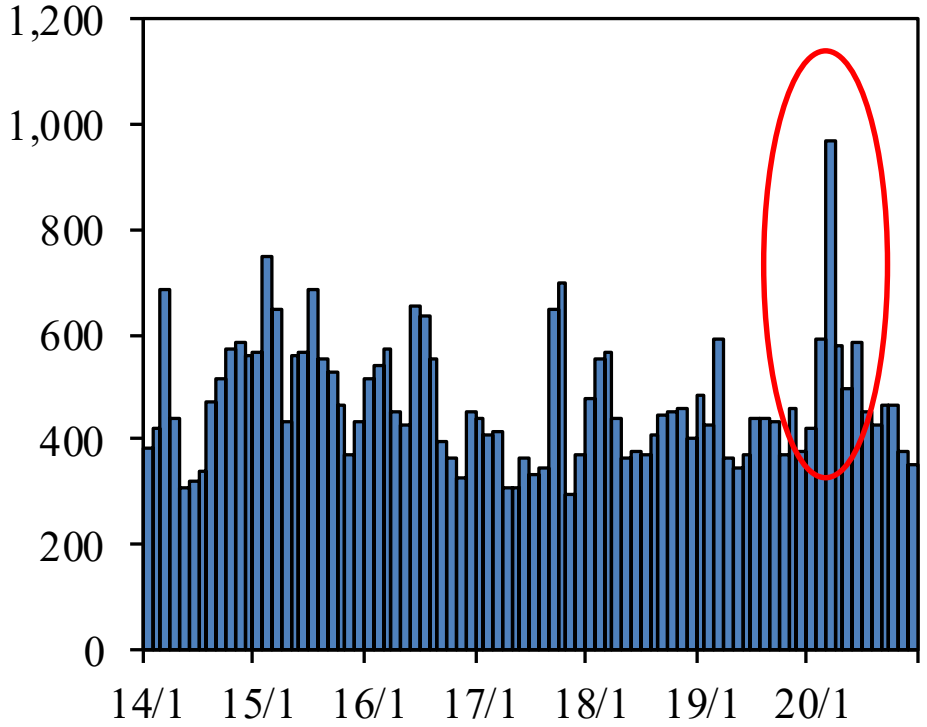
Source: OTC Derivative Transaction Data

Trading Volume and Counts

Trading Volume



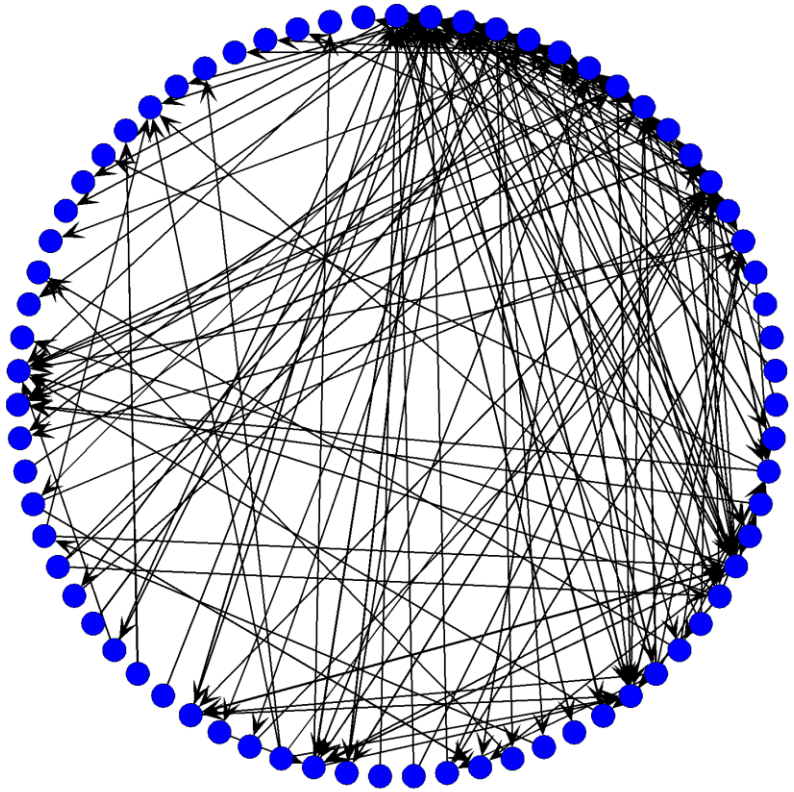
Trading Counts



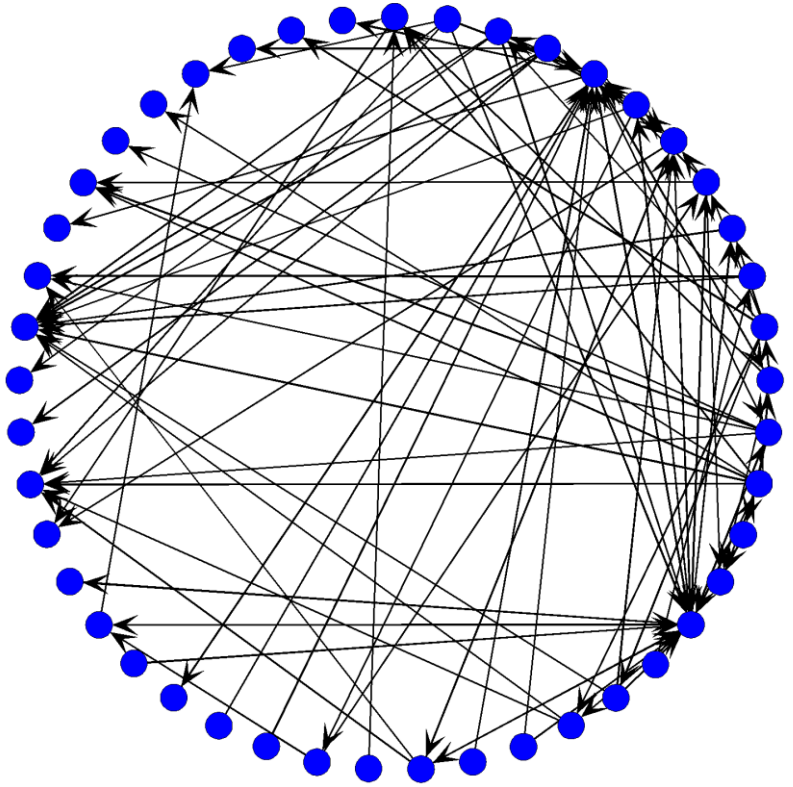
Source: OTC Derivative Transaction Data

Comparison of Network Topology

As of March 2020



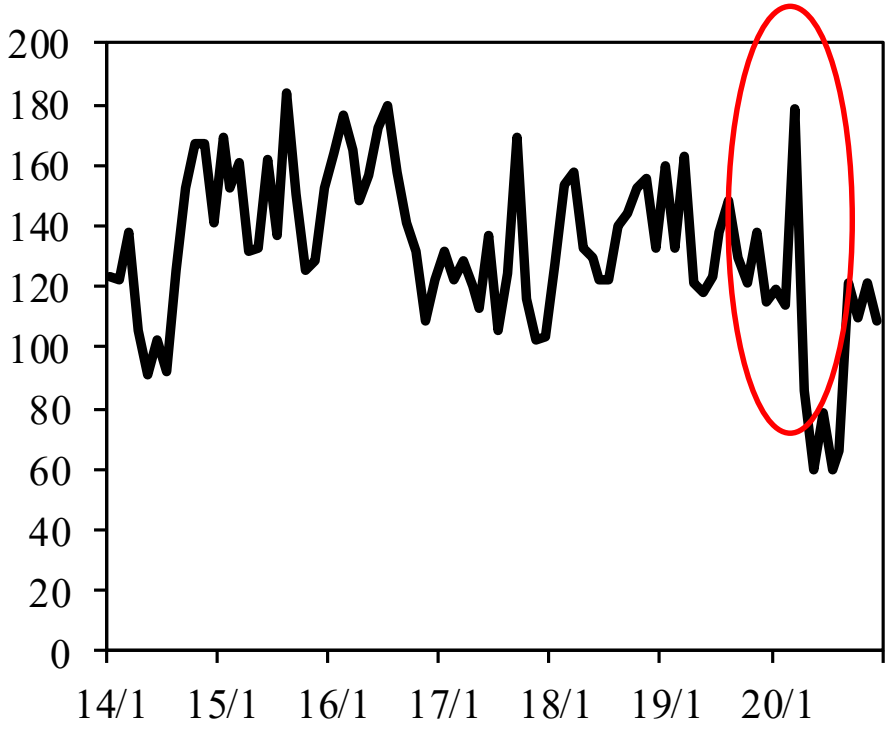
As of July 2020



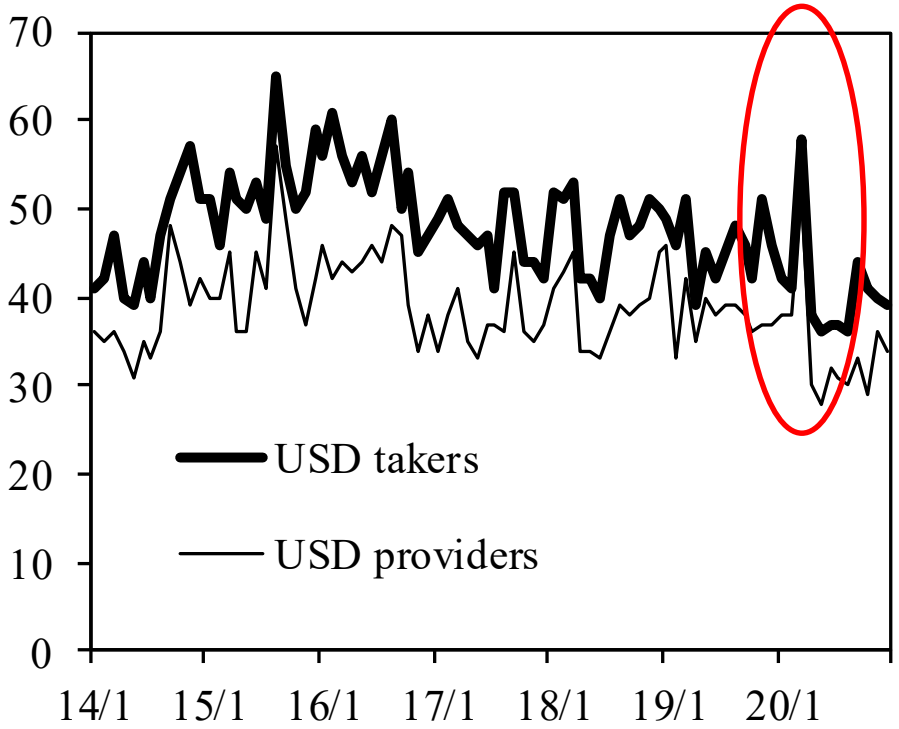
Note: The circles indicate the players, while the arrows represent the dollar flows.
Source: OTC Derivative Transaction Data

Network Measures

Number of Transaction Links



Number of Dollar Taker/Provider



Source: OTC Derivative Transaction Data

Summary

- Transaction-level data can help capture market structure and gauge trading behavior of market participants
- In the wake of COVID-19 crisis, it appears that trades were broken into smaller blocks and traded with more counterparties
- Future work can benefit from assessing other dollar funding tools on a global scale