



Central Bank Swap Lines During the COVID-19 Crisis*

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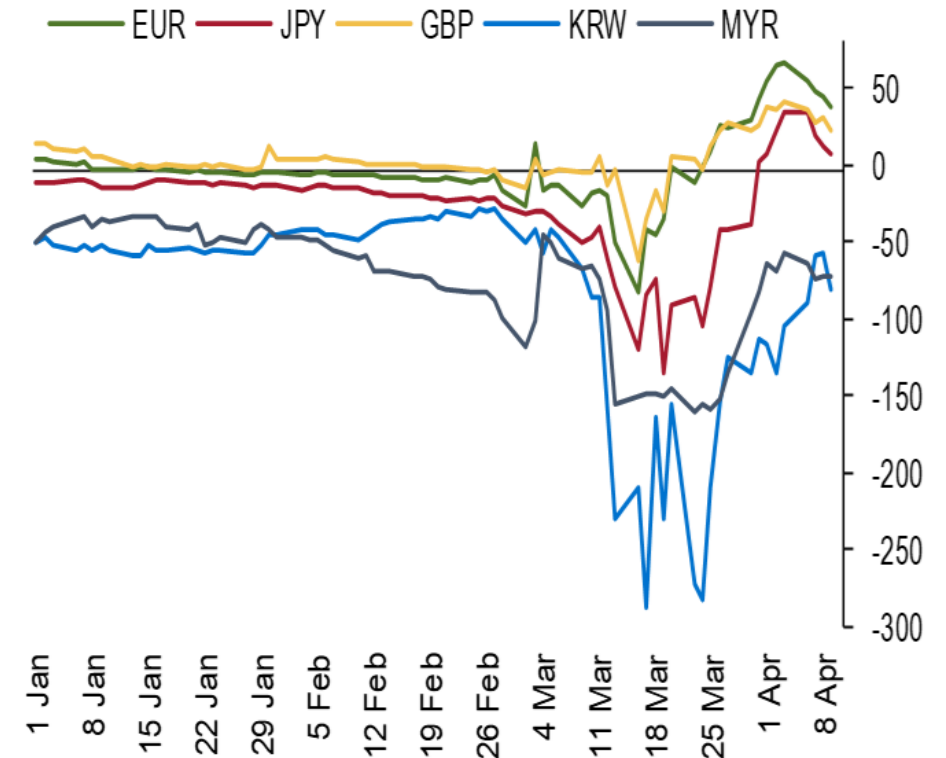
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* The views expressed in the paper are those of the authors and do not necessarily reflect those of the IMF, its Executive Board or the NBER.

US Fed responded to dollar funding strains during the COVID crisis through swap lines/FIMA

Date	Policy Action	Central Banks
March 15	Reduced Swap Pricing	BoC, BoE, BoJ, ECB, SNB
	Introduced 84-day operations	BoE, BoJ, ECB, SNB
March 19	Temporary swap lines with nine other central banks	BCB, BdM, BoK, DNB, MAS, NB, SR, RBA, RBNZ
March 20	Increased frequency of one-week operations to daily	BoC, BoE, BoJ, ECB, SNB
March 31	Established FIMA repo facility	Foreign International Monetary Authority account holders
June 19	Reduced the frequency of swap operations from daily to three times per week.	BoE, BoJ, ECB, SNB

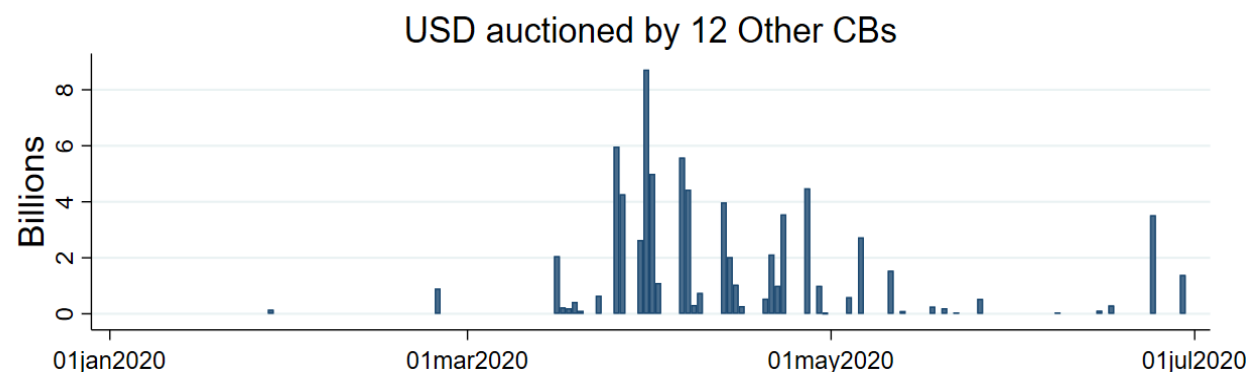
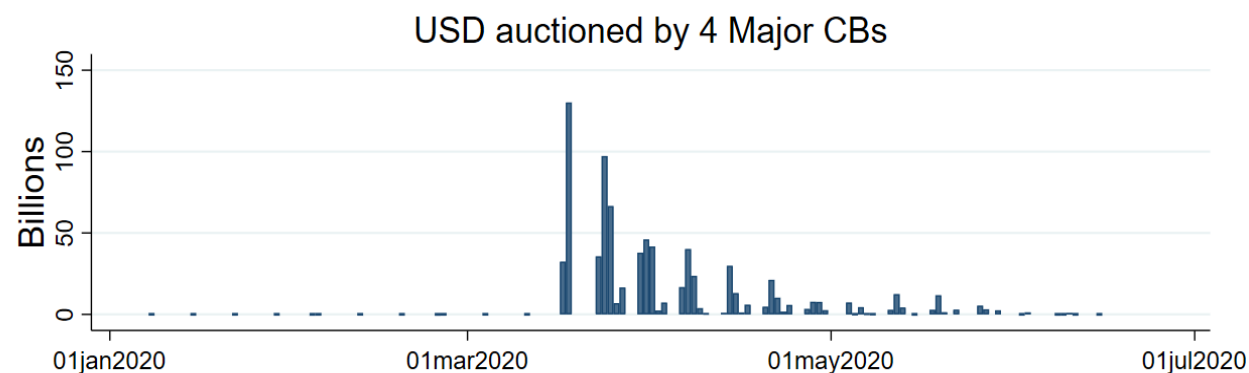
Cross-currency basis
(3-month swaps, basis points)



Source: IMF GFSR, April 2020

US dollar auctions peaked in March 2020

- ❑ US dollar liquidity was actively provided to local markets through US dollar auctions by many central banks:
 - first in mid- to late-March, 2020 by ECB, BOJ, SNB, and BOE
 - then by 12 other central banks.
- ❑ The US dollar auctions by the major central banks used US dollars obtained via swap lines with the Fed and were larger in magnitude than the US dollar auctions by other central banks.
- ❑ The US dollar shortage was mitigated by late June 2020, so was the demand for US dollar liquidity from major central banks



Major central banks: BoE, BoJ, ECB, SNB
Other CBs: Australia, Chile, Colombia, Denmark, Hong Kong, India, Indonesia, Korea, Mexico, Norway, Singapore, Sweden

This paper assesses the motivations and the impact of US Fed swap lines, and dollar auctions by CBs

Motivations:

1. What factors lead the Fed to **select nine economies as swap partners**?
2. What factors determine the **total availability of liquidity lines** (swaps and the FIMA facility) from the Fed?
3. What domestic conditions determine **the size of dollar auctions** by central banks?

Impact:

4. What are the **announcement effects of the Fed liquidity arrangements**?
5. What were the **domestic and spillover effects of dollar auctions** by central banks?
6. Do the economic impacts of the US dollar liquidity provision differ depending on the **degree of financial or trade exposure** to the US?

Motivations

1. What determined which economies received the Fed's swap arrangements?

- *P(Prob. of being included in the swap agreements) = f(X)*
- *X* includes:
 - ❖ *US BankExp* – share of the individual market in the foreign claims of U.S. banks
 - ❖ *US TradeShare* – share of economy *i* in total U.S. goods imports and exports
 - ❖ *KAOPEN* – de jure financial openness (Chinn-Ito index)
 - ❖ *Alliance* – military relationship with the US
- We apply the probit estimation model to a sample of 77 economies (ex. Canada, the euro countries, Japan, Switzerland, and the United Kingdom)
- All of the explanatory variables are sampled as of the end of Dec. 2019

Table 2: Probit regressions for explaining inclusion in Fed Swap arrangements

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Financial exposure of US banks	51.00 (16.79)***				39.41 (17.58)**			39.89 (17.56)**
Share in US trade		12.54 (6.67)*				17.14 (7.22)**	17.25 (7.39)**	
De jure financial openness			1.25 (0.66)*				0.46 (0.89)	0.31 (0.85)
Dummy for military alliance				1.27 (0.42)***	1.10 (0.46)**	1.56 (0.51)***	1.39 (0.59)**	1.03 (0.55)*
Constant	-1.56 (0.25)***	-1.34 (0.21)***	-2.10 (0.57)***	-1.79 (0.32)***	-2.03 (0.37)***	-2.22 (0.45)***	-2.45 (0.69)***	-2.20 (0.62)***
N	77	77	74	77	77	77	74	74
Adj. R2	0.16	0.07	0.08	0.18	0.27	0.29	0.30	0.28

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The figures reported are estimated coefficients, not marginal effects.

2. What determined the size of access to Fed facilities?

$$y_i^{USD} = \alpha + X_i' \beta + \varepsilon_i$$

- ❑ y_i^{USD} = **Access to Fed facilities for economy i** = $SWAP_i^{USD} + FIMA_i^{USD}$
- ❑ $FIMA_i^{USD}$ is proxied by the holding of dollar-denominated reserve assets held by central banks (Ito and McCauley, 2020)

- ❑ X_i includes:
 - ❖ **US BankExp** – share of the individual market in the foreign claims of U.S. banks
 - ❖ **US TradeShare** – share of economy i in total U.S. goods imports and exports
 - ❖ **KAOPEN** – de jure financial openness (Chinn-Ito index)
 - ❖ **Alliance** – military relationship with the US
 - ❖ **WorldTradeShare** – share of economy i in total world trade

- ❑ Variables sampled as of the end of Dec. 2019.
- ❑ A cross-sectional OLS regression 51 economies (excluding Canada, the U.K., Japan, the euro area, and Switzerland)

Table 3: Access to dollar liquidity via FIMA/Swaps largely reflected US financial and trade exposure

	(1)	(2)	(3)	(4)	(5)
Financial exposure of US banks	19.98	3.26	3.64	2.25	2.25
	(5.36) ^{***}	(1.19) ^{***}	(1.18) ^{***}	(0.85) ^{**}	(0.88) ^{**}
Share in US trade		13.75	13.67	6.03	6.04
		(0.41) ^{***}	(0.40) ^{***}	(1.13) ^{***}	(1.16) ^{***}
Dummy for military alliance			-0.03	-0.05	-0.05
			(0.02) [*]	(0.01) ^{***}	(0.01) ^{***}
Share of trade in world				8.85	8.84
				(1.27) ^{***}	(1.29) ^{***}
De jure financial openness					0.00
					(0.02)
Constant	0.02	-0.01	0.00	-0.00	-0.00
	(0.04)	(0.01)	(0.01)	(0.01)	(0.01)
N	51	51	51	51	51
Adj. R2	0.20	0.97	0.97	0.98	0.98

3. What domestic conditions determine the size of dollar auctions by central banks?

- ❑ The actual use of liquidity lines may differ from the availability of liquidity lines
- ❑ We regress the number of US dollars auctioned on:
 - **Cumulative depreciation:** of local currency against the dollar since the first two weeks of January 2020
 - **Exchange rate volatility:** S.D. of the rate of depreciation over rolling 14-day windows
 - **Stock market volatility:** S.D. of the rate of stock market total return over rolling 14-day windows
 - **Global financial instability:** log of VIX
 - **US Bank Exposure** to the economy, as of 2019Q4
 - **Number of new cases of COVID infection (COVID):** moving average of COVID-19 cases per million over previous 7 days
 - **Mobility index (MOBILITY)** to capture the possible impact of economic activities on daily basis
- OLS estimation model to daily panel data of 42 economies
- Sample period: January 15, 2020 through May 29, 2020

Table 4: Determinants of size of US dollar auctions by central banks

	(1)	(2)	(3)
Cumulative Deprec. Rate	-0.04 (0.01)***	-0.01 (0.00)	0.00 (0.01)
Exch. rate volatility	0.43 (0.16)***	-0.03 (0.05)	-0.06 (0.06)
VIX (in log)	1.19 (0.39)***	0.73 (0.26)***	0.86 (0.40)**
US Bank Exposure, 2019Q4	7.75 (1.66)***	-3.60 (3.07)	0.19 (3.40)
Cumul. Deprec. Rate*US Bank Exposure		-1.90 (0.67)***	-2.32 (0.75)***
Exch. rate volatility*US Bank Exposure		30.84 (10.10)***	30.24 (10.28)***
New cases, MA			0.00 (0.00)*
Mobility index, MA			-0.00 (0.00)
N	4,158	4,158	3,103
Adj. R2	0.04	0.09	0.10
# of countries	42	42	41

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. MA refers to 7-day backward looking moving average. Regressions also included stock market volatility, which is not shown as it is not significant.

On the motivations of the 2020 FX liquidity provision policies, we find ...

1. A foreign economy's share in US trade, finance and a military alliance with the US determined **access to a Fed swap agreement**.
2. Economies with strong financial and trade ties with the US tended to have more **access to dollar liquidity** via the Fed. Global major trading centers had greater access to US dollar liquidity via the Fed.
3. The **amounts auctioned** by central banks were larger for currencies that faced greater FX volatility, especially for economies to which US banks had greater exposure. Auction sizes were also larger when global financial conditions were more unstable (higher VIX).

Impact

What were the effects of the Fed liquidity arrangements?

□ Aizenman and Pasricha (2010) – “The FED swap-lines had relatively large short-run impact on the exchange rates of the selected EMs, but much smaller effect on the [CDS] spreads.”

□ Questions we ask:

- **Did announcements of swap agreements and FIMA mitigate financial stress?**
- **Did auctions of US dollars by central banks affect the financial variables?**

Methodology – Local Projection Estimation

(Jorda, 2005; Teulings and Zubanov, 2014; IMF 2020)

$$\begin{aligned}\Delta Y_{i,t-1 \rightarrow t+p} = & \sum_{r=0}^p \beta_1^{p,r} \text{Swapfima}_{i,t+p-r} + \sum_{r=0}^p \beta_2^{p,r} \text{Auction}_{\text{own}i,t+p-r} + \sum_{r=0}^p \beta_3^{p,r} \text{Auction}_{\text{Major}i,t+p-r} + \sum_{r=0}^p \beta_4^{p,r} \text{Other Controls}_{i,t+p-r} \\ & + \sum_{l=1}^3 \gamma_1^l \text{Swapfima}_{i,t-l} + \sum_{l=1}^3 \gamma_2^l \text{Auction}_{\text{own}i,t-l} + \sum_{l=1}^3 \gamma_3^l \text{Auction}_{\text{Major}i,t-l} + \sum_{l=1}^3 \gamma_4^l \text{Other Controls}_{i,t-l} \\ & + \delta \text{COVID}_{t-1} + \mu_i + w_s + \varepsilon_{i,t+p}\end{aligned}$$

where:

- $\Delta Y_{i,t \rightarrow t+p}$ = 1) Change in the log of **exchange rate** between economy i 's currency and the USD;
2) Change in Country i 's 10-year **sovereign bond yield**; or
3) Change in Credit default swap (**CDS**) spread for country i
4) Absolute value of **cross currency basis** (over its average in 2019)

Swapfima = takes the value of one when Fed swaps were announced/ enhanced and FIMA announced for countries that were included in these announcements (March 15, 19, 20, 31)

Methodology – Local Projection Estimation

$$\begin{aligned}\Delta Y_{i,t-1 \rightarrow t+p} = & \sum_{r=0}^p \beta_1^{p,r} \text{Swapfima}_{i,t+p-r} + \sum_{r=0}^p \beta_2^{p,r} \text{Auction}_{own,i,t+p-r} + \sum_{r=0}^p \beta_3^{p,r} \text{Auction}_{Major,i,t+p-r} + \sum_{r=0}^p \beta_4^{p,r} \text{Other Controls}_{i,t+p-r} \\ & + \sum_{l=1}^3 \gamma_1^l \text{Swapfima}_{i,t-l} + \sum_{l=1}^3 \gamma_2^l \text{Auction}_{own,i,t-l} + \sum_{l=1}^3 \gamma_3^l \text{Auction}_{Major,i,t-l} + \sum_{l=1}^3 \gamma_4^l \text{Other Controls}_{i,t-l} \\ & + \delta \text{COVID}_{t-1} + \mu_i + w_s + \varepsilon_{i,t+p}\end{aligned}$$

where:

- **Auction_{own}** = Dummy for the dates when economy *i*'s central bank auctions USD
- **Auction_{Major}** = Dummy for the dates when major central banks (ECB, BOE, SNB, and BOJ) auction USD

Other Controls:

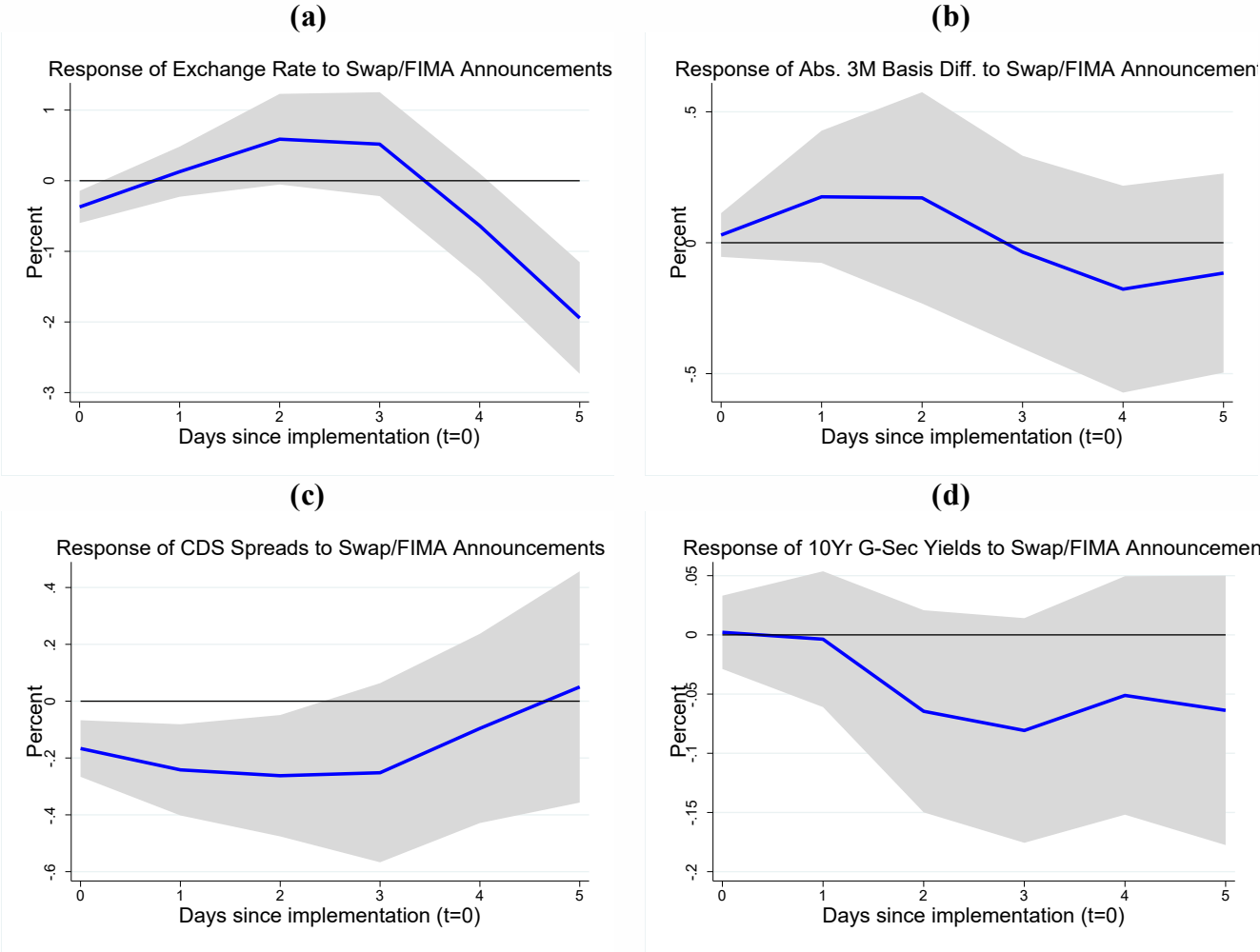
- **QE** = Dummy for quantitative easing (QE) implemented by the Fed on March 23
- **NPR** is the decline in the monetary policy rates of the sample economies
- **VIX** = VIX Volatility Index in log

COVID = 7-day moving average of new corona cases per million

- ❑ Economy fixed effects and weekly time fixed effects are included
- ❑ Estimation is conducted for 43 economies in the period of Jan. 2 through May 29, 2020

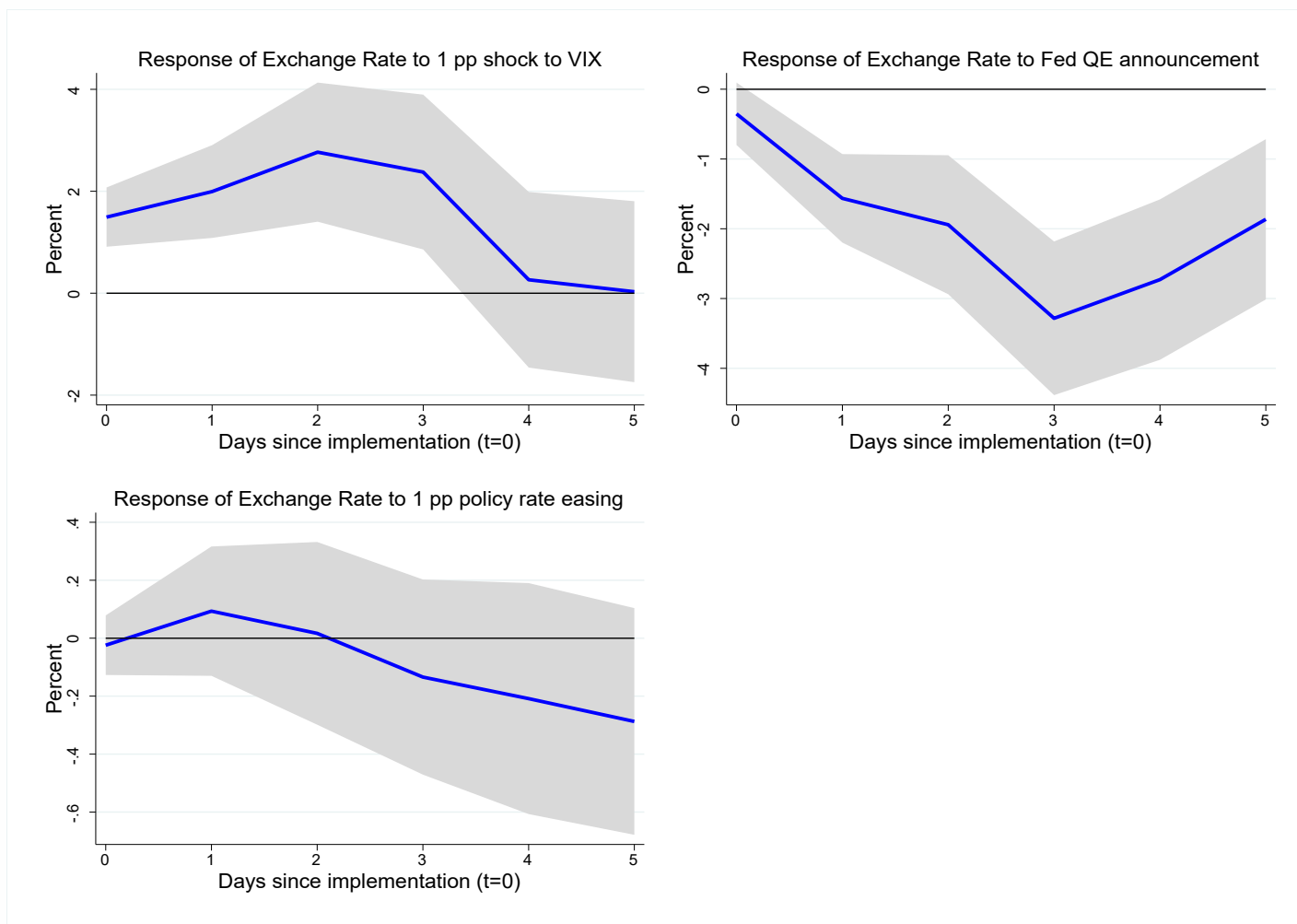
Fed swap expansion/FIMA announcements led to persistent appreciation of partner currencies

Figure 4: Estimated effect of the announcements of the swap agreements and FIMA on financial variables



Impact of other stimulus policies are as expected

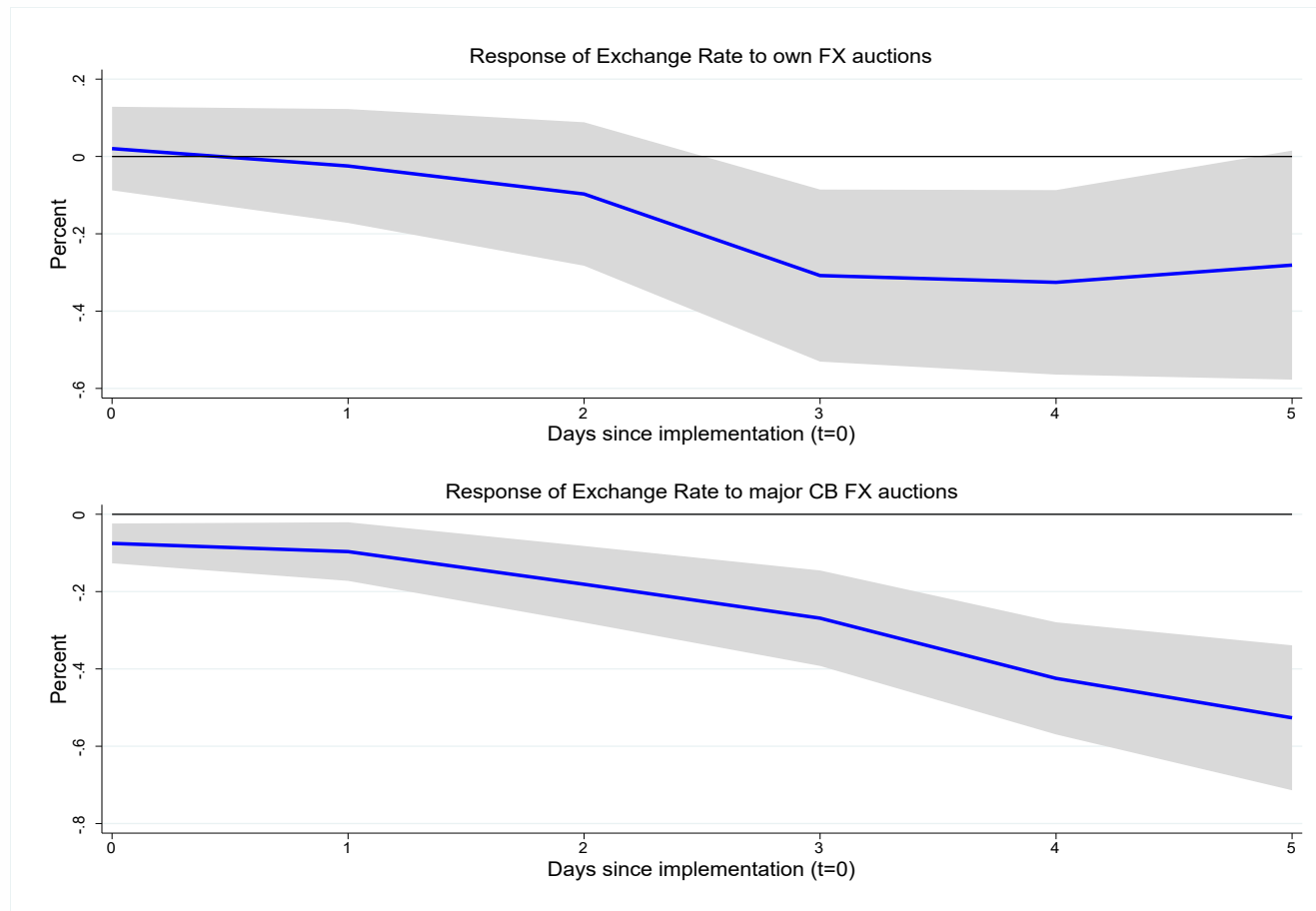
Figure 5 (a): Estimated effects of VIX, QE and domestic monetary policy easing on the depreciation rate of the home currency



Notes: The announcement takes place at $t=0$, and the cumulative impulse response functions are illustrated for the next five business days. The units for the y-axis are percent. Increase in exchange rate is depreciation of home currency against the US dollar.

Own CB's dollar auctions have a short-lived effect of alleviating pressure on the domestic currency; FX auctions by any of the major CBs lead to an immediate appreciation of other economies' currencies against the USD

Figure 6 (a): Estimated effects of FX auctions on the depreciation rate of the home currency



Notes: The announcement takes place at $t=0$, and the cumulative impulse response functions are illustrated for the next five business days. The units for the y-axis are percent. Increase in exchange rate is depreciation of home currency against the US dollar.

Economic impacts of the USD liquidity provision policies do not depend on US financial exposure

Figure 7 (a): Interactive effects of swaps and financial exposure on the exchange rate

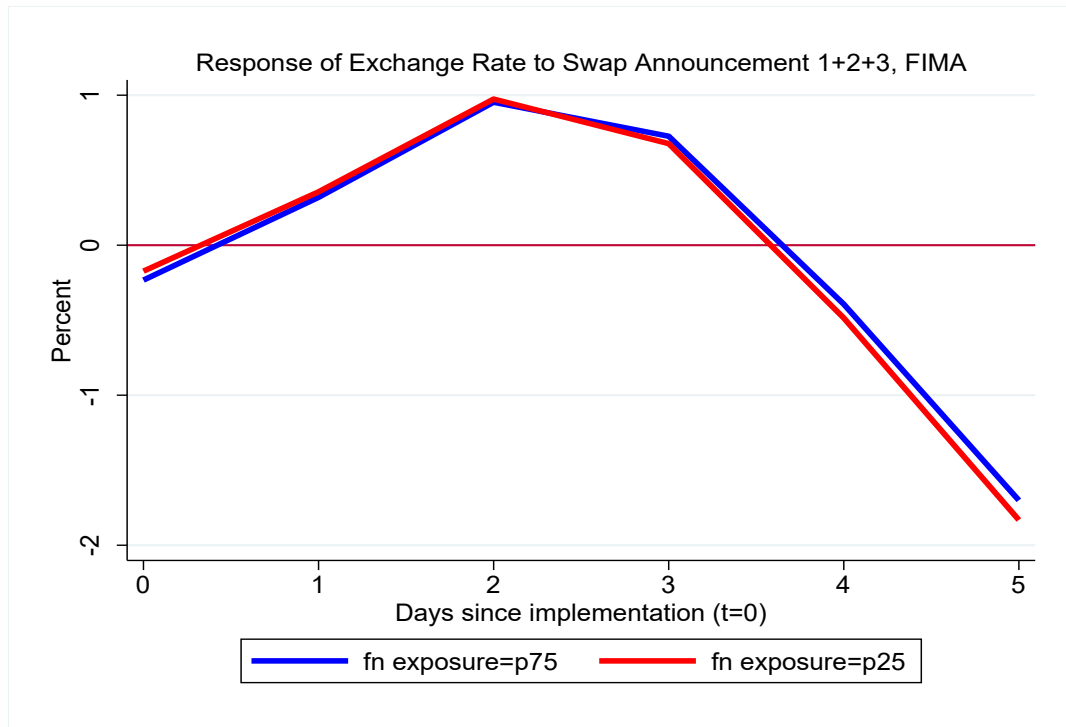
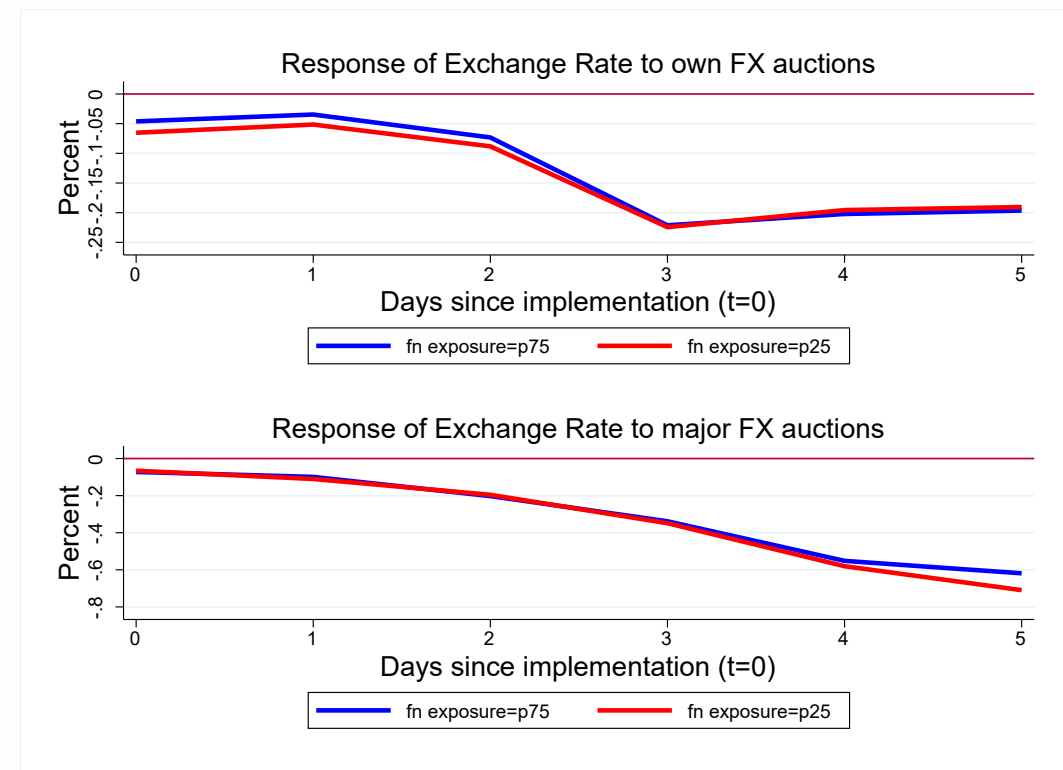


Figure 7 (b): Interactive effects of foreign exchange auction and financial exposure on the exchange rate



Robustness

The results are robust to:

1. Changes in lags and leads (especially announcement effects of Swap easing/FIMA)
2. Controlling for other announcements, e.g.: lockdowns, fiscal policy, macro-prudential policies
3. Using the USD amounts auctioned by CBs (i.e., the USD value of bids accepted) instead of the dummy to represent the days when auctions took place

Summary of the results

- **Selection to Fed's swap agreements**

- It is positively affected by foreign economy's share in US finance and trade and a military alliance with the US

- **Access to Fed liquidity:**

- Access to dollar liquidity reflects US bank and trade exposure as well as global trade exposure

- **Size of auctions by CBs**

- It is larger for currencies that faced greater FX volatility, and when global financial conditions are more financially unstable (higher VIX)

- **Impacts of Fed swap/FIMA announcements:**

- The announcements of expansion of Fed liquidity facilities leads to appreciation of partner currencies against the USD and improved CDS spreads of the recipient economies.

- **US Dollar auctions**

- US dollar auctions by economies' own CBs led to temporary appreciation of their currencies, but dollar auctions by major CBs (BoE, ECB, BoJ and SNB) led to persistent appreciation of other non-dollar currencies.

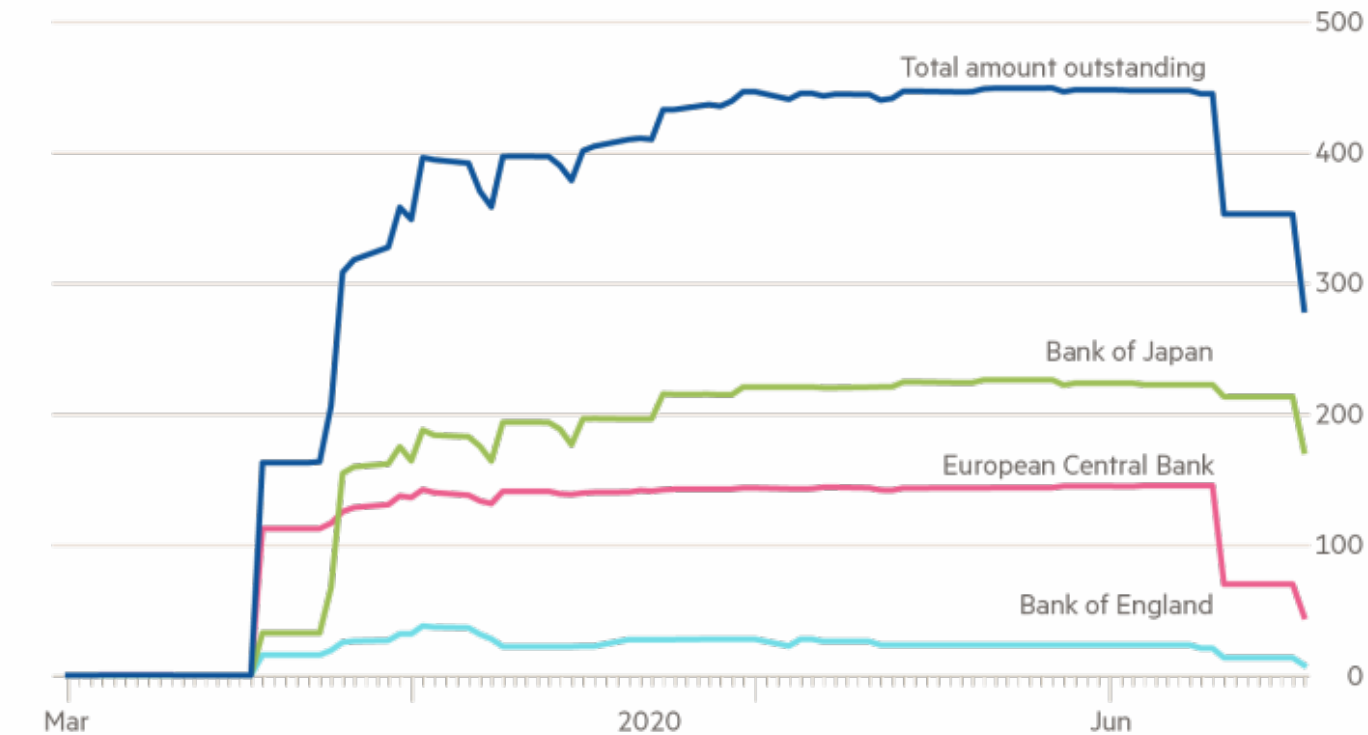
Thank you!

Questions and comments appreciated

Outstanding dollar liquidity lines with Fed peaked between March-May 2020

Demand for emergency dollars falls

\$bn



Source: Federal Reserve Bank of New York
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On the effects of the 2020 FX liquidity provision policies, we find ...

4. **Announcements of expansion of Fed liquidity facilities** led to appreciation of partner currencies against the US dollar and improved CDS spreads of the recipient economies
5. **US dollar auctions** by economies' own central banks lead to temporary appreciation of their currencies, but dollar auctions by major central banks (BoE, ECB, BoJ and SNB) have persistent spillovers – they led to appreciation of other non-dollar currencies.
6. Any of these responses do not differ whether the US has larger or smaller **financial or trade ties** with these economies → dollar liquidity policies have egalitarian impacts irrespective of the extent of these ties.