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A Study of Central Bank Swap Line Use: Are They a Suitable Tool for the IMF in Maintaining Central Bank Liquidity for Developing Countries?

Shane Krause
MS Economics
Colorado Christian University

Abstract
Developing countries do not have the same access for swap line use during times of economic stress, currently used by central banks in developed countries to maintain liquidity. Biblically, economic tools should favor all and not just developed nations. As Christians we are commanded to help others by bearing the burden of others and to help the poor. Of course, biblical wisdom is necessary, specifically an understanding of how exactly swap lines may be of benefit before making any recommendations, along with and considering the reality of level of risk when working with developing nations.

Swap lines are a currency exchange between two banks where an agreed upon amount is traded--a liquidity swap between two banks. The research on swap line use is limited, especially when related to use by developing countries. Since developing nations are more vulnerable to economic stress, expanding the use of swap lines from developed countries to developing nations appears reasonable and the IMF being the lender of last resort is the recommended organization to use them.

The purpose of the study is to determine if swap lines maintain or improve liquidity between central banks during times of economic stress, which in turn will be considered for feasibility as an additional financial assistance tool the IMF can use for developing countries. A pragmatic mixed approach will be used to determine if swap lines are improving liquidity conditions with the capacity to deliver U.S. dollar funding to institutions in their jurisdiction during times of market stress. The comparisons consider capital flow and foreign exchange rate differences between countries that used swap lines and countries not using swap lines during periods of economic stress. The results will be considered for use by the IMF for developing countries.

Keywords: Developing Countries, Central Bank Liquidity, Swap Lines, IMF

Shane Krause is a veteran of the United States Navy, who completed a Baccalaureate of Science in General Engineering with the Welding Option from Montana Tech of the University of Montana. He went on to work as a Reliability Engineer for over 10 years in the Mining and Food Processing industries, specializing in failure analysis and maintenance department development. He graduated with a Master of Science in Economics from Colorado Christian University. His interests are Economic Policy and Developmental Economics.

Introduction

Paul, in Galatians 6, says Christians should bear one another's burdens and instructs us to do good for everyone, especially to those who are of the household of faith. (Galatians 6:2 ESV, 2016). The central banks of different countries can bear such a burden and do good by using swap lines. Before bearing the burden, an understanding is needed, as found in Proverbs 4:7, "The beginning of wisdom is this: Get wisdom, and whatever you get, get insight" (Proverbs 4:7 ESV, 2016). This study is biblically inspired to use the ability of developed nations to help developing nations during times of economic strife.

One policy tool used by central banks for maintaining liquidity during times of economic stress is swap lines. Swap lines are a currency exchange between two banks, in which an agreed upon amount is traded, it is a liquidity swap between two banks. Currency exchanges occur between central banks of developed countries. Developing nations generally do not participate in the practice and are more vulnerable to economic stress.

An organization that works closely with developing nations is the International Monetary Fund (IMF), an international organization that promotes global economic growth and financial stability, encourages international trade, and reduces poverty (Kenton, 2023). One function of the IMF is assisting with financial stability via financial assistance. Swap lines show promise for maintaining liquidity but currently are used by developed countries. Since the IMF currently provides short-term loans to countries that experience a sudden stop of currency flow, other economic tools for financial assistance may be beneficial.

For this study prior research was reviewed, looking at areas of liquidity, economic development, cost associated with its use, and use beyond its original intent. Previous research found swap line use to be in its infancy, limiting the existing research related to the topic of this study. There are some references of use going back decades, but the use did not really become a frequent practice until more recently. The use of swap lines was hastily put together during economic crises and the impact is not fully understood, though the practical benefits are known to help central banks maintain liquidity.

The main question that was addressed in this study is: *Are swap lines improving liquidity conditions by providing central banks with the capacity to deliver U.S. dollar funding to institutions in their jurisdictions during times of market stress?*

This led to the following the sub questions:

a. *What is the capital flow difference between countries that use swap lines compared to those that do not during times of economic stress?*

b. *What is the currency exchange rate comparison between nations that use swap lines and those that do not during times of economic stress?*

To assess swap line usage and effectiveness, a mixed research approach was used with quantitative analysis of money movement, calculations for liquidity and appreciation, and a qualitative approach of simple observations of swap line usage. The population of study was the permanent and temporary swap line networks established by the Federal Reserve. The data used for analysis was collected from two database

sources to cover a 10-year period from April 2014 to April 2024. Swap line data use was collected from the Federal Reserve and the foreign exchange rates were collected from the IMF (imf.org, 2024) (federalreserve.gov, 2023).

Analysis found that swap lines were used much more frequently with central banks physically located at hubs for trade such as Japan and the European Union. Of interest is the duration of swap line agreements shifts. Many smaller 7-day instances were associated with more localized and smaller economic stress events and the longer swap line instances of 84 days occurred only during times of global economic stress, such as the Covid-19 pandemic. One surprising observation was that central banks that are not physically in a central trade area tend to use swap lines less frequently or not all. This suggests that liquidity needs can be correlated to the number of countries that are traded with.

Central Bank liquidity is seen to fluctuate and is impacted by periods of economic stress as expected. Most banks within the long-term swap line network tended to be more stable with the exception of the European Central Bank., This can be explained since it is an institution with the highest number of trading partners so its liquidity would be expected to fluctuate the most. Liquidity could be seen to shift with times of economic stress and when Central Bank activity increased, there was an increase in liquidity. Swap line networks that were temporary tended to show more volatility, which makes sense as the countries in general were smaller in population size such as the Scandinavian countries or lower in economic development as seen with Mexico and Brazil. Curiously, the central bank of Singapore also showed large swings, but this is likely due to its close relationship with China, Europe and the USA having an outsized influence on trade.

For this analysis, the foreign exchange rate was also observed for fluctuations during times of economic stress and compared to swap line use. The observations were similar to that of liquidity, with developed countries having more stable exchange rates. Again, the European Union and Singapore showed fluctuations that had obvious correlations with economic conditions and also were the most frequent users of swap lines.

This research found that swap line use does maintain liquidity for smaller more localized economic stress situations as well as global economic stress situations, with the reaction being controlled by central banks through duration and size of currency swaps. The observation suggests that the use of swap line networks as a financial assistance tool in developing nations by the IMF is feasible.

Literature Review

Several studies related information to liquidity improvement during times of economic stress, capital flow during times of economic stress and currency exchange rate comparisons (Reis, 2021) provides an overview of the history, terms and mechanism of “central bank liquidity lines” highlighting early research on the topic and emphasizing research is still in its infancy. Though several recommendations were made, of interest was the recommendations of a broad inquiry for two-way interaction between a central bank providing a liquidity line, and its currency being used internationally. Do the liquidity lines contribute towards a currency being used internationally or do they instead mitigate some of the financial frictions that cause the international financial system to gravitate to having one or a small number of dominant

currencies (Allen, 2021). Depending on the impact of swap line use, it may benefit a dominant currency or more local international currencies.

Goldberg (2013) assessed the optimal currency reserves, or liquidity, a central bank should have. Foreign countries hold reserves and are often overshadowed by trade deficits and surpluses and developing countries that have amassed large reserves. Countries have different definitions of appropriate reserves and have amassed reserves based on these definitions, though have a theme of being able to adjust to economic shocks. The paper shows reserves obtained and speculates on problems that can be resolved with proper reserves but does not determine what reserves should be because of the complexity of the topic. Further research should be of demand for reserves during shock to determine the need for reserve size. Understanding appropriate reserve size will ensure there is sufficient funds to maintain liquidity, and generating too large of a swap may cause undue interest payments.

Reis (2022) compares liquidity between central banks with and without a US presence influence. The research considers central banks as lenders of last resort within a nation, and the US dollar has a large, outsized influence on banking outside of the US. A no-arbitrage equation for borrowing by banks is placed in a model of the financial market for borrowing source-country currency synthetically, which in turn is placed within a general-equilibrium model of investment and production. The study concluded the swap lines put during days of swap line activity, encourage investment in foreign assets, reduced foreign bank expected costs preventing banking failure.

A study related to the cost of using swap lines by Allen (2021), used an empirical approach to measure the effects of the Federal Reserve's swap line use with the European Central Bank during the coronavirus epidemic. Several models were developed comparing liquidity, finding that enhanced swap lines contributed to narrowing the CIP deviations, minimizing the three-month dollar cross currency basis swap spreads against the euro.

Another cost related study was from an internal review by the Federal Reserve bank of New York by Goldbert (2011). The study looked at the pressure on central banks for the USD by comparing issue requests before and after the 2008 Great Recession, both on and off-balance sheets and held interviews of those involved using a mixed research approach. Several comparisons were made, with the first looking at foreign exchange swaps to determine arbitrage. Demand was determined by pulling data on the Federal Fund Markets following. This data was then compared to swap line usage to find correlations between demand and swap lines. The results were more of a practical observation, with measurable demand going up, and peaking at times of fiscal crisis. Swap lines do have an impact but can be difficult to isolate because of other tools used for maintaining liquidity such as Term Auction Facility (TAF) auctions. Overall swap lines were found to be effective in reducing dollar funding costs to domestic and foreign firms and viewed as successful by professionals working at the time.

Delving into developmental economics, Laura (2009), studies mid-level and low-level developing countries, measuring both private and official flows of money into developing countries between 1995 to 2009. The results were mixed since each developing country had different

circumstances. Patterns observed were during times of financial global crisis, there was a drop in foreign direct investment and trade negatively impacting developing countries. The amount of trade flow between countries impacted the banking system, so central banks in developing countries were more likely to be impacted if they relied on foreign funding whereas those that did not had little impact in their banking system (Laura, 2009). The final part of the study may be of interest to countries that rely heavily on US Dollar reserves.

Swap lines have been implemented beyond their original use by China (Fan Zhang, 2017). Since 2005, China has been actively pursuing wider use of the RMB in international transactions which was sped up after 2008 with the financial crisis. The study covers RMB trade settlement, RMB denominated investment, RMB bond issuance, and RMB currency swaps and direct trading. One way to improve liquidity with trading partners is to use swap lines, placing RMB into the central banks of trading partners. An interesting observation is that bilateral trade did improve with belt and road initiative countries, though this is a preliminary study and further research is needed (Fan Zhang, 2017).

Another study of creative applications of swap lines covers the size of RMB swaps and lists over twenty-three countries, and provides several speculative reasons for China's desire to use the swap lines with other countries. Destais (2016) speculates that the swap lines bypass China's currency controls and allows for expanded use of the RMB. Destais recommends IMF use of the swap lines with their growing role, and also recommends decentralized use, but further research is required. The most interesting finding is the expansion of the RMB into other markets encouraging trade (Destais, 2016).

Gaps in the Literature

There are multiple gaps in the research related to maintaining liquidity, especially in developmental economics. The risk of use of swap lines is considered low, but that has been controlled by using only low risk banks. Since swap lines use continued after economic shocks, it is often considered a practical solution for improving liquidity. The practice appears to be of benefit for the IMF's objective of financial aid for developing nations and feasibility needs to be understood if the network is to be expanded into developed countries.

Research on the topic of swap lines is relatively new, with little attention to the topic of potential use for developing countries. Quantitative research is often simple observations of money movement with an attempt to relate the movement of money to bank liquidity stability, but often does a poor job of estimating cause and effect since swap lines are normally used during times of economic crisis and used in conjunction with many other central bank tools and policies. A general conclusion from most of these studies is that swap line usage was is a pragmatic solution that was hastily developed during times of economic crisis. Thus, a relationship is difficult to suss out as other central bank policies were being used at the same time.

This study considers the balance of trade-offs for lenders of last resort. A key benefit is that the IMF could consider how a proper contract might be of mutual benefit between developing countries and the IMF (Reis S. B., 2021). Also of consideration is the dominance of the US dollar, which is often held in reserve by foreign countries and

often is used when performing financial transactions.

Practical questions would be, what is the proper reserve size and which currencies should be held? There is a cost associated with swap lines, which is included in the interest paid at the end of the agreed upon time period before the currencies swap back. It should be considered that using too much currency could incur a higher cost for a central bank in need of funds (Linda Goldberg, 2013). China is one of the few countries that has used swap lines with developing nations, but the swap information is not transparent, and the purpose is different from using swap lines for economic stability during periods of economic stress. For purposes of this study, that research, though promising, is unrelated.

Another gap in the research is that since swap lines usage occurs during times of peak crisis along with other policies set by governments and central banks, it is difficult to separate the actual use of swap lines relating to liquidity. Isolating the benefit of swap lines would be ideal, and examining swap line usage between countries during times of economic stress and not outright economic crisis might shed light on these relationships since fewer policy tools are used. There is also little research on comparing countries that used swap lines and those that did not use swap lines. Any increase in liquidity might be coincidental since other central bank tools were also concurrently being used.

Research Approach

The approach used in this study for determining swap line use and effectiveness is a mix of quantitative and qualitative, though the emphasis will lean more on the quantitative side (Cresswell, 2018). Swap line networks are established in domestic currency liquidity lines and foreign currency liquidity lines (federalreserve.gov, 2023). The quantitative approach is used to describe foreign currency exchange rates, swap line network usage, size and duration. Liquidity comparisons were in dollars, since that has been the currency of choice for reserve in many countries and is the preferred currency during trade seen with the dominant currency paradigm.

From a more qualitative perspective, simple observations of patterns of the use of swap lines within existing networks were made. Central banks using swap lines have swap line agreements forming a network, and swap line usage was estimated to have varying degrees of use from “not at all,” “only during times of high economic stress” and “as precaution to expected economic stress.”

Data was taken from the publicly disclosed federal reserve transactions, and then validated with foreign central bank disclosures, such as the European Central Bank (ecb.europa.edu, 2024). Another data source was the IMF which has a database of foreign exchange rates (imf.org, 2024). Also used here was a swap line tracker created by the Council of Foreign Relations, which provides a good visual for identifying swap lines over time (Steil, 2024). These multiple sources allowed for comparison to be made of banks within and without swap lines with a consideration of economic development since many developing countries do not exist in the network.

To ensure data validity, several considerations were made. One was that the swap lines analyzed were those used for liquidity, but eliminating swap lines being used for increasing liquidity for trade purposes by China to avoid confusion.

Though there may be some cross over information, swap lines used by China are not fully known and may have error in them. The more challenging aspect was comparing countries of similar developmental levels, since swap line usage is more commonly used by developed nations.

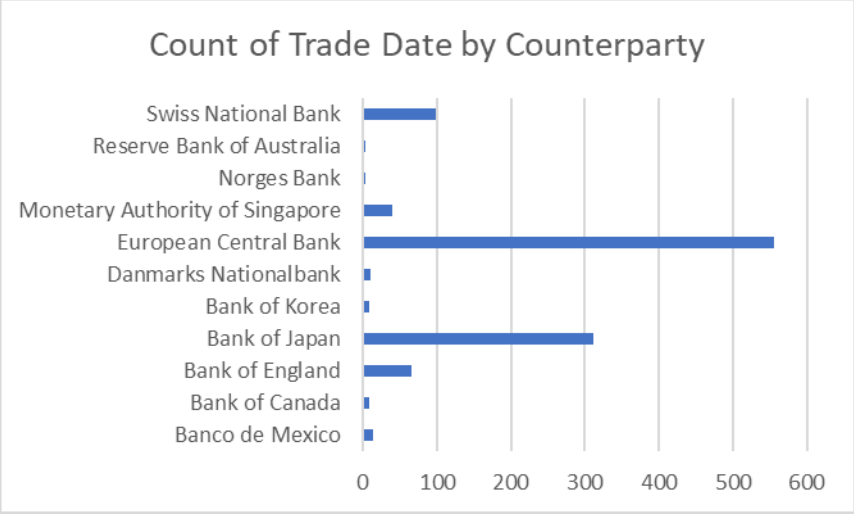
Not all swap lines were used and though the networks are predominantly used with developed countries, the temporary swap lines do include developing countries. The time frame used was between 2014 to 2024 and included the major economic global shock of the Covid-19 pandemic. The long-term swap line network is with the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, and the Swiss National Bank. The temporary swap lines are the Reserve Bank of Australia, the Banco Central do Brasil, the Bank of Canada, Danmarks National Bank, the Bank of England, the European Central Bank, the Bank of Japan, the Bank of Korea, the Banco de Mexico, the Reserve Bank of New Zealand, Norges Bank, the Monetary Authority of Singapore, Sveriges Riksbank, and the Swiss National Bank (federalreserve.gov, 2023)

Qualitatively, simple observations of swap lines within networks were made. If the swap line is considered useful, it will be used during times of economic stress, which can be hard to quantify at the time of economic crisis because of rapidly changing conditions involving large economic shocks.

Sampling Technique and Size

The population for the data collection will be permanent and temporary swap lines that exist between the United States and foreign central banks that have exists between 2004 and 2024. Data collected was categorized as either “use of swap line network” or “not used.” The amount of each swap was collected and referenced to periods of economic stress. Lack of swap line use during periods of high economic stress was also noted within swap line networks during the 2008 recession and the Covid-19 pandemic. Foreign exchange rates of swap lines networks were collected during periods of economic stress, whether the swap lines were used or not. The data gathered was compiled and analyzed using Microsoft Excel.

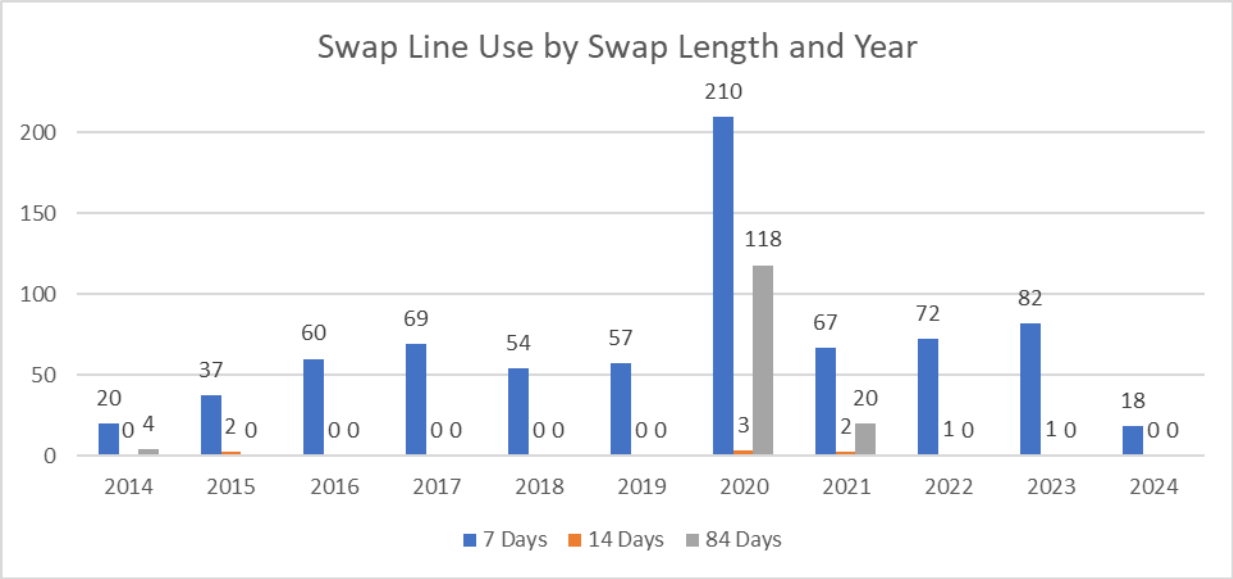
Swap Line Use



Swap lines were heavily used by the Central Banks with long term swap line agreements, which includes the Swiss National Bank, European Central Bank, Bank of Japan, and Bank of England. Canada was the only long-term bank in the long-term swap line network to infrequently use the swap lines. Temporary swap lines were set up specifically during times of economic stress, which includes state level and the more widespread Covid-19 pandemic, the countries that used these swap lines are seen with the Reserve Bank of Australia, Noreges Bank, Monetary Authority of Singapore, Danmarks National Bank, Bank of Korea, and the Banco de Mexico. Banks in the temporary swap line network not used are the Banco Central do Brasil, Reserve Bank of New Zealand and the Sveriges Riksbank.

An interesting immediate observation is that banks in centralized locations with a lot of neighboring trade partners had a higher frequency of swap line use with the Central Bank of Europe, the Monetary Authority of Singapore, Bank of Japan, Bank of England the Swiss Bank. The other banks with lower swap line use were physically in countries on the edge of major trade countries such as Canada, Norway and Australia or belonging to countries that are less mature in their economic development such as Mexico and Brazil.

Table 1. Swap Line Use by Swap Length and Year



federalreserve.gov, 2023

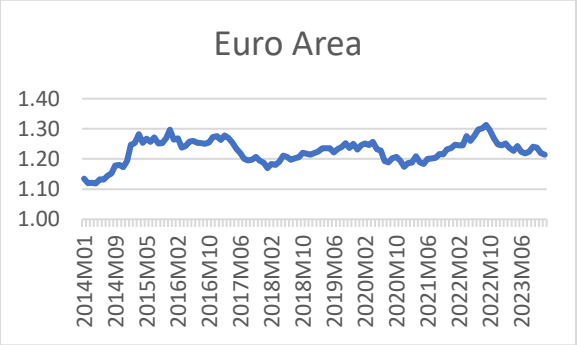
Table 1 shows swap line use from 2014 to March 2024. Swap lines ranges measured were 7 days, 14 days, and 84 days, though time frames could range from 1 day to 91 days. The other time frames were not used due to the infrequency of their use and the brevity of this study.

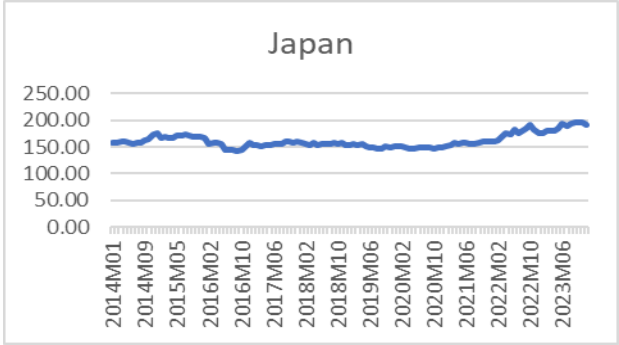
The 7-day swap line use was seen more frequently than all other swap line use and was used even during years of low economic stress. 7-day swap line use increased during the Covid-19 pandemic. The 14-day swap lines were used infrequently, and by only three central banks, the European Central

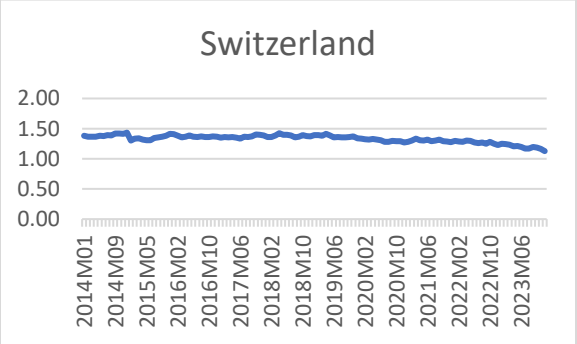
Bank, the Central Bank of Japan and once by the Swiss Central Bank. The Central Bank of Japan used the swap 14-day swap line in 2015 suggesting a more regional economic stress was occurring.

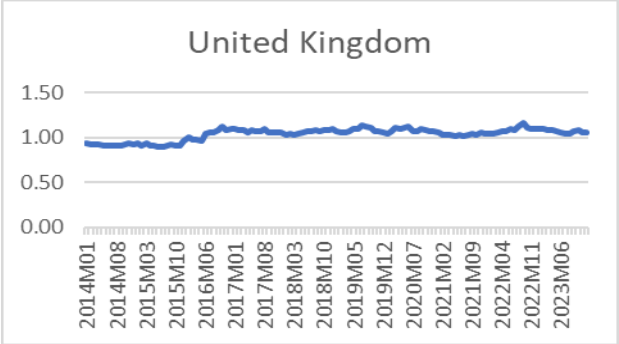
The 84-day swap line use was seen in 2014 with the European central bank likely related to the final stabilization after the 2008 financial crisis. Swap line use went up significantly during the Covid-19 Pandemic, when the global economy received to shocks, of a complete stop of the economy and the restarting of the economy.

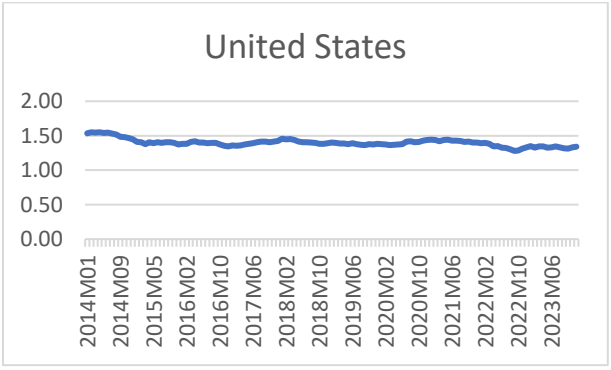
Tables 2 through 6: Exchange Rates









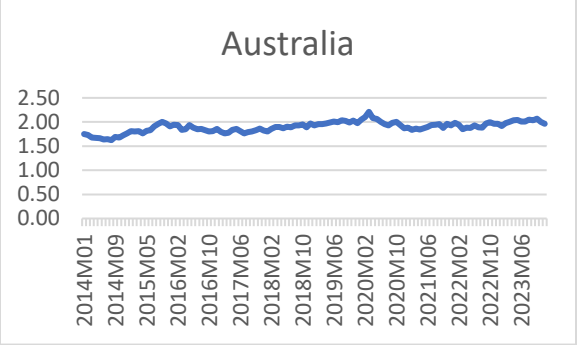


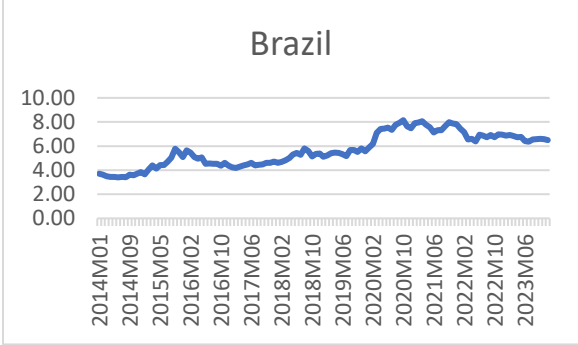
imf.org, 2024

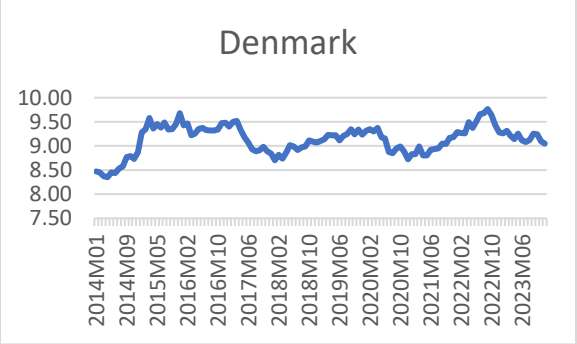
Tables 2 through 6 are the graphs for countries whose central banks are part of long-term swap line networks with the US Federal Reserve. The central banks in the

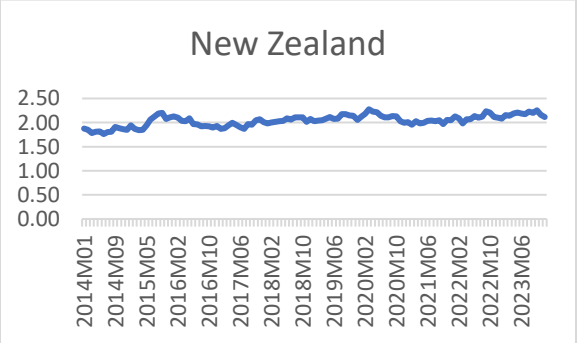
long-term swaps generally have a fairly steady exchange rate. Canada and the European Union have larger swings, but this could be due to larger differences in currency exchanges exchange rate the numbers. The European union is the only exchange rate that shows shifts related to times of economic stress which is likely due to their centralized role having to absorb countries of different economic development. This may also be why the European central bank is the most likely to use swap lines.

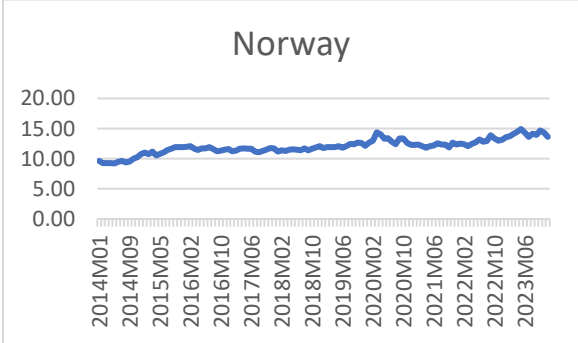
Tables 7 through 14: Exchange Rates

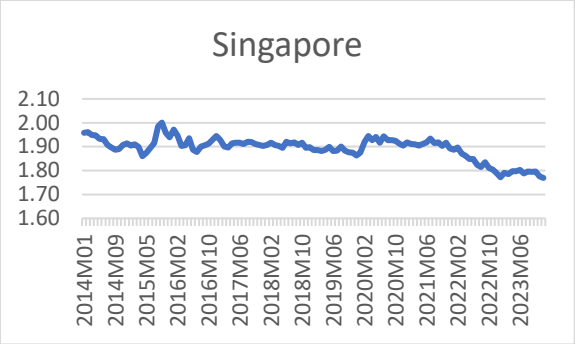


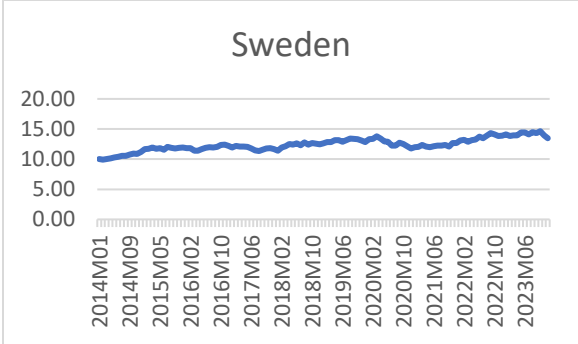








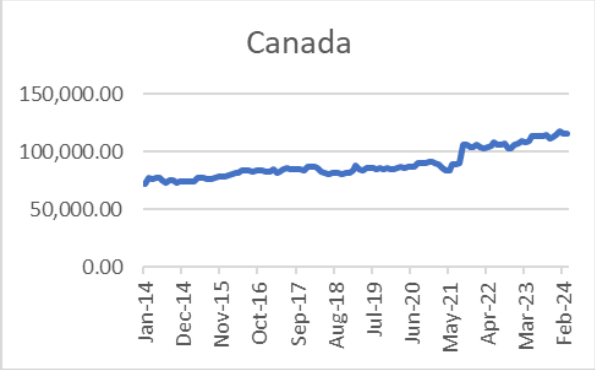


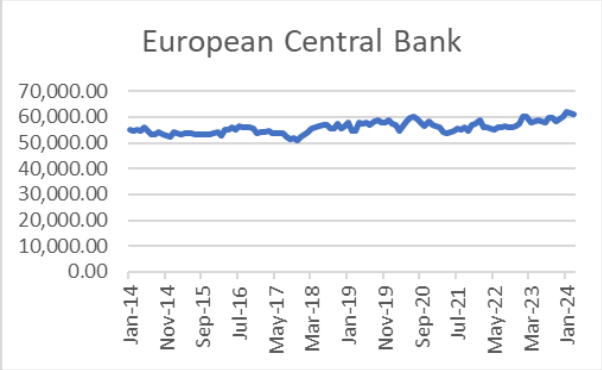


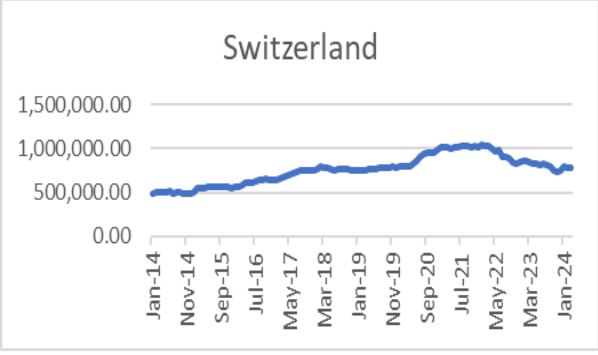
imf.org, 2024

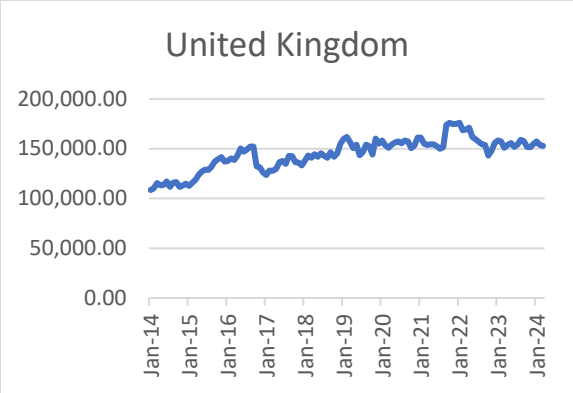
Looking at the central banks with temporary swap lines in Tables 7 through 14, exchange rates seem to follow economic stress with Brazil, Denmark, Mexico, Norway, Singapore, and Sweden suggesting they may have advantages or disadvantages in trade during global impact of the economy and impacted by the changes in trade.

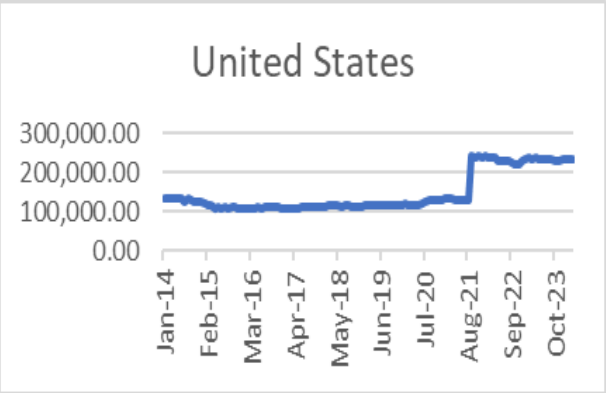
Tables 15 through 20: Central Bank Liquidity







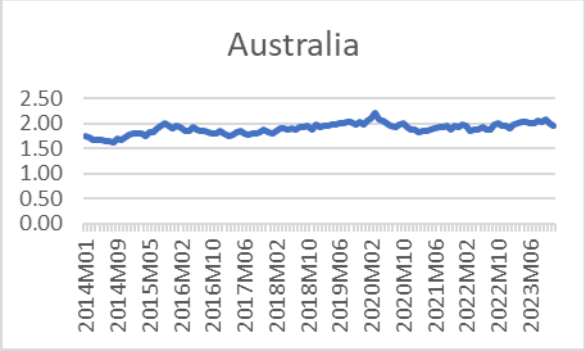


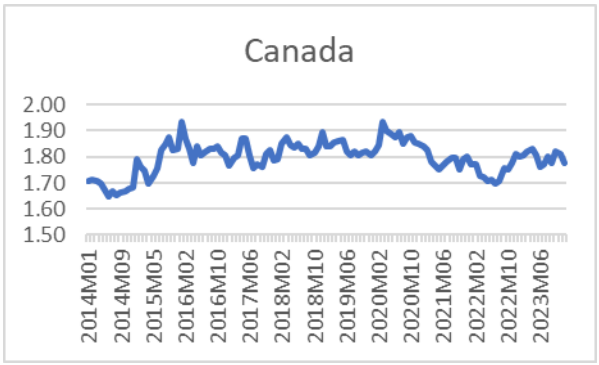


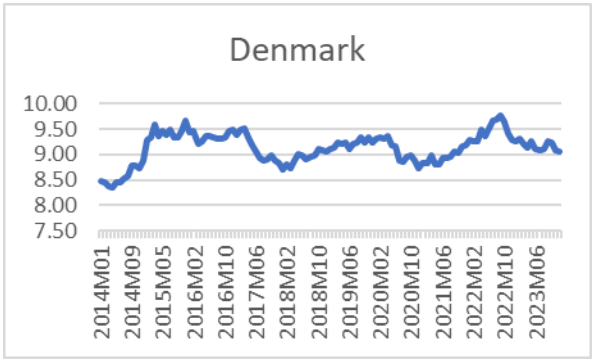
imf.org, 2024

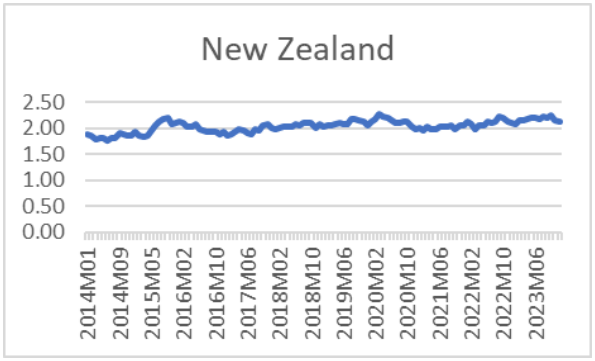
Tables 15 through 20 show liquidity of central bank assets minus gold reserves denoted in millions of US Dollars. The graphs are interesting as the trend for liquidity adjusts at the time of the Covid 19 pandemic seen with changes around the years 2020 to 2022. Of interest is that the shifts are not all consistent. Canada, the United States, Switzerland, Japan, and Great Britian all increase liquidity, whereas liquidity seems to stay steady for the European Central bank. The Bank of Canada, Bank of England, Bank of Japan, and the US have a sharp increase during the pandemic, suggesting some kind of policy was implemented causing the reserves to go up. Japan and Switzerland have an upward trend suggesting the central banks actions are not as large and may have been a step-by-step approach.

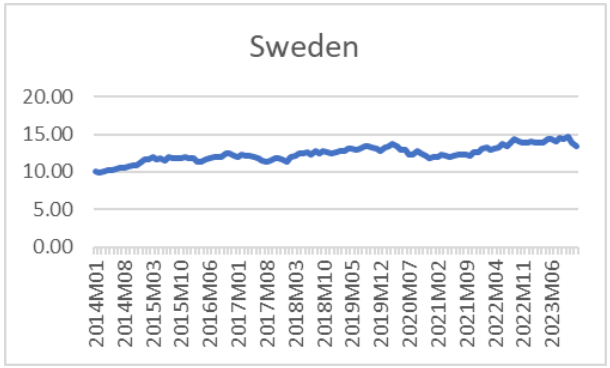
Tables 21 through 27: Central Bank Liquidity











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Observations of the central bank activity of short-term swap lines shows banks that dropped in liquidity were the central banks of Australia, Brazil, Denmark, and New Zealand. Liquidity maintained for South Korea, Mexico, and Sweden. Norway and Singapore increased in liquidity during the Covid-19 pandemic.

Tables 21 through 27 suggest that central bank activity increased liquidity, but that cannot be directly attributed to swap line use, though the use of swap lines is a likely contributor. Comparisons can be made as banks that used swap lines maintained or increased in liquidity and it is therefore plausible that being part of a swap line

network is beneficial to maintaining liquidity.

Discussion of Results

The result, which was most surprising, was that banks that are physically, centrally located, and that were most subject to global or regional economic shifts tended to be physically centralized to other countries. This as opposed to countries that were physically at the "edge of a map" tended to hold steadier in most cases as seen by gradual increases and decreases of liquidity and foreign exchange rates and the lack of swap line use.

Central banks that tended to be more volatile, especially during times of economic stress and which were also more likely to use the swap line network were the European Central Bank, Bank of Japan, Monetary Authority of Singapore, and the Bank of Mexico. It seems that banks that trade heavier are the ones more impacted by global economic events, but are also more influential as they must maintain liquidity with multiple major currencies. The United States appears to stand out by as more stable and having an ability to increase liquidity quickly, showing its outsized influence by having the world's dominant currency. The results do show promise for the IMF to utilize swap lines with developing countries, analyzing where they might have the most impact, though more research in this area is needed.

Findings Regarding Questions in This Study

Are swap lines improving liquidity conditions by providing central banks with the capacity to deliver U.S. dollar funding to institutions in their jurisdictions during times of market stress?

The answer seems to be yes. Countries that use swap lines tend to maintain liquidity and there is often a noticeable improvement in liquidity during larger amounts and longer-term network swaps though it is difficult to say swap line use is the only cause of improvement since other central bank policies are being used at the same time.

What is the capital flow difference between countries that use swap lines compared to those that do not during times of economic stress?

Swap line use generally shows an increase in liquidity and a more stable foreign exchange rate, though some countries that tend to be physically at the edge of maps tend to be more stable. There appear to be other factors that may influence capital flow and should be considered in a case-by-case situation.

What is the currency exchange rate comparison between nations that use swap lines and those that do not during times of economic stress?

The currency exchange rate tended to shift more with countries that were centrally located, which makes sense since those countries had more frequently used trading partners. Those that used swap lines tended to stabilize to comparable levels prior to the period of economic stress but however, it is difficult to attribute this stabilization to swap line use as other central bank policies are were also in use at those times.

Recommendations

The IMF often acts as a lender of last resort, and swap line use has proven to be a practical tool for maintaining liquidity. While the IMF is not a central bank, it could act to improve liquidity during times of economic stress. Working with developing countries' central banks does come with risk, and swap line networks exist in "low risk" banking networks which will be the first hurdle to consider. Swap line use was more frequent between banks in countries that appear to be trading hubs, physically centralized between countries and continents.

To capitalize on swap line use for developing countries, the IMF could create swap line networks with countries that do not currently participate in any swap line network. The level of risk would have to be assessed and swaps initiated with central banks experiencing a temporary liquidity problem from which they could recover. Developing countries should be identified that are centrally located to trading partners on each continent to establish a long-term swap line network.

Summary

To aid in the IMF's objective of financial aid for developing nations during periods of economic stress, the practice of using swap lines was evaluated as a feasible tool for IMF use. Swap lines are of interest because of their use during fiscal crises and is a practical solution for resolving liquidity issues. Previous research provides evidence that liquidity is maintained, though much needs to be learned as the research is just as new as the modern use of swap lines. Developing countries have many different intricacies, which can make research difficult as trade patterns, and money movement can vary greatly.

This study found that countries using swap lines tended to maintain liquidity and there was often a noticeable improvement of liquidity when larger exchanges with longer length of swaps were used. Swap line use also resulted in a more stable foreign exchange rate for countries that are geographically at the edge of maps. The currency exchange rate tended to shift more with countries that were centrally located, which makes sense since the countries likely had more frequently used trading partners. Those that used swap lines tended to stabilize to comparable levels prior to the period of economic stress but it is difficult to attribute to swap line use as other central bank policies are also in use.

Further research should consider how central banks with improved liquidity as a result of using swap lines affect neighboring countries' central banks since research suggests countries on the edge of trading areas used swap lines less frequently suggesting a potential ripple effect from centralized central bank usage. Other research possibilities include currency appreciation comparisons within the swap line network and isolating the impact of swap line use from other central bank policies designed to help with currency liquidity.

Practically, central banks will use swap lines only if they work, and what was observed is that swap lines were used frequently by banks that were physically centrally located with other trade partners which was a surprising observation. The higher frequency swaps were often for shorter durations of 7 days suggesting a more localized economic stress event was occurring. Larger swaps broadened usage by central banks, but again banks that were centrally located tended to use larger swaps

and more frequent swaps at 84 days. The largest hurdle will be considering the risk involved, since banks within existing swap networks are considered low risk.

The results of this study suggest that the IMF should focus on banking with central banks in developing countries that are physical central hubs with its trading partners.

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