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Cherry-Picking in Central Bank Currency Swaps

EMPIRICAL INSIGHTS INTO THE DETERMINANTS AND INCOME BIAS IN SWAP ACCESS DURING CRISES

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ABSTRACT

Since the 2007-9 global financial crisis, central bank currency swaps have become a crucial element of the Global Financial Safety Net (GFSN)—the set of institutions and arrangements that backstop countries in financial distress. Considering the uneven distribution of swaps among countries, our study empirically investigates the determinants of access to swaps, employing logistic panel regressions on a comprehensive novel swap dataset covering 194 countries from 2007-2022. The width of this dataset allows us to verify the effect of crisis indicators, country-specific variables and bilateral relations. By analyzing swaps provided by all central banks, the results indicate that both the US Federal Reserve and

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the People's Bank of China act as quasi-international lenders of last resort, distinguishing these institutions from other swap providers. However, contrary to prior assumptions, we find that a country's income level is a more significant factor in securing access to swaps than crisis status or external debt levels: advanced economies are more likely to receive swaps during crises than middle-income countries, and low-income countries are completely excluded from swaps. Other important determinants of swap access are economic size, country risk, trade agreements and geographical closeness. Finally, the results point to the interaction between different elements of the GFSN, showing that unconditional IMF lending lowers the likelihood of access to a central bank swap. Overall, these findings provide a better understanding of the dynamics of central bank swaps as a crisis finance instrument, which is crucial for evaluating the resilience of the international financial system and ensuring adequate support for all countries facing financial distress. Furthermore, they highlight potential gaps in the GFSN and raise questions about its inclusivity and efficacy in addressing systemic shocks and economic vulnerabilities. Addressing these flaws is crucial for sustained global economic growth and achieving the United Nations Sustainable Development Goals.

Keywords: Global Financial Safety Net; Central Bank Swaps; international monetary system; international financial architecture; financial crises

INTRODUCTION

Central bank currency swaps, which are credit lines between central banks aimed at providing liquidity to stabilizing markets during turmoil (Bahaj & Reis 2022), have become a prominent topic in recent debates on international monetary policy. These swaps have garnered attention due to their pivotal role in maintaining global financial stability. For instance, during the 2007-9 global financial crisis, the US Federal Reserve (Fed) acted as a lender of last resort (LOLR) and injected over \$2 trillion into the international economy through swaps (Sahasrabuddhe 2019), and during the COVID-19 pandemic, this monetary policy instrument was again used extensively (Aizenman 2021; Bahaj and Reis 2022).

The Fed is not the only central bank to offer swaps to partner central banks. Among the many providers from advanced and emerging economies, swap agreements from the People's Bank of China (PBOC) have considerably increased and received special attention in academic and policy circles, pointing out that Chinese swaps compose an emerging system of cross-border bailouts (Horn et al. 2023; Kynge 2023). Hence, currency swaps have emerged as third element of the so-called Global Financial Safety Net (GFSN), which comprises all institutions and agreements that provide shortterm emergency liquidity for countries in financial distress.

Currency swaps constitute the most voluminous layer of the GFSN. During the COVID-19 pandemic, the GFSN reached approximately \$3.7 trillion—about 4.5 percent of global gross domestic product (GDP)—with swaps alone accounting for \$1.7 trillion, representing more than a third of the GFSN (Stubbs et al. 2020). The GFSN used to comprise only the International Monetary Fund (IMF) until the 1970s. Since then, various regional financial arrangements (RFA) of different sizes and scopes

have been established as additional sources of third-party crisis finance (Mühlich & Fritz 2018). Compared to IMF and RFA loans, swaps have two key advantages: immediate and voluminous disbursement and absence of conditionality. These features are critical in averting financial crises. However, access to swaps is unevenly distributed among countries, and they are privileged to a relatively small sample of countries. In that sense, swaps enhance discoordination, fragmentation and inequalities in access to emergency finance (Mühlich et al. 2022b).

Bearing in mind their features and the uneven access to them, our study aims to answer the following research question: What factors determine whether a country receives a currency swap agreement? Existing empirical literature on that subject is scarce and has two main limitations. First, when studying the motives for providing swap agreements, it has focused almost entirely on the Fed (Aizenman et al. 2010, 2011, 2022; Eichengreen 2013; Sahasrabuddhe 2019; Bahaj & Reis, 2022) or the PBOC as providers (Garcia-Herrero & Xia 2013; Liao & McDowell 2013; Lin et al. 2016; Horn et al. 2023). As Perks et al. (2022) highlight, swap agreements by other central banks (such as Japan, the European Central Bank (ECB), Korea, Qatar and Turkey), have received very limited attention. Second, the period of analysis is rather short in existing studies, focusing either on the financial crisis of 2007-9 or the COVID-19 pandemic.

This study advances the literature in several aspects. First, compared to other studies, it encompasses a larger sample in terms of time and country coverage. To this end, we have constructed a novel bilateral swap dataset that includes all 194 countries, spanning data from 2007 (when swaps emerged as a new layer of the GFSN) to 2022 (the most recent data available). Second, unlike other studies, we consider all central bank swap agreements with publicly available information, including those from emerging economies. Furthermore, we provide a comparative analysis of the two main swap providers. Specifically, we verify if the Fed and PBOC behave differently than other central banks when a receiving country is in crisis or has high external debt. Third, bearing in mind the uneven distribution of swap access, we assess the likelihood of distinct income groups receiving swaps in times of crisis and controlling for the level of external debt. Finally, our data allow exploring the determinants for new swap agreements and renewed swap agreements separately. We suppose that the decision to sign a swap agreement for the first time could be driven by other factors than its renewal or expansion in size at a later point in time (Lin et al. 2016). Yet, their differences are oftentimes ignored empirically.

These contributions are important for enhancing our understanding of the dynamics of central bank swaps as a crisis finance instrument. Furthermore, they aid in evaluating whether swaps improve the GFSN's efficacy in addressing systemic shocks and economic vulnerabilities and whether they provide adequate liquidity support for all countries facing financial distress. An inclusive and resilient international financial architecture is key to sustaining economic growth, allowing fiscal space for preventing relapses in achieving the United Nations Sustainable Development Goals (SDGs), particularly in developing countries (Hausmann et al. 2022).

The paper is organized as follows. First, we summarize the results of existing empirical studies on determinants of swap provision. Second, we explain the swap dataset utilized for the empirical analysis and the methodology applied to estimate the importance of crisis indicators, country-specific variables and bilateral relations to gain access to swaps. Fourth, we summarize the main results of our empirical investigation. In particular, we examine the access to currency swaps for different groups of countries during financial distress. Further, we analyze the Fed and the PBOC as swap providers in a comparative perspective. Finally, we summarize our findings and recommend reforms of the GFSN in order to make it more inclusive and effective in addressing systemic shocks and economic vulnerabilities.

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LITERATURE REVIEW

There is a small yet growing literature on the empirical assessment of central bank currency swap arrangements. Yet, the overwhelming part of this literature is split up in its assessment, considering either only swaps provided by the Fed (Aizenman & Pasricha 2010; Sahasrabuddhe 2019; Aizenman et al. 2022) or by the PBOC (Garcia-Herrero & Xia 2013; Liao & McDowell 2015; Lin et al. 2016; Horn et al. 2023). Very few papers offer broader coverage (Aizenman et al. 2011; Perks et al. 2021), and to our best knowledge, no analysis encompasses all types of countries—advanced, emerging and developing economies—and empirically tests the determinants of swap access. We divide our literature survey in those analyzing US swaps, Chinese swaps or a broader group of providers. Additionally, we look at the few political economy papers that investigate the politicized nature of currency swap provisions.

Table 1 gives an overview of existing empirical studies that investigate the determinants of central bank swaps provision, categorizing variables into external vulnerability, country characteristics and bilateral relations. Regarding the motives for the provision of Fed swaps, Aizenman & Pasricha (2010) analyze the first round of Fed swaps provided to the most relevant advanced economies (Eurozone, United Kingdom, Switzerland, Canada and Japan), and to the only four Fed-swap-receiving emerging market economies (EMEs) (Brazil, Mexico, Singapore and South Korea). Using probit regressions, they empirically test for 27 emerging countries (including the "selected four") if financial and trade linkages, financial openness and credit default history explain the US selection of swap partners among EMEs. They find that US bank exposure is the most relevant variable, while the other three variables are not statistically significant.

Aizenman et al. (2022) came to slightly different results when analyzing the selection of Fed swap partners that received a renewal of swap agreements during the pandemic—the Fed did not sign first swap agreements during the pandemic but merely renewed those agreements that had expired after the global financial crisis and made several ones to advanced economies permanent. For this exercise, they use data from January to March 2020 in a probit model considering 39 swap-receiving countries, plus all countries included in the Foreign and International Monetary Authorities (FIMA) repo facility program.⁵ Their results indicate that financial links, measured as US bank exposure to the swap partner country, still was the key explanatory variable during the pandemic. In addition, trade links, in the form of reliance on the US as export destination, also show a positive effect on the extension of swaps as well as military ties. The increased relevance of trade links for swap agreements might reflect a changed significance of economic ties between the US and its partners since the global financial crisis, or they might be particularly relevant for countries included in the FIMA repo facility. In any case, from these results, we deduce that the motives for swap provision may change between the first provision and their renewal at a later point in time.

Sahasrabuddhe (2019) examines the political economy of currency swap provision by the Fed, employing a probit estimation with swap data from 2008 and reaching similar conclusions to those of Aizenman et al. (2022). The author finds that Fed swaps are determined by financial ties, economic significance for the US and political alignment with the US. The main contribution of this study is to point to the fact that considerations of sound economic management do not unambiguously explain the Fed's selection of swap partners. The results suggest that the Fed strategically chose the "only four" emerging markets (Brazil, Korea, Mexico and Singapore) to reinforce alliances in the global economy: aligned with the US within the existing governance framework, with US preferences for non-reform and relatively financialized EMEs.

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⁵ The FIMA repo facility allowed foreign central banks to temporarily raise dollars by selling US Treasuries to the Fed.

Table 1: Literature Review Summary

Authors	Coverage	Period	Regression	External	Country	Bilateral relations							
			Method	vulnerability	characteristics	Commercial	Financial	Geostrategic	Distance				
Aizenman & Pasricha 2010	Fed swaps (27 EMEs)	2008	Probit	Default history	CapOpen	Trade share US	US Bank exposure						
Sahasrabuddhe 2019	Fed swaps (127 EMDCs)	2008	Probit		GDP (% global) * CapOpen Inflation Liabilities (% global) †	Trade share US†	US bank exposure†						
Aizenman et al. 2022	Fed swaps & FIMA repo (65 countries)	Jan-Mar 2020	Probit			Trade share US	US Bank exposure	Military alliance					
Garcia-Herrero & Xia 2013	PBOC swaps (24 EMEs)	12/2008- 03/2013	Logit	Default history	GDP CapOpen Inflation Gov. Qual. Corruption	X share partner FTA	Inward FDI share CHN		in km				
Liao & McDowell 2015	PBOC swaps (172 countries)	2008-11	Logit		GDP GDP pc GDP growth	Trade share CHN Trade share partner Trade CHN*part. FTA	FDI share CHN FDI share partner FDI CHN*part. BIT	SCO member Oil product. Coal product.	in km				
Lin et al. 2016	PBOC swaps (130 countries)	2003-14	Probit & Heckman 2stage	Default history	GDP Political Stability Corruption	Trade share X share partner X share CHN FTA	Outward FDI	Strategic partner	in km time*km				
Horn et al. 2023	PBOC swaps (13 EMEs)	2020-21	Fixed effects OLS	Sov. risk rating Foreign reserves									
Aizenman et al. 2011	Fed, ECB & PBOC swaps (213 countries)	12/2007- 10/2009	SUR, Probit, and Tobit			Trade share providing country							
Perks et al. 2021	Swaps from all providers (132 EMDCs)	2020-21	Fixed effects OLS & Logit	External debt Foreign reserves Cur.Acc. balance ∆Exch. Rate	GDP pc GDP growth Inflation Fiscal balance IMF net lending	Trade openness	Total net capital inflows						

Source: Compiled by the authors.

Notes: Bold = highly significant in most regressions, black ink = significant in most regressions, grey ink = not significant at the 10 percent level in most regressions. Empty boxes = none of the utilized explanatory variables was from the respective category. SOC = Shanghai Cooperation Organization, BIT = Bilateral Investment Treaty. †Sahasrabuddhe (2019) does not verify the significance of these variables independently but creates an "Economic Significance" variable that bundles the four variables.

On PBOC swaps, Garcia-Herrero and Xia (2013) apply a logit model to examine the determinants of currency swaps provided by the PBOC. They find that trade relationships are more important than financial connections for the likelihood of providing a currency swap. Moreover, they conclude that countries with default history are more likely to sign a swap with PBOC, a finding that Horn et al. (2023) recently confirmed (see below). Liao and McDowell (2013) also use a logit model to investigate the importance of trade treaties between China and swap recipient countries. Their main finding is that, for the provision of PBOC swaps, both the de jure and de facto trade and investment integration matter. Furthermore, they argue that there is a strong motive for PBOC swaps in the internationalization of the Renminbi, in contrast to the US dollar, and that PBOC swaps are not offered to resolve the recipient's balance of payments difficulties. Overall, they conclude that the motives of both the offering and receiving countries matter for the decision to sign a swap agreement.

Lin et al. (2016) find for Chinese swaps that bilateral trade relations and strategic partnerships, along with country characteristics such as economic size and institutions (corruption and political stability), affect the decision to sign a swap agreement. They further establish that once a swap agreement decision is made, the swap line's size is mainly affected by economic size, trade intensity and the presence of a free trade agreement. Horn et al. (2023), based on Chinese swap data between 2000-2021, also investigate the determinants of PBOC offering a currency swap. Based on non-econometric case studies of 13 countries that have drawn on Chinese swaps, they find that China has established a new global system for cross-border rescue lending to countries in debt distress. Moreover, they present simple ordinary least squares regression (OLS) fixed effects regressions, which indicate that a better sovereign risk rating and higher foreign reserves are significant determinants of receiving Chinese swaps. Yet, they do not provide a comparative analysis including countries that did not draw on PBOC swaps or countries that did not receive Chinese swaps, so the role of swaps in debt-distressed countries is not analyzed in a comparative manner (see also Gallagher et al. 2023).

With regard to studies that consider more than one swap provider, Aizenman et al. (2011) employ seemingly unrelated regression (SUR), probit and tobit regressions for a sample of 213 developed and developing countries, of which 22 countries received swaps from the Fed, ECB and PBOC during the global financial crisis (2007-09). They find that trade ties with the swap provider are a significant determinant of swap provisions. Additionally, they present some data that indicate that high foreign exchange reserves as a sign of overall macroeconomic soundness of the swap-receiving country are a relevant factor for swap access.

Perks et al. (2021) is—to the best of our knowledge—the only scholarly contribution that considers all swap providers. The authors take into account the Fed, PBOC and other central bank swaps for the period of the pandemic (2020-21). However, on the recipient side, they only include in their analysis emerging markets and developing countries as potential swap recipients. The authors find that, in general, central bank currency swaps' stabilizing effect on the international monetary system is not clear, although Fed currency swaps appear to have been effective at maintaining market stability during the COVID-19 shock. With fixed effects OLS and logit regressions, the authors show that countries are more likely to sign and renew a currency swap designed to alleviate balance of payments needs when their external position weakens. They conclude that swaps can be an important source of liquidity, although in some cases, they might contribute to prolonging weak policies. Finally, the likelihood of a recipient country signing a currency swap with the PBOC is higher if the country has strong trade ties with China, which resembles the abovementioned findings on the determinants of the PBOC offering a currency swap.

Besides the different empirical studies of swap-providing countries, several studies take an explicit political economy perspective on the politicized nature of currency swap provision by major central

banks. As Destais (2016: 2265) argues, "Currency swaps are quickly becoming an additional layer of an already multilayered global safety net (Rana 2012) where the key players are the issuers of the reserve currencies. This situation gives the global issuers the possibility to deny access to international liquidities on noneconomic grounds, be they legitimate or not, and to arbitrage between their own interests and the superior interest of the world's financial stability." On the other hand, in a qualitative assessment, Murau et al. (2021) see Fed swaps as an instrument to influence global liquidity conditions to control domestic monetary conditions, such as an international dimension of US monetary policy.

Finally, studying central bank currency swaps needs to consider that swap-providing central banks have been identified by some scholars to act as LOLR, in the tradition of Bagehot (1873), to prevent disruptions in banks' access to borrowing that could result in investment crashes (Bahaj & Reis 2022). The LOLR argument is made based on the effects of swaps on interest rates and financial market stability in the receiving country.

RESEARCH DESIGN

Swap Agreements: Data Sources and Statistical Summary

To identify the main determinants of central bank swap agreements, our dependent variable is a dummy variable that equals 1 if a country-pair has a swap agreement in a specific year (and zero otherwise). To create this dummy, we utilize data from the GFSN Tracker (Mühlich et al. 2023) for the years 2018-2022. This novel dataset provides information on access to IMF lending, access to RFA funds and central bank currency swap agreements for all UN member countries. It gathers currency swap data from central banks' websites and media reports and categorizes swap agreements between advanced and developing economies as unidirectional, assuming that advanced economies are providers and developing countries are recipients. Conversely, when both partners belong to the same income group, swaps are considered reciprocal (i.e., both partners are swap providers and receivers at the same time).

Swap agreements from the Fed and the PBOC are exceptions to this assumption. The PBOC swaps are treated the same way as those from advanced economies, reflecting China's important role in providing currency swaps. The Fed swaps are classified as unidirectional, irrespective of the partner country, as the US has no need to draw swap lines from other countries due to the US dollar's distinct role as major international key currency. To be able to analyze the period from 2007-2022, we collected additional data on swap agreements for the years 2007-2017, employing the same methodology as the GFSN Tracker. We differentiate between all swap agreements and first agreements, where a swap agreement is categorized "first" when a country-pair has not previously established a swap agreement (e.g., the Fed-ECB agreement in 2007). This distinction allows us to examine in our analysis whether the reasons for renewing a swap agreement differ from those for initiating a first agreement, as suggested by the distinct findings from Aizenman & Pasricha 2010 and Aizenman et al. 2022 regarding the determinants of first and renewed Fed swaps (see above).

Since Eurozone countries participate in swap agreements collectively through the ECB, it seems reasonable to consider the characteristics of the Eurozone as a whole, instead of focusing on individual member countries (Sahasrabuddhe 2019). Moreover, introducing each country separately in the dataset would imply the multiple counting of ECB swap agreements, likely biasing the results. Hence, we treat Eurozone countries as a single entity (country). This implies that for the creation of the country-pair dataset, we aggregate the data of member countries, either by averaging (e.g., GDP per capita) or summing (e.g., GDP).



Our novel dataset records 410 total bilateral central bank swap agreements during this period, of which 157 were first agreements. Figure 1 depicts that the provision of these swaps was relatively constant over time, with expected peaks during the 2007-2008 financial crisis and the COVID-19 pandemic. Meanwhile, the peak in 2013 was likely an aftermath of the European debt crises, aimed at restoring confidence in the European financial systems. This is evident as most of the swap agreements this year involved European countries (i.e., Eurozone, UK, Switzerland, Lithuania, Albania, Iceland and Hungary). Naturally, over time the proportion of renewed agreements has been significantly higher than that of first agreements. Nonetheless, first agreements have been signed every year, showing that more and more countries engage in swap agreements and that their use is not confined to global crisis situations.



Figure 1: Distribution of Swap Agreements Over Time

Source: Data collected by the authors. based on information from central bank websites and GFSN Ttracker. **Note:** This figure depicts the evolution of bilateral swap agreements over time, distinguishing between first and renewed agreements.

Figure 2 also depicts the provision of swaps over time, with a focus on those provided by the Fed and PBOC. The Fed's provision of new swaps is concentrated in the 2007-9 global financial crisis, with renewals during subsequent periods of turbulence such as the Eurozone crisis in 2019 and the COVID-19 pandemic. In contrast, the provision of new swaps by the PBOC shows no concentrated timing pattern. The lower frequency of observed US swap renewals is partly due to the Fed converting its temporary liquidity arrangements with Japan, Canada, the UK, European Union and Switzerland into standing and unlimited arrangements in 2013. In contrast, while all countries that accessed Fed swaps renewed their arrangements at some point, not all new arrangements made by China were renewed—at least at the time of this research. Out of the 40 swaps signed, 29 remained effective, as reported by the PBOC in 2023 (PBOC 2023).

Figure 2: Distribution of US and Chinese Swap Agreement Provisions Over Time



Source: Data collected by the authors based on information from central bank websites and GFSN Ttracker. **Note:** This figure shows the evolution of the Fed and PBOC swap agreements over time, distinguishing between first and renewed agreements.

Table 2 shows that nearly two-thirds of total swap agreements were made by advanced economies (255 out of 410), with 40 percent of them made between advanced economies and 22 percent provided from advanced to developing economies. Agreements between developing country pairs accounted for 27 percent, while 12 percent were from developing to advanced economies, all of which were provided by the PBOC. Generally, relatively few (40 out of 154) developing countries received or provided (16 out of 154) swaps, with the majority being upper-middle-income emerging markets. China was responsible for nearly 80 percent of all swap provisions originating from developing countries (122 out of 155), and nearly 40 percent of all swap provisions towards developing countries (78 out of 202). Surprisingly, Mexico and Brazil were the only developing countries that received swaps from the Fed, although the Fed was responsible for almost 30 percent of all advanced economy swap provisions (74 out of 255).

With regard to the 157 first swap agreements, the concentration among providers and receivers was very similar but a little less pronounced than that of all swap agreements. Approximately 58 percent of first agreements were made between advanced countries (41 percent) and provided from advanced to developing countries (17 percent). Almost 40 percent of the latter were provided to China. China played an even bigger role as a provider of first swaps, being responsible for 63 percent of all developing country first swap provisions (41 out of 65), with most being granted to other developing countries (30 out of 41). In contrast, the share of the US among the first swap provisions of advanced economies was much smaller, with 16 percent (15 out of 92). More generally, the data shows that China has been the main provider of central bank swaps, followed by the US, Japan, Korea and the ECB.



Table 2: Providers and receivers of central bank swap agreements between 2007-2022

		Providers (3	3 countrie	es)		Receivers (58 countries)								
	Advanced	(17)	C	Developing	g (16)		Advanced	(18)	D	eveloping	(40)			
	Freq.	% of total		Freq.	% of total		Freq.	% of total		Freq.	% of total			
USA	74	18.0%	CHN	122	29.8%	JPN	28	6.8%	CHN	44	10.7%			
JPN	40	9.8%	TUR	7	1.7%	ECB	24	5.9%	IDN	17	4.1%			
KOR	22	5.4%	QAT	4	1.0%	CHE	20	4.9%	TUR	12	2.9%			
ECB	21	5.1%	IND	3	0.7%	GBR	19	4.6%	MYS	11	2.7%			
CHE	15	3.7%	IRN	3	0.7%	CAN	16	3.9%	IND	8	2.0%			
AUS	13	3.2%	LKA	3	0.7%	KOR	16	3.9%	THA	8	2.0%			
GBR	13	3.2%	ARE	2	0.5%	AUS	14	3.4%	ARE	7	1.7%			
SGP	13	3.2%	PAK	2	0.5%	SGP	13	3.2%	QAT	7	1.7%			
CAN	10	2.4%	POL	2	0.5%	DNK	9	2.2%	PAK	6	1.5%			
ISL	7	1.7%	BGD	1	0.2%	SWE	9	2.2%	UKR	6	1.5%			
HKG	6	1.5%	ETH	1	0.2%	NZL	8	2.0%	BRA	5	1.2%			
SWE	6	1.5%	IDN	1	0.2%	ISL	7	1.7%	LKA	5	1.2%			
DNK	5	1.2%	IRQ	1	0.2%	LTU	7	1.7%	MNG	5	1.2%			
NZL	4	1.0%	MYS	1	0.2%	NOR	7	1.7%	ARG	4	1.0%			
NOR	3	0.7%	SDN	1	0.2%	HKG	6	1.5%	CHL	4	1.0%			
LVA	2	0.5%	UKR	1	0.2%	HRV	2	0.5%	HUN	4	1.0%			
EST	1	0.2%				LVA	2	0.5%	MEX	4	1.0%			
						EST	1	0.2%	PHL	4	1.0%			
									POL	4	1.0%			
									ALB	3	0.7%			
									BLR	3	0.7%			
									IRN	3	0.7%			
									KAZ	3	0.7%			
									RUS	3	0.7%			
									ZAF	3	0.7%			
									EGY	2	0.5%			
									SRB	2	0.5%			
									SUR	2	0.5%			
									TJK	2	0.5%			
									ARM	1	0.2%			
									BGD	1	0.2%			
									BGR	1	0.2%			
									ETH	1	0.2%			
									IRQ	1	0.2%			
									LAO	1	0.2%			
									MAR	1	0.2%			
									NGA	1	0.2%			
									SDN	1	0.2%			
									UZB	1	0.2%			
Total	255	62%	Total	155	38%	Total	208	51%	Z VVE	202	0.2% 49%			

Source: Data collected by the authors based on information from central bank websites and GFSN Ttracker.

Note: This table lists the countries providing and receiving swaps from 2007-2022, detailing the number of swap agreements each country engaged in, along with their share of the 410 total agreements signed.



Overview of the Explanatory Variables Considered

Concerning the explanatory variables, data availability allows us to consider 19,292 country-pairs (as outlined above, ECB countries are considered as one "country"). In line with previous empirical studies (see Table 1), we consider a broad set of explanatory variables that intend to capture the role of financial crisis and liquidity provision, the receiving country's economic characteristics, and economic and political ties and distance between the receiving and providing countries (see Table 3 for an overview).

Concerning the role of swap provisions as a financial rescue mechanism, we consider a dummy variable that equals 1 if a banking, financial or currency crisis occurs in the receiving country (and zero otherwise). To create this dummy, we rely on a comprehensive dataset from Nguyen et al. (2022) for the years 2007-2020. For 2020-2021, we assume that all countries experienced a crisis due to the profound impacts of the COVID-19 pandemic on the economies and financial systems around the world. For 2022, we rely on a financial crisis list from Reuters (2023). In line with the LOLR literature, we expect the crisis dummy to be positive and highly significant.

Table 3: Summary of the Explanatory Variables

Category	Variable name	Variable description	Source			
	Financial Crisis	Occurrence of banking, financial or currency crisis in the partner country (dummy; 1=crisis)	Nguyen et al. (2022) for 2007-20; Reuters (2023) for 2023			
External vulnerability	External Debt	External debt stock (as % of GNI)	World Bank (2023) and IMF (2023b)			
liquidity provisions	IMF Access	Unconditional IMF lending limits (as % of GDP)	Own data collection			
	RFA Access	RFA membership (dummy; 1=RFA access limit \geq 80% of conditional IMF credit lines)	Own data collection			
	InGDP	Logarithm of GDP (in constant USD)	World Bank (2023a)			
	InGDPpc	Logarithm of GDP per capita (in constant USD)	World Bank (2023a)			
Country	Reserves	Foreign reserve holdings (as % of GDP)	World Bank (2023a)			
characteristics	Kopen	Capital openness index (ranging from 01)	Chin-Ito (2023)			
	Rating	Average sovereign credit rating from S&P, Moody's and Fitch (ranging from 120)	Own calculation with Trading Eco- nomics (2023) data			
	Image: Problem Problem ProblemFinancial CrisisOccurrence of ban partner country (di partner country (di partner country (di partner country (di 	Free trade agreement (FTA)	CEPII (2023)			
	Trade	Bilateral trade volumes (as % of the GDP of the origin country)	World Bank (2023b)			
	UN Voting	Disagreement in UN General Assembly resolution voting	Voeten et al. (2023)			
Bilateral relations	InDistance	Logarithm of distance between capital cities (in km)				
	Contigous	Common border (dummy; 1=yes)				
	Colonial ties	Colonial ties (dummy; 1=yes)				
	Legal origins	Common legal origins (dummy; 1=yes)				

Source: Compiled by the authors.

Note: This table lists the explanatory variables used in the regressions, provides a brief description of each, and cites the sources from which the data were retrieved.



Additionally, we utilize the external debt stock (as a percentage of gross national income (GNI)) as a proxy for the financial fragility of the destination country. The data is retrieved from the World Bank's (2023a) World Development Indicators (WDI) database and the International Monetary Fund (IMF)'s (2023c) Quarterly External Debt Statistics (QEDS) Special Data Dissemination System (SDDS) database. Moreover, we account for the receiving country's access to GFSN liquidity provisions outside of swap agreements. As a proxy, we use the unconditional cumulative access limit to IMF loans (as a percentage of their GDP)⁶ and a dummy variable that is 1 if the receiving country is part of an RFA that provides credit lines with an access limit equal to or higher than 80 percent of the country's conditional IMF credit lines.⁷ Mühlich and Fritz (2018) suggest a threshold of 80 percent of the IMF conditional normal lending as a reasonable threshold to compare RFA with IMF lending volumes.⁸ We assume that having access to alternative liquidity sources in the GFSN, such as through the IMF or an RFA, reduces the probability of signing a swap agreement.

Regarding the economic characteristics of receiving countries, we consider the logarithm of GDP and GDP per capita (both in constant USD), foreign reserve holdings (as a percentage of GDP), capital openness (index; 0...1), and the average of S&P, Moody's and Fitch's sovereign credit rating of the country (index; 1...20, where AAA=1). The data for the first three variables was retrieved from the World Bank (2023a), capital openness data was available from Chin-Ito (2023) up to the year 2020 -for the years 2021-2022 we assume that the index values were the same as in 2020-and the credit rating data was retrieved from Trading Economics (2023), which compiles historical information on credit rating. We expect a negative sign for the rating variable and positive signs for the other four variables, given that a better rating, higher GDP, higher GDP per capita and higher capital openness are expected to reduce the perceived risk for swap-providing countries.

As proxies for economic and political ties, we use a dummy variable that equals 1 when country-pairs have a free trade agreement (FTA) in place, bilateral trade volumes (as percent of the GDP of the origin country), and the ideal point distance of UN General Assembly resolution voting (0...6; where a higher score indicates less agreement). The variables are retrieved from Centre d'Études Prospectives et d'Informations Internationales (CEPII) (2023), World Bank (2023b) and Voeten et al. (2023), respectively. According to the literature, one can expect a positive effect of bilateral trade, FTAs and agreement in UN voting because these are indicative of tighter economic linkages and closer political alignments. Additionally, we control for several variables that are commonly used as distance measures in financial gravity models: the logarithm of the distance between capital cities, having a common border, colonial ties and common legal origins (see e.g., Brei & von Peter 2018). These variables are readily available from CEPII (2023). We expect that geographical proximity and shared historical ties enhance the probability of signing swap agreements.

Please note that all the explanatory variables utilized appear to contain different information content, as they are not strongly correlated (see Table A1 in the Appendix). An exception is the relatively strong correlation between sovereign rating and GDP (0.567) and GDP per capita (0.696). However, the main findings are unlikely to suffer from multicollinearity, given that the results remain robust when the rating variable is excluded from the regressions (see the next section).

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⁶ Based on the Handbooks of IMF facilities for low-income countries (2012, 2017, 2023), we approximate unconditional access limits as follows, excluding countries with access to Flexible Credit Line and Precautionary and Liquidity Line: 2006-2015: 25 percent of a country's quota; 2016-2019: 37.5 percent; 2020-2022: 100 percent.

⁷ Based on the Handbooks of IMF facilities for low-income countries (2012, 2017, 2023), we approximate cumulative conditional access limits as follows: 2006-2007 300 percent of a country's quota; 2008 - 2016 600 percent; 2017 - 2022 435 percent.

⁸ Mühlich and Fritz (2018) find that 32 percent of all RFA members have access to a lending volume that is at least 80 percent of their normal access limit to IMF conditional lending. This holds true for an access limit of at least 55 percent as well as of at least 90 percent and reduces to 28 percent of all RFA members when applying a 100 percent threshold—if access to RFA lending is at least as large as access to IMF normal conditional lending in 2018.

Methodological Approach

We employ a logistic panel model to examine the likelihood of countries engaging in bilateral swap agreements in relation to economic, political and gravity factors. Various studies on bilateral swap agreements have utilized logit models (see Table 1), underscoring their appropriateness for such analysis. These models are particularly well-suited for dichotomous dependent variables, providing a robust framework for identifying the determinants of discrete events like the presence or absence of swap agreements. The logistic function estimates the log odds of an event's occurrence from a linear combination of independent variables, accommodating static and dynamic factors. The logistic distribution's heavier tails compared to the normal distribution make logit models tolerant of outliers or extreme values (Coles 2001). This attribute is beneficial for analyzing rare events in diverse panels comprising both high- and low-income countries and implies that logit models are more appropriate for our purpose than probit models.

Another advantage of logistic panel models is that they allow for the inclusion of continuous and categorical explanatory predictors and account for observed and unobserved heterogeneity over time, addressing autocorrelation and heteroskedasticity inherent in panel data (Wooldridge 2010). This feature is important for datasets encompassing many entities and periods, enhancing data utilization by pooling information across entities while still acknowledging within-entity correlation. Hence, logistic models are particularly suitable for panels that include countries with and without currency swap agreements, enabling a detailed exploration of swap agreement dynamics. Additionally, the ability to incorporate time-fixed effects, robust standard errors and interaction terms further enhances the ability to accurately identify and analyze the factors influencing the establishment of swap agreements.

The baseline logistic model equation we are using is as follows:

$$\log\left(\frac{P(SWAP_{ijt}=1)}{1-P(SWAP_{ijt}=1)}\right) = \beta_0 + \beta_1 X_{1,ijt} + \dots + \beta_n X_{n,ijt} + \delta_t + \varepsilon_{ijt}$$
(1)

where **log** refers to the natural logarithm, $P(SWAP_{ijt} = 1)$ is the probability that country i signs a swap agreement with country j in year t, $\left(\frac{P(SWAP_{ijt}=1)}{1-P(SWAP_{ijt}=1)}\right)$ are the odds of this event occurring (i.e., the ratio of the probability of receiving a swap to the probability of not receiving one), $X_{1,ijt}, ..., X_{n,ijt}$ are the independent variables, β_0 is a constant, $\beta_1, ..., \beta_n$ are the coefficients to be estimated, δ are time-fixed effects to control for any unobserved heterogeneity that varies over time but is constant across countries, and ε is an error term (with robust standard errors to provide consistent estimates in the presence of heteroskedasticity).

We use a random-effects model that does not incorporate time-invariant fixed effects because our primary interest is in examining differences between country-pairs that signed a swap agreement and those that did not. Hence, the inclusion of country or country-pair fixed effects is impractical for our purpose because it would lead to the automatic exclusion of all countries that did not sign a swap agreement during the period under study. Given that our dataset comprises only 410 swap events distributed among a limited number of country-pairs, for most pairs the dependent variable consists of zeros across all years. Incorporating time-invariant fixed effects would lead to an exclusion of these pairs due to collinearity.

To mitigate potential reverse causality, we introduce a one-year lag for most explanatory variables under the premise that the current state of the dependent variable cannot influence these lagged explanatory variables. This temporal structure helps in establishing a more precise direction of causality, as past values are not affected by current or future states of the dependent variable. Additionally, lagging the explanatory variables is used as a strategy to lower the probability of endogeneity



arising from omitted variable bias. Such bias emerges when unobserved factors affect the dependent and independent variables concurrently, creating a correlation with the error term. By employing lagged variables, we aim to disrupt this contemporaneous correlation, thereby enhancing the robustness of our causal inferences. Exceptions to this lagging approach are the distance measures and the crisis dummy. The distance measures are static and exogenous by nature and, thus, do not require lagging. The crisis dummy is introduced at contemporary levels to verify the often-made argument that central bank swaps fulfil an international LOLR function during financial crises (see Bahaj & Reis 2022), and because it is unlikely that initiating a swap agreement causes a crisis.

To verify the robustness of our results, we employ Firth logit regressions. The Firth correction is designed to reduce the bias in the maximum likelihood estimates in cases of rare events (Firth 1993). However, this correction is aimed at cross-sectional data rather than handling the complexities associated with panel data, such as within-entity correlation, unobserved heterogeneity and time dynamics. Therefore, Firth regressions are not inherently more suitable for rare event panel data than logistic panel regressions and are used as robustness check instead of as preferred modelling approach. Especially, considering that the use of robust standard errors helps accounting for the within-cluster correlation present in panel data.

Additionally, we validate the temporal stability of the results. If the results hold across distinct time periods, this would indicate that the findings are not merely artefacts of specific time frames and events, such as the 2007-9 global financial crisis or the COVID-19 pandemic. Furthermore, this robustness tests helps us verify whether the motives for signing a first swap agreement or renewing it has changed over time, as differences in some results from previous studies suggest (see Section 2).

RESULTS

Main Results

Table 4 presents the main results. Regressions (i), (iii), (v), (vii) and (ix) include only explanatory variables that have widespread data availability to ensure that our findings are not influenced by a limited sample size. This approach enables us to analyse 19,290 country pairs. Conversely, Regressions (ii), (iv), (vi), (viii) and (x) incorporate all explanatory variables, which reduces the sample size to 10,830 country pairs, also resulting in a less balanced sample with an average of 9.6 yearly observations per country pair. Please note that in the reduced sample, mainly developing countries are excluded because they have a lower bilateral trade data availability and/or they have not been rated by rating agencies.

Regarding external vulnerability as swap determinant, regression (i) shows that the financial crisis dummy variable is not significant at the 10 percent level, suggesting that being in a financial crisis does not increase a country's relative likelihood (i.e., odds) of receiving a swap compared to countries not in crisis. This implies that, in general, swaps do not represent a LOLR instrument for countries in financial distress. This finding diverges from prior empirical evidence found on Fed and PBOC swap provision, which indicates that central bank currency swaps are effectively providing international rescue lending (Aizenman et al. 2021; Bahaj & Reis 2022a, 2022b; Horn et al. 2023). A likely reason for this divergent finding could be our novel approach to consider all swap-providing and swap-receiving as well as non-providing and non-receiving countries, rather than focusing solely on the swap networks of either the Fed or BPOC as prior studies have (see Section 2).



Table 4: Unequal Access to Swaps during Times of Financial Crisis

			All S	waps				First S	Swaps	
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Financial Crisis _t	0.3390	0.4183	-0.2350	-0.1031	0.6733**	0.6823**	-0.4585**	-0.2503	0.8935*	0.9959**
	[0.2618]	[0.2705]	[0.2866]	[0.2942]	[0.3192]	[0.3246]	[0.2312]	[0.2487]	[0.4606]	[0.4536]
Crisis_USA _t			3.0604***	3.0062***			2.6978***	2.3949***		
			[0.8110]	[0.7949]			[0.6736]	[0.6454]		
Crisis_CHN _t			1.0098**	0.7373			4.1756***	3.5602***		
			[0.4704]	[0.4607]			[0.3951]	[0.4393]		
Crisis_Middle _t					-0.9752**	-0.8090**			-1.7914***	-1.8383***
					[0.3789]	[0.3906]			[0.5352]	[0.5597]
External Debt _{t-1}	0.0024**	0.0015	0.0024**	0.0016	0.0018	0.0011	0.0008	0.0005	-0.0003	-0.0005
	[0.0011]	[0.0011]	[0.0011]	[0.0011]	[0.0011]	[0.0011]	[0.0011]	[0.0011]	[0.0014]	[0.0013]
IMF Access _{t-1}		-0.0032**		-0.0040***		-0.0034*		-0.0049**		-0.0052**
		[0.0016]		[0.0016]		[0.0018]		[0.0025]		[0.0025]
RFA Access _{t-1}		-0.392		-0.3572		-0.4013		-0.2684		-0.4001
		[0.3117]		[0.3140]		[0.3101]		[0.3005]		[0.3186]
InGDP _{t-1}	0.8026***	0.5503***	0.7564***	0.5373***	0.7668***	0.5384***	0.4251***	0.2886***	0.3721***	0.2496***
	[0.0968]	[0.1118]	[0.0899]	[0.1064]	[0.0929]	[0.1090]	[0.0639]	[0.0810]	[0.0540]	[0.0779]
InGDPpc _{t-1}	1.3164***	0.9484***	1.2579***	0.9379***	1.2689***	0.9498***	0.7157***	0.4788***	0.7070***	0.5639***
	[0.2423]	[0.2789]	[0.2253]	[0.2746]	[0.2333]	[0.2737]	[0.1482]	[0.1654]	[0.1585]	[0.1797]
Reserves _{t-1}	-0.0165*	-0.0158*	-0.0188*	-0.0177*	-0.0170*	-0.0159*	-0.0009	0.0008	0.0012	0.0049
	[0.0093]	[0.0094]	[0.0103]	[0.0105]	[0.0091]	[0.0093]	[0.0044]	[0.0046]	[0.0047]	[0.0049]
Kopen _{t-1}	-0.8162*	-1.2466***	-0.9931**	-1.3224***	-1.0940**	-1.4129***	-0.8640***	-0.8507**	-1.1327***	-1.0499***
	[0.4530]	[0.4657]	[0.4607]	[0.4753]	[0.4671]	[0.4804]	[0.3306]	[0.3704]	[0.3551]	[0.3842]
Rating _{t-1}		-0.1369**		-0.1195**		-0.1191**		-0.0657*		-0.0312
		[0.0578]		[0.0570]		[0.0572]		[0.0391]		[0.0428]
InDistance _t	-0.4802**	-0.4276**	-0.4354**	-0.4104**	-0.4684**	-0.4303**	-0.2815**	-0.2709**	-0.2246*	-0.2230*
	[0.2194]	[0.2133]	[0.2074]	[0.2087]	[0.2107]	[0.2087]	[0.1167]	[0.1229]	[0.1207]	[0.1269]
Contiguous _t	2.4944***	1.9588***	2.2825***	1.8352***	2.3890***	1.8944***	0.6906**	0.5530*	0.8205**	0.6296*
	[0.7002]	[0.6799]	[0.6496]	[0.6518]	[0.6787]	[0.6652]	[0.3127]	[0.3160]	[0.3772]	[0.3442]
Colonial ties _t	0.1775	0.0495	0.1473	0.0421	0.1421	0.0338	0.4291	0.3807	0.2527	0.2280
	[0.9233]	[0.8506]	[0.8925]	[0.8404]	[0.8869]	[0.8297]	[0.3622]	[0.3657]	[0.4031]	[0.3823]
Legal origins _t	-0.2347	-0.1829	-0.2416	-0.1819	-0.2371	-0.1885	-0.1534	-0.0748	-0.2033	-0.0956
	[0.3695]	[0.3586]	[0.3439]	[0.3457]	[0.3563]	[0.3516]	[0.2043]	[0.2093]	[0.2227]	[0.2259]
FTA _{t-1}	1.5020***	1.2449***	1.6020***	1.3527***	1.4742***	1.2308***	1.4534***	1.2097***	1.3218***	1.0822***
	[0.3330]	[0.3257]	[0.3195]	[0.3206]	[0.3263]	[0.3207]	[0.2373]	[0.2602]	[0.2475]	[0.2747]

Table 4: Continued

			All S	First Swaps						
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Trade _{t-1}		-0.0425		-0.0506		-0.0424		-0.0166		-0.0106
		[0.0559]		[0.0539]		[0.0538]		[0.0260]		[0.0256]
UN Voting _{t-1}	0.4342**	0.4242**	0.3293*	0.3069	0.4301**	0.4238**	0.2097	0.2113	0.3493***	0.3405**
	[0.2112]	[0.2057]	[0.1918]	[0.1956]	[0.2039]	[0.2021]	[0.1345]	[0.1456]	[0.1235]	[0.1342]
No. of observations	278,953	103,898	278,953	103,898	278,953	103,898	278,953	103,898	278,953	103,898
No. of country-pairs	19,292	10,830	19,292	10,830	19,292	10,830	19,292	10,830	19,292	10,830
Avg. obs. per pair	14.5/16	9.6/16	14.5/16	9.6/16	14.5/16	9.6/16	14.5/16	9.6/16	14.5/16	9.6/16

Source: Models estimated by the authors.

Note: This table summarizes the main logistic panel regression results for the period 2007-2022. All regressions include unreported time fixed effects. The dependent variable is a dummy that equals 1 when a country-pair (re-)signs a swap agreement (All Swaps) or their first swap agreement (First Swaps). The explanatory variables are a destination's financial crisis dummy, the destination's external debt stock (% of GNI), the destination's access to IMF loans (% of GDP) and RFA credit lines (dummy), logs of the destination's GDP and GDP per capita, the destination's foreign reserve holdings (% of GDP), the destination's capital openness, the destination's credit rating, a trade agreement dummy variable, bilateral trade volumes (% of GDP of the origin country), the pair's point distance in UN General Assembly resolution voting, the log distance of capital cities, a common border dummy, a colonial tie dummy, and a common legal origins dummy. Crisis_USA and Crisis_PBOC are interactions between the crisis dummy and respective dummies that equal one when swaps are provided by either the Fed or the PBOC, while Crisis_Middle is an interaction with a dummy that equals one for middle-income destination countries. Columns 2-11 report coefficients and heteroskedasticity robust standard errors. The significance of a coefficient at the 1 percent, 5 percent and 10 percent level is indicated by ***, ** and *, respectively.

On the other hand, the positive and significant sign of external debt suggests that bank exposure might play an important role in the signing of swap agreements. However, due to the unavailability of bilateral bank exposure data for most countries in our sample, we cannot further test this hypothesis. Regression (i) furthermore reveals the significance of the recipient countries' characteristics in determining bilateral swap agreements. Consistent with existing literature (Liao & McDowell 2015; Lin et al. 2016), we find that economic size and per capita income positively affect the odds of receiving a swap. In contrast, the levels of reserve holdings and capital openness exhibit a negative sign and are less significant. The finding that capital account openness diminishes the odds of receiving a swap might be explained by a higher vulnerability and economic instability of more open countries, especially during global shocks (Fernandez-Arias & Montiel 1996; Gosh et al. 2016). Conversely, larger foreign reserve holdings might reduce the necessity for emergency swap lines by acting as a self-insurance against liquidity shocks (Aizenman & Pasricha 2010).

Regarding economic and political ties, consistent with previous literature (Liao & McDowell 2015; Broz & Zhang 2018), we observe that having a free trade agreement significantly improves the odds of engaging in a swap agreement. In contrast, our proxy for political ties yields an unexpected result: the positive coefficient for the UN Voting variable indicates that countries with greater disagreement in General Assembly resolution voting are more inclined to sign swap agreements. This counterintuitive finding may stem from the fact that General Assembly votes primarily concern peace and security resolutions (see Bailey et al. 2017 for details). Hence, general UN Voting may not effectively capture political closeness related to economic interdependence between countries (see Sahasrabuddhe 2019). With regard to the other bilateral relation proxies, geographical closeness and having a common border appear to significantly increase the odds of signing a swap agreement, while colonial relationships and common legal origins do not seem to matter.

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Regression (ii) incorporates the following additional variables: the two measures for access to other GFSN liquidity provisions -the destination's access limit to IMF loans and RFA credit lines-the destination's sovereign credit rating and bilateral trade volumes (as a percentage of the originating country's GDP). Although the inclusion of these variables reduces the sample size, it does not affect the significance of the other variables. A notable exception is the external debt variable, which becomes insignificant. The lack of significance for the added bilateral trade variable is surprising, given theoretical expectations and prior empirical evidence, especially since the significant impact of the free trade agreement dummy highlights the critical role of trade relations in swap agreements.

Conversely, the credit rating is significant at the 5 percent-level, with its direction conforming to theoretical expectations; that is, a lower rating score reduces the odds of receiving a swap due to heightened country risk. Similarly, access to greater IMF loans is associated with decreased odds of entering into swap agreements. This could indicate that swaps may serve as an alternate liquidity source when IMF loan access is limited. In contrast, RFA lending and swap agreements do not show a statistically significant relationship. This shows that more research is needed on the relationship between different GFSN elements, such as their interactions as complements or substitutes (see Mühlich et al. 2022).

We are mainly interested in the variables' significance rather than in size effects, partly because the low swap event rate implies that our estimates are likely to be imprecise. However, it is still worthwhile to point out the odds ratios of a swap occurrence⁹, considering the variables with robust statistical significance. For IMF access, a 1 percent higher unconditional cumulative access limit lowers the odds of receiving a swap by 0.3 percent, ceteris paribus. Regarding country characteristics, a 1 percent increase in economic size correlates with a 0.6 percent to 0.8 percent increase in the odds of receiving a swap. The impact of a 1 percent difference in GDP per capita has slightly stronger effects, improving the odds by 1.0 percent to 1.3 percent. Concerning geographical distance, a 1 percent distance increase between capital cities is linked with a 0.4 percent to 0.5 percent odds reduction, while sharing a common border increases the odds of signing a swap agreement 7.1 to 12.1-fold. Concerning country risk, a 1 percent increase in foreign reserve holdings is associated with a decrease of approximately 1.6 percent in the odds of receiving a swap. Furthermore, countries that have a fully open capital account have 56 percent to 71 percent lower odds of receiving a swap compared to those that are completely closed. Regarding countries' credit ratings, a one-notch downgrade (e.g., from BBB+ to BBB) results in a 13 percent decrease in the odds of receiving a swap. On the contrary, closer economic ties seem to foster swap agreements, given that the existence of a trade agreement improves the odds of receiving a swap 3.5 to 4.5-fold.

To investigate further the finding that the crisis dummy variable is not significant in regressions (i)-(ii), we introduce crisis interaction terms to differentiate the provision of currency swaps by specific countries. Furthermore, we run regressions considering either all swap agreements (renewed and first) or only first agreements. The rationale for the latter is that the motives for renewing a swap agreement in a crisis might be distinct from those to offer a first agreement (see Section 2). Concerning the crisis interaction terms, we are interested in whether there is a discernible difference between the largest swap providers, namely the Fed and the PBOC, compared to other central banks. To explore this, we multiply the crisis dummy with one dummy variable for swaps provided by the Fed and another for those provided by the PBOC.

Additionally, we examine whether the provision of swaps as a crisis rescue mechanism is selectively targeting specific country groups. Specifically, we aim to determine whether the exclusion from

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⁹ Odds ratios compare the relative odds of a swap agreement's occurrence versus its non-occurrence and are calculated by exponentiating the regression coefficients ($e\beta$). For continuous variables that are log-transformed, a 1 percent increase in the variable's original scale is approximately equivalent to a 0.01 change in the log-transformed variable. Thus, the corresponding odds ratio of GDP, GDP pc, and distance are calculated as $e\beta \times 0.01$.

swap liquidity provisions during a crisis is limited to low-income countries or extends to middle-income countries. Recall that nearly all developing countries that have received swaps are middle-income countries (see Table 2 in Section 3). To assess whether middle-income countries are also less likely to receive swaps during financial crises than advanced countries, we utilize an interaction term between the crisis dummy and a dummy variable that equals 1 if the destination is classified as either an upper- or lower-middle-income country.¹⁰

The interaction term results indicate a complex relationship between financial crises and the relative likelihood of swap agreements, influenced by the providing central banks and the economic status of the recipient countries. As concluded by prior studies, regressions (iii)–(iv) and (vii)–(viii) confirm that the Fed and PBOC provide international rescue lending during financial distress, whereas the nonsignificant crisis dummy indicates that other swap-providing central banks do not offer the same support to crisis countries. The latter explains why the crisis dummy in the baseline regressions is not significant. This finding highlights the unique role of both of the world's two largest economies in responding to international crises and challenges the prevalent notion that other central banks are similarly involved in swap provision during crises.

When considering all swap agreements, the Fed's provision of swaps during a crisis is notably more likely than that of the PBOC, as reflected by the larger coefficients and higher significance. Specifically, in regression (iii), the odds of receiving a swap during a crisis from the Fed are over 20 times higher compared to other central banks (excluding the PBOC), whereas the odds from the PBOC are only 2.7 times higher, ceteris paribus. Moreover, in regression (iv) the PBOC interaction term is not significant at the 10 percent level. A likely explanation for this result is that the reduced sample includes fewer developing countries, which are more dependent on PBOC swaps than on Fed swaps—recall that Mexico and Brazil were the only developing countries that received swaps from the Fed, whereas the PBOC provided more than half of their swap agreements to middle-income countries.

Concerning first agreements, the importance of the PBOC and the Fed appears to be inverse. In the full sample regression (vii), the PBOC is 65 times more likely to provide a first swap to a country in crisis compared to other central banks (excluding the Fed), whereas the Fed's odds are 15 times higher. Moreover, the PBOC interaction term has a higher significance in the first agreement regressions than in those that include renewals. This could be attributed to the PBOC having fewer opportunities to renew swaps during a crisis than the Fed, as it started providing swaps later (see Figure 2). Alternatively, it may indicate that while the PBOC is proactive in establishing new swap lines in response to a crisis, it may be less willing to renew them if the crisis persists.

The large and negative coefficients of the middle-income group interaction term, on the other hand, indicate that middle-income countries have lower odds of receiving swaps when they are in a financial crisis than when they are not. The opposite is true for advanced countries. This finding is robust across all regressions (i.e., regressions (v)-(vi) and (ix)-(x)). Specifically, advanced countries have nearly 2-fold higher odds of receiving a swap in a crisis compared to a non-crisis situation, which increases to 2.4 to 2.7-fold when only first swaps are considered. On the contrary, the odds of middle-income countries decrease by 12 percent to 26 percent when they are in crisis (compared to a non-crisis situation). This result reveals a stark disparity in the GFSN. While advanced countries have a high likelihood of receiving swaps as liquidity provisions during a crisis, most middle-income countries and all low-income countries are excluded from this emergency liquidity mechanism.



¹⁰ The sole swap agreement involving low-income countries, a bilateral agreement between Sudan and Ethiopia, is not included in our regressions due to missing data for explanatory variables. Please note that the results are robust when using two separate dummy variables: one for upper-middle-income and another for lower-middle-income countries. In other words, both upper- and lower-middle-income countries are equally less likely to receive swaps during a financial crisis.

Given these country (group) differences, we next verify whether the above finding that the external debt level is not a robust covariate of swap agreements holds across all swap providers and receivers. Table 5 indicates that not only being in financial crisis but also external debt levels have unequal effects on swap allocation. Both the Fed and the PBOC swap provisions seem to be positively affected by external debt levels. This result is robust throughout all four regressions and is likely corroborating previous findings that showed that the Fed and PBOC have a higher likelihood to provide swaps to countries with greater financial exposure (Aizenman & Pasricha 2010; 2021; Horn et al. 2023). According to our results, a 1 percent increase in external debt levels raises the odds of receiving a Fed swap by 1.2 percent to 2.0 percent, while for PBOC swaps, the increase is slightly higher, ranging from 1.5 percent to 2.3 percent, ceteris paribus. For first swap agreements, the effect is lower, with an increase of odds by 0.5 percent to 0.6 percent for the Fed and 0.7 percent to 0.8 percent for the PBOC.

In contrast, the relationship between external debt and swap provision by other central banks is inverse: a 1 percent increase in external debt is linked with a 0.3 percent to 0.6 percent decrease in the likelihood of receiving either first or renewed swaps. This result could indicate that other central banks perceive higher debt levels as a greater risk for the repayment of provided swap lines. In any case, these differences further emphasize that the Fed's and PBOC's swap policies do not necessarily extend to all central banks, thereby reinforcing the above finding that the results from previous studies focusing on these two entities are not universally applicable.

		All S	waps		First Swaps						
	(xi)	(xii)	(xiii)	(xiv)	(xv)	(xvi)	(xvii)	(xviii)			
External Debt _{t-1}	-0.0056	-0.0059*	0.0018*	0.0012	-0.0037*	-0.0035*	0.0005	0.0003			
	[0.0037]	[0.0034]	[0.0011]	[0.0010]	[0.0020]	[0.0019]	[0.0010]	[0.0010]			
External Debt_USA _{t-1}	0.0199***	0.0182***			0.0100***	0.0088***					
	[0.0050]	[0.0046]			[0.0020]	[0.0019]					
External Debt_CHN _{t-1}	0.0227***	0.0207***			0.0119***	0.0105***					
	[0.0083]	[0.0075]			[0.0019]	[0.0018]					
External Debt_Middle _{t-1}			-0.0535***	-0.0532***			-0.0418***	-0.0436***			
			[0.0124]	[0.0139]			[0.0121]	[0.0144]			
Model specification as in (i)	x		х		х		x				
Model specification as in (ii)		х		х		х		х			
No. of observations	278,953	103,898	278,953	103,898	278,953	103,898	278,953	103,898			
No. of country-pairs	19,292	10,830	19,292	10,830	19,292	10,830	19,292	10,830			
Avg. obs. per pair	14.5/16	9.6/16	14.5/16	9.6/16	14.5/16	9.6/16	14.5/16	9.6/16			

Table 5: The Unequal Effects of External Debt on Access to Swaps

Source: Models estimated by the authors.

Note: This table summarizes the logistic panel regression results that include external debt interaction terms: External Debt_USA and External Debt_PBOC are interactions between the External debt (as % of GDP) variable and respective dummies that equal one when swaps are provided by either the Fed or the PBOC, while External Debt_Middle is an interaction with a dummy that equals one for middle-income destination countries. Additionally, the regressions incorporate the same explanatory variables as the baseline regressions (see Table 4).

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The results from Table 5 additionally reveal that middle-income countries with higher external debt levels are less likely to receive swaps: a 1 percent increase in debt level reduces their odds of receiving a swap by approximately 4.1 percent to 5.2 percent, ceteris paribus. This effect is highly significant and remains robust across all four regressions that include the middle-income interaction term. In contrast, the external debt level does not appear to play a significant role in swap provision for advanced countries. This finding adds a further layer of complexity, suggesting that high debt levels lead to the exclusion of middle-income countries from swap provisions. Here, our findings diverge from Horn et al. (2023) which find that often, countries receiving swaps from the PBOC have significant levels of debt.

Robustness Checks

Table 6 (below) validates the temporal stability of our baseline results, ensuring they are generalisable and not solely outcomes of the global financial crisis or the COVID-19 pandemic. To accomplish this, we analyse three distinct sub-periods: excluding the years affected by the COVID-19 pandemic (considering the period 2007-19), excluding the years impacted by the global financial crisis (examining the period 2010-22), and excluding the years of both events (restricting the period to 2010-19). Moreover, we distinguish between all and first swap agreements for the reasons discussed in Section 3.

Nevertheless, the results show that our main findings are robust across time, with fairly stable coefficient sizes throughout. To start with, the crisis dummy is not significant across all sub-periods, except for regression (xxii). Conversely, economic size and income per capita are among the most significant determinants of swap agreements. However, in line with the results from the crisis interaction terms (Table 4), regressions (xxiii)–(xxiv) and (xxix)–(xxx) show that income per capita has been a less significant determinant for the provision of swaps when the financial and COVID-19 crisis periods are excluded from the sample. This is especially true for first agreements.

Moreover, Table 6 indicates that IMF loan access reduces the odds of signing a swap agreement, while the presence of a common border and a free trade agreement are significant facilitators for them. Similarly, UN Voting alignment correlates with swap agreement likelihood, though its negative sign keeps being contrary to expectations. Further, the results indicate a negative impact of foreign reserve holdings and a positive impact of external debt on the renewal of swap agreements, which was specifically pronounced before the pandemic. However, neither variable appears to be a significant determinant for first agreements. Meanwhile, a lower rating only decreased the odds of receiving a first swap during the financial crisis but adversely affected renewal odds in all periods. Lastly, capital openness significantly influenced swap renewal throughout the study period, with its impact on first swaps only apparent during the global financial crisis.

However, the results from the subperiods should be treated with some caution, given that swap agreements were even rarer events in each subperiod than in the whole period under study. To more broadly assess whether the maximum likelihood estimations might be influenced by a rare event bias, Table 7 (below) provides the results from cross-sectional logistic regression with Firth's (1993) correction for rare events. The results show that the robustness of the logit panel regressions is maintained with this correction method, indicating that our principal conclusions are unlikely to be biased by the low frequency of swap agreements.¹¹

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¹¹ Please note that the main results are also robust when only first swap agreements are considered (instead of first and renewed agreements). The results are available upon request.

Table 6: Robustness Check: Different Time Periods

			All S	waps		First Swaps						
	200	7-19	201	0-22	201	0-19	200)7-19	2010)-22	201	0-19
	(xix)	(xx)	(xxi)	(xxii)	(xxiii)	(xxiv)	(xxv)	(xxvi)	(xxvii)	(xxviii)	(xxix)	(xxx)
Financial Crisis _t	0.1735	0.2387	0.3813	0.5503*	0.1380	0.2324	-0.0315	0.1340	-0.1180	0.0879	-0.0159	0.1517
External Debt _{t-1}	0.0035**	0.0027*	0.0030**	0.0018	0.0050***	0.0041**	0.0012	0.0008	0.0019	0.0013	0.0024	0.0018
IMF Access _{t-1}		-0.0051**		-0.0020		-0.0036*		-0.0047*		-0.0047*		-0.0045*
RFA Access _{t-1}		-0.5191		-0.1653		-0.3169		-0.3115		-0.2366		-0.2835
InGDP _{t-1}	0.8540***	0.5547***	0.9074***	0.6292***	1.0433***	0.7468***	0.4617***	0.2884***	0.5007***	0.3719***	0.5746***	0.4208***
InGDPpc _{t-1}	1.1878***	0.7333***	1.1012***	0.7618***	0.8479***	0.5276*	0.6881***	0.4029**	0.4244***	0.2951*	0.3275*	0.1838
Reserves _{t-1}	-0.0201**	-0.0200**	-0.0152	-0.0148	-0.0182*	-0.0181*	0.0015	0.0019	0.0016	0.0040	0.0047	0.0063
Kopen _{t-1}	-1.0222*	-1.2643**	-0.7430	-1.308***	-1.1722*	-1.4428**	-0.7078**	-0.7076*	-0.6378*	-0.5611	-0.4734	-0.3720
Rating _{t-1}		-0.1302**		-0.1510**		-0.1141*		-0.0767*		-0.0463		-0.0408
InDistance _t	-0.3138	-0.2248	-0.2304	-0.1955	-0.0639	0.0220	-0.1650	-0.1411	-0.0904	-0.1029	0.0295	0.0595
Contiguous _t	2.3309***	1.9095***	3.1406***	2.4153***	2.8662***	2.3049**	0.8474**	0.7134*	1.1194**	0.6979	1.1856**	0.7960
Colonial ties _t	0.2820	0.2722	0.1957	-0.0615	0.6147	0.5278	0.3071	0.3511	0.1875	0.1506	0.2396	0.3161
Legal origins _t	-0.4381	-0.3162	-0.3220	-0.2655	-0.5890	-0.4398	-0.3212	-0.2090	-0.2667	-0.1989	-0.5024*	-0.3885
FTA _{t-1}	1.9809***	1.6974***	1.3582***	1.1120***	1.9170***	1.6788***	1.3151***	1.1010***	1.3266***	1.0910***	1.2802***	1.1365***
Trade _{t-1}		-0.0554		-0.0120		-0.0222		-0.0115		-0.0047		0.0004
UN Voting _{t-1}	0.6132***	0.5310**	0.4943**	0.4830**	0.5434**	0.4557**	0.3834***	0.3313**	0.2449*	0.2345	0.3357**	0.2824*
No. observations	229,103	84,137	226,793	87,555	176,943	67,794	229,103	84,137	226,793	87,555	176,943	67,794
No. country-pairs	19,082	10,538	18,893	10,374	18,683	10,070	19,082	10,538	18,893	10,374	18,683	10,070
Avg. obs. per pair	12.0/13	8.0/13	12.0/13	8.4/13	9.5/10	6.7/10	12.0/13	8.0/13	12.0/13	8.4/13	9.5/10	6.7/10

Source: Models estimated by the authors.

Note: This table summarizes the robustness check results using logistic panel regressions across different time periods. Columns 2-13 report the coefficients and their 1 percent, 5 percent and 10 percent significance levels, indicated by ***, ** and *, respectively. See Table 4 notes for more details.



Table 7: Robustness Check: Firth Regressions

		All Swaps													
	(xxxi)	(xxxii)	(xxxiii)	(xxxiv)	(xxxv)	(xxxvi)	(xxxvii)	(xxxviii)							
Financial Crisis _t	-0.5299***	-0.3098**	1.0394***	1.1798***	0.3990***	0.5876***	0.4338***	0.5284***							
Crisis_USA _t	4.0797***	3.8351***					2.5724***	2.3763***							
Crisis_CHN _t	4.5972***	4.1707***					3.9491***	3.5051***							
Crisis_Middle _t			-1.7596***	-1.7514***											
External Debt _t	0.0006	0.0001	-0.0004	-0.0007	-0.0085***	-0.0087***	0.0002	0.0001							
External Debt_USA _t					0.0166***	0.0153***									
External Debt_CHN _t					0.0174***	0.0161***									
External Debt_Middle _t							-0.0509***	-0.0569***							
IMF Access _t		-0.0027***		-0.0025***		-0.0021***		-0.0016**							
RFA Access _t		0.0818		-0.0133		0.1826		0.1222							
InGDP _t	0.5099***	0.3720***	0.4480***	0.3357***	0.5479***	0.3979***	0.3876***	0.3217***							
InGDPpc _t	0.8204***	0.6171***	0.8013***	0.6821***	0.8273***	0.6217***	0.5581***	0.4836***							
Reserves _t	0.0002	0.0006	0.0016	0.0032	-0.0074**	-0.0056*	-0.0003	0.0034							
Kopen _t	-0.9679***	-1.0071***	-1.3014***	-1.2562***	-0.0507	-0.2931	-1.4170***	-1.4204***							
Rating _t		-0.0661**		-0.0273		-0.0818***		0.0197							
InDistance _t	-0.1192	-0.1082	-0.0502	-0.0470	-0.2148***	-0.2112**	-0.0389	-0.0864							
Contiguous _t	0.8960***	0.8532***	1.1377***	1.0678***	0.8544***	0.7892***	1.2178***	1.0789***							
Colonial ties _t	0.1279	0.1581	-0.0718	-0.0401	0.5824**	0.6512***	-0.0437	0.0269							
Legal origins _t	-0.2963**	-0.2290*	-0.3872***	-0.2952**	-0.4062***	-0.3263**	-0.3063**	-0.2049							
FTA _t	1.4681***	1.2257***	1.2708***	1.0433***	1.5379***	1.2572***	1.1828***	0.9531***							
Trade _t		0.0121		0.0147		-0.0045		0.0111							
UN Voting _t	0.3187***	0.2996***	0.6108***	0.5793***	0.3514***	0.3398***	0.5603***	0.5606***							
No. observations	263,552	100,063	263,552	100,063	263,552	100,063	263,552	100,063							

Source: Models estimated by the authors.

Note: This table summarizes the robustness check results using cross-sectional logistic regression with Firth's (1993) correction instead of panel regressions. Columns 2-9 report the coefficients and their 1 percent, 5 percent and 10 percent significance levels, indicated by ***, ** and *, respectively. See Table 4 notes for more details.

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To be more precise, regressions (xxxi)-(xxxii) confirm the finding that the Fed and the PBOC are more likely to provide swaps to countries in financial crisis, while other swap-providing central banks do not seem to provide emergency lending. Regressions (xxxii)-(xxxiv), on the other hand, confirm that the odds of middle-income countries receiving a swap are substantially lower when they experience a financial crisis. Similarly, regressions (xxxvii)-(xxxviii) confirm that the odds decrease with higher external debt levels for middle-income countries. Furthermore, countries with higher per capita income have significantly increased odds of receiving a swap, indicating that access to swap liquidity is uneven between advanced and developing countries. Other key determinants of swap agreements include the receiving country's access to IMF lending, economic size, capital account openness and credit rating, as well as the presence of a common border and free trade agreements.

CONCLUSION

The paper empirically investigated the determinants of access to a currency swap as a crisis finance instrument based on a novel dataset of 410 swap agreements, covering 194 countries between 2007-2022. The descriptive analysis of this dataset revealed that nearly two-thirds of total swap agreements were made by advanced economies and that relatively few developing countries provided and received swaps. China accounted for almost 80 percent of swap provisions from developing countries and 40 percent towards them. Meanwhile, the Fed extended swaps to just two developing countries (Mexico and Brazil).

In contrast to existing literature, the width of our dataset allowed us to take a look at crisis indicators, country-specific variables and the characteristics of bilateral relations and to compare swap access for distinct country income groups. Furthermore, it enabled us to move beyond the singular focus of previous studies on either the Fed or the PBOC, thereby allowing us a comparative perspective that differentiates between these two main swap providers and other central banks. Hence, this paper provides new insights into the role of liquidity lines in preventing or backstopping financial crises on a more granular level than existing currency swap literature.

This paper's first finding is that, in line with previous studies on Fed and PBOC swaps, a country is more likely to receive a currency swap the higher its level of economic development, economic size and credit rating are, and when it has a trade agreement and is geographically close to the country of the swap-providing central bank.

The second finding is that both the Fed and the PBOC have a much higher likelihood to provide currency swaps to countries in financial crisis and with high external debt levels than other central banks. This finding indicates that these two major swap providers differ less in their behavior as LOLR than stated by previous authors. Specifically, it contrasts with Horn et al. (2023), who conclude that China almost only bails out developing countries with high levels of outstanding debt to Chinese banks. It also extends beyond the work of Bahaj and Reis (2022), who study exclusively the LOLR function of Fed swaps.

Our third finding, however, reveals that this LOLR function does not extend to all countries. Especially developing countries, which are most in need of currency swaps as additional unconditional crisis finance instruments in the case of systemic shocks, are systematically excluded from this swap "safety net" due to their low level of economic development, small size, riskiness, geographical distance and low involvement in trade agreements. Additionally, advanced countries are more likely to receive a swap during a crisis, while middle-income countries are substantially less likely to receive swaps during a financial crisis than when they are not in crisis. Accordingly, central bank swaps do not seem to fulfill an effective LOLR function for most developing countries because, apparently,



not the need for liquidity is the mayor influence for the likelihood of receiving a swap, but rather the country's income level.

The fourth main finding from the results is that a country's access to unconditional IMF lending lowers the probability of receiving a central bank swap, which points to the interaction between different layers of the GFSN. However, for countries that are members of a regional financial arrangement, we do not find statistically significant evidence that this membership influences currency swap agreements. These contrasting results show that more research is needed on the interaction between the GFSN elements.

The complete exclusion of low-income countries from currency swaps and the low likelihood for middle-income countries to access swap crisis finance shows that the GFSN, of which central bank swaps are a key element, is biased against poorer countries. While the empirical results do not allow drawing conclusions on the causal relationship between the different elements of the GFSN, it is timely to understand better how access to multiple crisis finance sources affects the crisis response capacity of the GFSN to systemic crises such as the COVID-19 pandemic. The systemic risk of concentrating a selective quasi-LOLR function of the GFSN in two central banks, the Fed and the PBOC, is very high.

Some scholarly contributions on the motives for swap provision test and identify bilateral financial links between providing and receiving countries as a major determinant of currency swaps. A limitation of our study is that we cannot consider this variable due to the lack of data for our broad sample of countries. However, our finding that the Fed and PBOC have a higher likelihood to provide swaps to countries with greater external financial exposure and the strong significance of bilateral free trade agreements for swaps indicate that financial and trade links are important criteria for the selection of swap receivers. Thus, swap provision does not seek to establish a fit-for-purpose GFSN but is driven by national economic interests. To see if political considerations also play a role, future research will need to identify better indicators for political relationships than general UN voting alignment, which has provided no relevant results in our regressions.

Addressing inequalities in access to currency swaps and, more generally, in access to GFSN crisis finance, is crucial for developing countries to sustaining economic growth, and to widening fiscal space for preventing relapses in achieving the SDGs. Hence, we derive the following two policy recommendations from our findings. First, we suggest intensifying coordination between the lending of different elements of the GFSN. This should include closer coordination between RFAs and the IMF, as envisioned by the RFAs (ESM 2018). More important, major swap-providing central banks should be involved in the exchange of information and coordination of lending activities. Recently, the IMF (2023b) initiated a review of its policy coordination, underscoring the necessity for strong coordination to enable countries to access the different layers of the GFSN. However, it remains unclear to what extent swap provisions are considered. More broadly, a transparent and predictable institutionalization of swap agreements has yet to be achieved.

Second, we recommend expanding IMF's unconditional lending, especially for developing economies that are hit by external shocks and excluded from swaps and sufficient RFA finance. Such change would level out differences in the 'safety net' coverage of currency swap provision, creating a more level playing field that enhance crisis resilience for all countries (Mühlich & Zucker-Marques 2023). This could prevent the marginalization of both multilateral crisis finance through the IMF and RFAs and of certain country groups with in the GFSN. Strengthening the timeliness and volume of unconditional crisis finance for solvent developing countries would enhance transparency, predictability and sustainability in crisis prevention and backstop.

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APPENDIX

Table A1: Correlation Matrix of Variables

	SWAP	Crisis	Ext.Debt	IMF	RFA	InGDP	InGDPpc	Reserves	Kopen	Rating	InDistance	Contiguous	Colonial	Legal	FTA	Trade	UNVote
SWAP	1	0.004	0.053	-0.022	0.013	0.071	0.077	0.003	0.030	-0.089	-0.017	0.040	0.029	0.001	0.052	0.041	0.019
Crisis	0.004	1	0.137	0.164	-0.096	-0.070	-0.153	0.016	-0.130	0.282	-0.046	0.004	0.002	0.020	0.012	-0.035	0.002
Ext.Debt	0.053	0.137	1	0.079	0.061	-0.075	0.364	0.287	0.250	-0.242	-0.065	0.002	0.124	-0.014	0.158	0.003	0.072
IMF	-0.022	0.164	0.079	1	-0.104	-0.198	-0.058	0.078	0.008	0.116	-0.001	-0.002	-0.022	0.031	0.057	-0.065	-0.022
RFA	0.013	-0.096	0.061	-0.104	1	0.118	0.094	0.170	0.158	-0.201	0.029	0.001	0.008	-0.032	0.059	0.007	0.011
InGDP	0.071	-0.070	-0.075	-0.198	0.118	1	0.348	-0.087	0.012	-0.567	0.091	0.053	0.060	-0.027	0.033	0.200	-0.018
InGDPpc	0.077	-0.153	0.364	-0.058	0.094	0.348	1	0.170	0.379	-0.696	0.020	0.006	0.097	-0.042	0.198	0.091	0.067
Reserves	0.003	0.016	0.287	0.078	0.170	-0.087	0.170	1	0.168	-0.186	-0.020	-0.015	-0.036	-0.028	0.078	0.016	0.033
Kopen	0.030	-0.130	0.250	0.008	0.158	0.012	0.379	0.168	1	-0.366	0.002	0.000	0.064	-0.029	0.123	-0.012	0.092
Rating	-0.089	0.282	-0.242	0.116	-0.201	-0.567	-0.696	-0.186	-0.366	1	-0.044	-0.030	-0.095	0.053	-0.184	-0.158	-0.039
InDistance	-0.017	-0.046	-0.065	-0.001	0.029	0.091	0.020	-0.020	0.002	-0.044	1	-0.407	-0.033	-0.161	-0.475	-0.172	0.119
Contiguous	0.040	0.004	0.002	-0.002	0.001	0.053	0.006	-0.015	0.000	-0.030	-0.407	1	0.074	0.152	0.277	0.243	-0.093
Colonial	0.029	0.002	0.124	-0.022	0.008	0.060	0.097	-0.036	0.064	-0.095	-0.033	0.074	1	0.138	0.085	0.065	0.094
Legal	0.001	0.020	-0.014	0.031	-0.032	-0.027	-0.042	-0.028	-0.029	0.053	-0.161	0.152	0.138	1	0.095	0.044	-0.140
FTA	0.052	0.012	0.158	0.057	0.059	0.033	0.198	0.078	0.123	-0.184	-0.475	0.277	0.085	0.095	1	0.169	-0.055
Trade	0.041	-0.035	0.003	-0.065	0.007	0.200	0.091	0.016	-0.012	-0.158	-0.172	0.243	0.065	0.044	0.169	1	-0.047
UNVote	0.019	0.002	0.072	-0.022	0.011	-0.018	0.067	0.033	0.092	-0.039	0.119	-0.093	0.094	-0.140	-0.055	-0.047	1

Source: Compiled by the authors.

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