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China's Bilateral Currency Swap Lines*

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Abstract

We study the determinants of China's bilateral local currency swap lines that were established since the recent global finance crisis. It is found that economic factors, political considerations, and institutional characteristics including trade intensity, economic size, strategic partnership, free trade agreement, corruption, and stability affect the decision of signing a swap line agreement. Once a swap line agreement decision is made, the size of the swap line is then mainly affected by trade intensity, economic size, and the presence of a free trade agreement. The results are quite robust with respect to the choices of the Heckman two-stage framework or the proportional hazard model. The gravity effect captured by distances between China and its counterparts, if present, is mainly observed during the early part of the sample period under consideration.

JEL Classification: F30, F33, F36

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1. Introduction

During the 2007-8 global financial crisis, the international monetary system experienced an acute US dollar shortage that severely curtailed global trade and pressured international banking business (McCauley and McGuire, 2009; McGuire and von Peter, 2009). The US authorities, in response to the elevated strain in the global market, have arranged dollar swap lines with major central banks to mitigate the global dollar squeeze (Aizenman and Pasricha, 2010; Aizenman, Jinjarak and Park, 2011). On Thursday, October 31, 2013, the network of central banks comprises the Bank of Canada, the Bank of England, the Bank of Japan, the European Central Bank, the Federal Reserve, and the Swiss National Bank agreed to convert their bilateral liquidity swap arrangements to standing arrangements until further notice.¹

The dollar squeeze critically illustrated the danger of operating a US-centric global financial system. Against this backdrop, China has actively implemented measures of promoting the cross-border use of the Chinese currency, the renminbi (RMB), to reduce its reliance on the US dollar. The aggressive policy move was considered a clear signal of China's efforts to internationalize RMB (Chen and Cheung, 2011; Cheung, Ma and McCauley, 2011). In 2009, China launched the scheme of cross-border trade settlement in RMB to encourage the denomination and settlement of international trade in its own currencies. One practical issue of settling trade in RMB is the limited availability of the currency outside China. China at that time had strict regulations on circulating the RMB across its border.

To facilitate its RMB trade settlement initiative, China signed its first bilateral RMB local currency swap agreement with the Bank of Korea in December 2008, and the second one with Hong Kong in January 2009. Since then, China has signed various swap agreements with economies around the world.²

The RMB swap line allows, say, the Bank of Korea sells its local currency to China for the RMB and, at the same time, agrees to reverse the transaction at a pre-specified exchange rate and date in the future. Then, the RMB can be lent to the banking sector in Korea to facilitate trading financing. Bank of Korea (2012), for example, provides a schematic introduction of the swap operation. In principle, these RMB swap lines offer the liquidity that is necessary for

¹ <http://www.federalreserve.gov/newsevents/press/monetary/20131031a.htm>.

² Strictly speaking, the use of RMB to settle cross-border trade can be traced back to at least 2003 (State Administration of Foreign Exchange; 2003a, b in Chinese). These cross-border trade settlements were of quite small scales. Thus, we focus here only on the post-2008 agreements.

conducting RMB-denominated transactions overseas, and reduce China's dependence on the vehicle currency – the US dollar.

Since its inception, the bilateral RMB local currency swap agreement has become a staple feature of China's efforts of promoting the RMB use overseas. Besides trade settlements, the RMB swap line is perceived to be a backstop liquidity facility for offshore RMB trading that ensures the stability of offshore RMB markets. Compared with the US swap lines established during the global financial crisis, these Chinese swap lines are not there (just) for difficult times. They are a part of the policy that integrates the RMB and China's financial sector with the global financial market. The swap agreement exemplifies China's vision of its role in the international monetary system.

In the following, we investigate the empirical factors that determine the establishment of China's bilateral RMB local currency swap agreements. We anticipate the trade activity, among other economic relationships, is a factor. Indeed, some earlier studies verified the role of trade activity (Garcia-Herrero and Xia, 2015; Liao and McDowell, 2015; Yang and Han, 2013).³

It is quite well known that, given its unique development experiences, China's dealings with the rest of the world are not necessarily driven by pure economic considerations. Thus, non-economic factors including political relationships and societal institutional characteristics can play a role forming China's bilateral RMB local currency swap line agreements.⁴ In addition to the likelihood of signing these agreements, we explore factors contributing to the size of these swap lines.

To anticipate results, it is found that the decision of establishing a Chinese bilateral RMB local currency swap line depends on economic factors, political considerations, and institutional characteristics. For instance, the trade intensity, economic size, strategic partnership, free trade agreement, corruption, and stability are found to be determining factors. Once a swap line agreement decision is made, then the size of the swap line is mainly affected by trade intensity, economic size, and the presence of a free trade agreement. The results are quite robust with respect to the choices of the Heckman two-stage framework or the proportional hazard model. The gravity effect captured by distances between China and its counterparts, if present, is mainly observed during the early part of the sample period under consideration.

³ These studies defined trade activity differently.

⁴ Cheung and Qian (2009), for instance, show that political and institutional characteristics play a role in explaining China's outward direct investment patterns.

2. Preliminaries

After the 1997 Asian financial crisis, China became part of the Association of Southeast Asian Nations plus Three network and signed bilateral currency swap agreements under the Chiang Mai Initiative with other members.⁵ These swap agreements are established to fence off potential speculative attacks that can inflict serious economic pains to the region. Even though they have never been actually drawn upon, these dollar-based swap lines provide needed liquidity and resources during economic tough times. China's participation attests its commitment to maintain the stability of regional financial markets.

In the midst of the recent global financial crisis, Zhou (2009) pronounces his skepticism about the viability of an international monetary architecture that relies on a single super-sovereign reserve currency. The dollar shortage did not only curtail trade with the US; it restricted transactions between other countries as the US dollar is the main vehicle currency for international transactions. The RMB-denominated bilateral local currency swap lines were introduced against this backdrop, and are meant to provide backstop liquidity without resorting to the dollar to lubricate China's trade with the rest of the world.

Since the first bilateral local currency swap line agreement was signed in December 2008, there are only a few reported instances of using the facility. The notable case took place in October 2010 when Hong Kong drew RMB 20 billion to meet the territory's trade financing needs. Korea in 2013 accessed RMB 62 million, while China in 2014 accessed Korean won 400 million via their bilateral local currency swap arrangement to facilitate trade financing of their domestic companies. Argentina, instead of trade settlement, drew from the swap line with China in October 2014 to add to its plummeting holding of international reserves. According to the report (in Chinese) by the People's Bank of China, as of the end of 2014, the usage of these swap lines was amounted to RMB 96.5 billion.⁶

The relative low frequency/volume of uses does not undermine the interest for setting up a bilateral RMB local currency swap line with China. The enthusiasm is underpinned not only by bilateral trade opportunities, but also the prospect of being part of China's grand program to

⁵ In 2010, the Chiang Mai Initiative was converted to a multilateral arrangement of the Chiang Mai Initiative Multilateralization.

⁶ See 中国人民银行 (2015); RMB 15.8 billion were initiated by China, and RMB 80.7 by its counterparties. For the swap lines offered by the US, the highest draw down was US\$ 583 billion in December 2008.

globalize its currency. In tandem with its initiative to promote the use of RMB in the trade arena, China has gradually stepped up its efforts to open up its financial sector and encouraged the use of the RMB overseas in both trade and financial transactions.

For instance, offshore RMB markets, which were first established in Hong Kong, have been propagated to different time zones and different continents with a growing number of RMB-denominated assets. Over time, the local currency swap agreement that defines a specific and managed channel through which the RMB is made available overseas has become part of China's policy of promoting the offshore uses of its currency.

On top of its designated function of a backstop liquidity facility that ensures a smooth operation of offshore RMB markets, the bilateral RMB local currency swap agreement is view as a symbol of endorsement and support of RMB business overseas, and signifies trust between sovereignty authorities. The signing of the swap agreement, thus, is likely driven by both economic and political considerations.

Table 1 lists the economies that have signed with China a bilateral RMB local currency swap agreement, as of the end of 2014, and the related information. The swap line arrangements have a strong concentration in the Asian Pacific and Central Asia in the beginning. Then they spread to other geographic areas.⁷ Further, there is a large proportion of developing and emerging economies on the list. The circumstantial observations are in accordance with the view that China takes a regional approach to establish its global economic network. Typically, these agreements have a three-year tenor, and are renewed upon expiration. Of these 28 economies, only Belarus and Uzbekistan did not renew the swap agreements upon expiry.⁸

3. Empirical Determinants

In this section we investigate the empirical determinants of China's bilateral RMB local currency swap line agreements. While a swap agreement is signed by two parties, we implicitly assume that China plays a main role in finalizing the decision. A practical consideration is that China has maintained a tight grip on capital movements across its border. Capital controls are in placed to regulate funds going in and out of China, and insulate the Chinese economy from

⁷ At the time of writing, China extended its swap network to include Surinam, Armenia, South Africa, Chile, and Tajikistan, with a combined swap facility of RMB 57 billion.

⁸ The agreement with Turkey expired on February 2015 was not renewed. Belarus signed a new one in May 2015.

external shocks.⁹ It is of China's interest to determine which economy to collaborate with in promoting the overseas use of its currency.

We consider a balanced panel of 130 economies from 2003 to 2014. The bilateral trade data between China and these economies are taken from the *Directions of Trade Statistics*, provided by IMF.¹⁰ Using the sample, we study the decision on whether to sign a bilateral local currency swap agreement or not. If an agreement is signed, then what are the factors that determine the size of a swap line.

3.1 To Sign or Not to Sign

The Heckman two-step procedure offers a framework to sequentially analyze decisions about setting up a swap line. The first decision is whether to sign or not to sign an agreement. It is studied using the specification:

$$SWD_{it} = \alpha_0 + \alpha_1 ECI_{it-1} + \alpha_2 DIS_i + \alpha_3 POL_i + \alpha_4 INS_{it-1} + u_{it}, \quad (1)$$

where the qualitative response variable SWD_{it} is 1 when China signed a bilateral swap agreement with economy i at time t , and is 0 otherwise. Four types of explanatory variables that could influence the decision of signing a swap agreement are considered. They are grouped under the labels ECI , DIS , POL and INS . Specifically, ECI includes variables that measure a country's economic size and its economic interactions with China. The economic size of i is given by the country's gross domestic product measured in current US dollars in logs and is commonly used as a proxy for economic performance and market opportunity.

Two types of economic interactions are considered; one assesses the trade link and one the investment link. The trade link is measured by the trade intensity variable that is given by, for a given economy, the ratio of its bilateral trade with China and its total trade; where the trade volume is given by the sum of imports and exports. The variable measures the importance of China's trade to the economy. The trade data are from the *Directions of Trade Statistics* database. The definitions of this and other variables used in the exercise and their sources are presented in the Appendix.

⁹ Some recent studies on China's capital controls are Cheung and Herrela (2014) and Ma and McCauly (2009).

¹⁰ We did not include the group of least developed countries defined by the United Nations 2014 classification scheme (http://www.un.org/en/development/desa/policy/cdp/ldc/ldc_list.pdf; United Nations Conference on Trade and Development, 2014).

China's outward direct investment is used to characterize the investment link. The choice is driven by the observation that China has been promoting its investment overseas since the "Going Global" or "Stepping Out" strategy adopted in 2002.¹¹ The ratio of foreign direct investment into China to its outward direct investment, for instance, declined from 21 in 2002 to 1.1 in 2014. In 12 years, China accelerated its pace of investing in overseas markets to catch up with the strong inflow. In January 2011, China launched the pilot program that permits outward direct investment be conducted in the RMB. Thus, the Going Global policy is a channel for China to deploy its capital and currency overseas, and to integrate with the global financial market.

The investment link variable is given by the ratio of an economy's foreign direct investment from China to its total foreign direct investment received. The bilateral and economy-specific foreign investment stock data are compiled from the *Statistical Bulletin of China's Outward Foreign Direct Investment* which is published by the Ministry of Commerce of the People's Republic of China, and the United Nations Conference on Trade and Development database.

Two distance variables are included in the vector *DIS* to capture the gravity effect that is commonly considered in studies on, say, trade and investment relationships. The first variable is a distance variable defined by the distance measured in kilometers between China's capital city and another economy's capital city. The second variable is an interaction variable defined by the product of a time dummy variable and the distance variable. The time dummy variable is 0 after 2011 and 1 otherwise. The interaction variable is included to assess if the gravity effect has changed three years after China started its bilateral local currency swap program.

The results of estimating the effects of *ECI* and *DIS* variables using the panel data probit regression with random effects are presented in columns 2 and 3 in Table 2. Among the three economic variables included in *ECI*, both the trade intensity and economic size variables are highly significant, while the outward direct investment variable is not.

The trade intensity effect is in accordance with the official assertion that the swap line is

¹¹ The "Going Global" strategy was discussed in, say, the 2002 issue of the *Almanac of China's Foreign Economic Relations and Trade*. Sometimes, the "Going Global" policy is referred to as the "Go Global" policy. Cheung and Qian (2009), for example, is an early empirical study of China's outward direct investment behavior.

for facilitating bilateral trade.¹² Further, in the initial stage of promoting the RMB overseas, the focus is on cross-border trade settlement. The finding is also consistent with China's foreign exchange policy. The economic size effect has a positive impact on China's decision to sign a swap agreement. While the effect is expected, it is not transparent when we look at the list of economies that have a swap agreement with China in Table 1. The insignificance of the outward direct investment (ODI) variable may reflect the fact that overseas direct investment made in RMB is quite minute, and is only a nascent phenomenon.

In the presence of the two distance variables, the trade intensity and size variables retain their statistical significance but the magnitudes of their effects are reduced. The gravity effect, apparently, is only a relevant factor in the early phase of China's program of setting up local currency swap lines – the distance variable though is negative but not significant while the interaction variable is significantly negative. That is, China displayed a bias towards economies that are geographically close to itself in the first few years of setting up its global swap line network, though such a bias is not observed afterward.

The result attests China's sequential approach in developing its international relationship. Looking at Table 1 again, we observed that in the early sample period, the signees of swap lines were mainly economies in the Asia area. Indeed, in term of the broad policy of promoting the cross-border use of the RMB, China takes a regional perspective before pushing it to the global stage. The significant interaction distance variable captures the initial regional focus of the policy on swap line agreements.

The variable vectors *POL* and *INS* are included in equation (1) to control for effects of political and institutional factors. *POL* contains two dichotomy variables – one contains information on whether these countries have a free trade agreement with China, and the other on whether these countries have established a “partner” relation with China. Conceivably, a free trade agreement signifies the political willingness and the mutual intention of promoting trade, which can be benefited from the currency swap arrangement. The list of China's FTA arrangements is given in the Appendix. The free trade dummy variable assumes a value of 1 when the economic entity has a free trade arrangement with China, and 0 otherwise.

The partnership variable requires some explanations. After being officially recognized as

¹² Similar trade intensity effects are reported in, for example, Garcia-Herrero and Xia (2015), Liao and McDowell (2015), and Yang and Han (2013) despite the effects are measured differently.

the only lawful representative of China to the United Nations, the People's Republic of China (the “China” referred to in the current study) has established diplomatic relations with most of countries of the world. Diplomatic relations are symbolic of recognizing China’s legal sovereignty status, and are conducive for developing bilateral relationship. China’s decisions on interacting with other economies, however, do not necessarily rely on pure economic reasoning. While the role of ideological considerations in economic matters is subsiding in recent years, it is still not a nonfactor.

China in the 1990s launched its strategic partnership program for deepening and broadening bilateral relationships with selected economies in designated areas including specific economic and industrial cooperation programs, and signed with Brazil its first strategic partnership in 1993. The partnership with Russia is perceived to be the most elaborated one. Note that a China’s “friendly” country, such as the North Korea is not necessary China’s strategic partner. The strategic partnership designation, thus, has implications for the nexus of China’s political and economic considerations, and is anticipated to have a positive influence on setting up swap line arrangements.

By the end of 2014, China has established strategic partner relations with 69 economic entities, which are listed in the Appendix. It is noted that the coverage of strategic partnership programs varies across partners and over time. For simplicity, we assign a value of 1 to the partnership dummy variable in the presence of a partnership arrangement, and 0 otherwise.¹³

The institutional variables included in *INS* are a “default” variable, a “Role of Law” index, a “Corruption” index, and a “Stability” index. The default variable is a 0-1 dummy variable which equals 1 when the country experienced sovereign debt crisis default between 1970 and 2014.

The other three indexes are components of the World Bank Worldwide Governance Indicators.¹⁴ The Role of Law index assesses the quality and effectiveness of government, and a high index value stands for good governance. A high value of the (control of) corruption index indicates a low level of corruption activity attained by good anti-corruption efforts. The stability index is given by the “Political Stability and Absence of Violence/Terrorism” component of the

¹³ They are four levels of strategic partners; namely, comprehensive strategic partners, strategic partners, comprehensive partners, and cooperative partners. While the cooperation with partner economies is deemed to be multi-levels and multi-directional, the exact coverage of collaboration programs varies even among economies in the same level of partnership. See the Ministry of Foreign Affairs for detail.

¹⁴ <http://info.worldbank.org/governance/wgi/index.aspx#home>.

World Governance Indicator; a large value implies safe social and stable political conditions. These institutional variables offer a general assessment of a country's economic, societal, and political environments.

The estimated *POL* and *INS* effects are presented in the last two columns in Table 2. In the pre-test, we noted that the three indexes under *INS* are quite highly correlated. To mitigate the multicollinearity effect, we added each of them sequentially to the regression separately and reported only the significant results.

As anticipated, an economy that is a strategic partner and a free trade partner is likely to have a local currency swap line with China. The coefficient estimate of the strategic partner dummy variable is smaller than that of the free trade agreement dummy variable. The relative estimated magnitude is in accordance with, at least, the initial proposed functionality of swap lines for facilitating bilateral trade.

In presence of the insignificant ODI and distance variables, the elements of *INS* are hardly significant in the statistical sense. Nonetheless, when the insignificant variables are excluded, it is found that the default and corruption variables are statistically significant. The last column in Table 2, after filtering out the effect of irrelevant variables, presents the parsimonious specification that includes only significant explanatory variables. The result affirms that it is less likely for China to establish a local currency swap line with an economy if it has a default record or has a good corruption reputation, *ceteris paribus*.

The negative corruption effect; that is, corruption increases the chance to set up a swap line is perplexing. We note that a similar confounding corruption effect is found in, for example, the empirical specification of China's outward direct investment (Cheung, *et al.*, 2012). The result is likely driven by the relative high concentration of emerging and developing economies, which tend to have a not-so-good record on corruption. The empirical corruption effect, thus, may be related to China's strategy of going from regional to global, and from developing to developed economies to establish its own currency swap network. Cuervo-Cazurra (2006), for instance, argues that the similarities in the conditions of the institutional environment including corruption can promote economic interactions.

In sum, the decision to establish a bilateral local currency swap line facility is affected by economic, political and institutional characteristic considerations. The parsimonious specification under column 4 in Table 2 indicates that, according to the pseudo-R² statistics, the

selected factors explain the data quite well.

3.2 The Size of Swap Agreement

In the current sub-section, we study the factors that determine the size of a bilateral local currency swap agreement signed by China. Data on economies that have a swap agreement with China are examined using the following specification

$$Swap_{it} = \beta_0 + \beta_1 ECI_{it-1} + \beta_2 DIS_i + \beta_3 POL_i + \beta_4 INS_{it-1} + \rho Mills_{it} + v_{it}, \quad (2)$$

where $Swap_{it}$ is the log value of the size of the swap line that economy i has signed with China at time t , and $Mills_{it}$ is the inverse Mills ratio calculated from equation (1) and is included to control for potential biases arising from including only data from economies that have a swap arrangement.¹⁵

Are the reasons for signing a currency swap agreement and for deciding its size the same? We do not know. However, it seems not unreasonable to assume that these two decisions can be driven by similar factors, albeit with different degrees of importance. Thus, we initially included the explanatory variables of (1) in (2), and let the data to discriminate their effects on swap line sizes. The results presented below show that the factors affecting of the size of swap lines are not totally identical to those determining the establishment of swap lines in the first stage.

The results of estimating (2) are presented in Table 3 in a format similar to the one in Table 2. The results under Columns 1, 2, and 3 are similar, but not identical, to the corresponding ones in Table 2. The trade and economic size variables have the expected effects on the size of swap arrangements. In the absence of political and institutional factors, both distance-related variables are significantly negative; that is the swap line value is inversely proportionally to the geographic distance from China (Column 2 of Table 3). Again, the result is in accordance with the circumstantial observation that China's counterparties have a high concentration in Asia; especially in the early sample period. Nevertheless, the appeal to geographic distance seems over-simplistic – the gravity effect vanishes once other factors are incorporated in the

¹⁵ Technically speaking, (2) is the second stage regression of the Heckman two-stage process. The inverse Mills ratio is given by the probability density function over the cumulative distribution function estimated from (1), which includes both zero and non-zero SWD observations. Intuitively, the ratio captures the effect of truncating the sample and is included to control for selection biases in the second stage regression, which uses only observations associated with a positive swap line size.

specification (Columns 3 and 4 of Table 3).

According to the parsimonious representation given under Column 4, the value of a swap line is mainly determined by three factors; namely, the trade intensity, the economic size of the counterparty, and the presence of a bilateral free trade agreement. Combined, the three factors explain 70% of the variation in the sample. The number of factors for determining the size of a swap line is smaller than those relevant for deciding to have a swap line agreement or not. For instance, the institutional characters such as the default record and level of corruption become nonfactors after a swap agreement is reached. Our results highlights the different roles of these factors in different stages of the decision process of establishing China's bilateral RMB local currency swap agreements.

In passing, we note that the inverse Mills ratio is always statistically significant in Table 3 – it is prudential to include the ratio to control for possible biases induced by dropping the no-swap-agreement observations.

3.3 Imports or Exports

The role of trade intensity in determining China's recent currency swap arrangements is affirmed in the previous two subsections. The swap line is meant initially to be a backstop liquidity facility that provides local currency liquidity to support cross-border trade. Nevertheless, these swap lines have been seldomly drawn upon. A question is whether exports intensity and imports intensity carry the same weight in the process of setting up swap lines.

China's tight grip on the RMB restricts the global availability of the RMB. Anecdotal evidence indicates that, in the early phase of the RMB cross-border trade settlement program, the Chinese importers instead of exporters were the main users of the program. The possibility of foreigners to pay for their imports from China by the RMB is constrained because the RMB is not freely available to non-residents. The global liquidity of the RMB improves over time as the offshore RMB pool expands. Then, the RMB trade settlement scheme involves a more balanced of imports and exports activities.

Against this backdrop, we empirically assess the possible differential effects of imports and exports. Similar to the trade intensity variable, an economy's exports (imports) intensity variable is defined by the ratio of its exports to (imports from) China and its own total exports (imports). We re-estimated equations (1) and (2) with the trade intensity variable replaced with

either the exports or the imports intensity variables. The results are reported in Tables 4 to 7.

Specification by specification, the results reported under each column in Tables 2 and 3 are quite comparable to the corresponding ones in Tables 4 and 5. In addition to the sign and the magnitude of coefficient estimates, the patterns of significance are similar. These results suggest that the role of exports intensity in determining China's swap agreements is almost identical to the trade intensity variable. Comparing the pseudo-R² and adjusted-R² estimates, we can infer that, compared with the trade intensity variable, the exports intensity variable offers a very marginally weaker explanatory power for the decision of establishing a swap line but explains slightly better the size of a swap line.

The results pertaining to the imports intensity variable presented in Tables 6 and 7 are different from those of trade and exports intensity variables. For instance, the magnitude of the imports intensity coefficient estimate is noticeable smaller than those of the other two intensity measures; the imports intensity is even statistically insignificant in determining the size of a swap line. The result also indicates that the swap line size is positively related to a good corruption record. The overall fitness of the empirical specifications, judged by either the pseudo-R² or the adjusted-R² measure, is weakened when the imports intensity variable, instead of the other two intensity variables, is used.

The results suggest that the trade effect on China's swap line arrangements is mainly driven by exports intensity considerations. When the exports of a foreign economy is more dependent on China, the more likely it has a bilateral local currency swap line with China, and the value of the swap line is likely to be larger. The finding does not contradict the observed low frequency of the use of these swap lines. The establishment of these swap lines, despite the stated purposes, has a heavy symbolic value, and serves mainly as an emergency liquidity facility.

3.4 The Cox Proportional Hazard Model

To offer an alternative perspective on the properties of China's bilateral local currency swap line agreements, we consider the Cox proportional hazard model (PHM, Cox (1972)) which is given by:

$$h_i(t) = h(t, x_i) = h_0(t) \exp(x_i' \beta), \quad i = 1, \dots, N. \quad (3)$$

The variable $h_i(t)$, in the present context, is the probability density that a swap line agreement is established at time t conditional on a) there is no agreement signed earlier, and b) the explanatory

variables in the vector x_i . The generic name of $h_i(t)$ is the hazard ratio (or function). The probability, at time, of signing a swap line agreement depends on the baseline hazard rate $h_0(t)$; that is $h_i(t)$ when $x_i = 0$, and the explanatory variables included in x_i and the unknown parameters β . One advantage of PHM is that it is semiparametric and imposes no functional form on the baseline function $h_0(t)$.

The results of fitting the PHM with the trade intensity and other explanatory variables considered in subsection 3.1 are presented in Table 8. Essentially, the findings affirm the relevant of trade intensity, economic size, strategic partnership, free trade agreement, and default history to the establishment of China's bilateral local currency swap lines. These significant variables have the same signs as those reported in Table 2. The distance and corruption variables that are significant under the Probit setup in Table 2 are insignificant under PHM.

The estimation results based on the exports and imports intensity variables are presented in Tables 9 and 10. Under PHM, the exports, and imports intensities garnered significant coefficient estimates that are of similar magnitudes, which are marginally smaller than the trade intensity variables. Among the three trade-intensity-related variables, the specifications that include the exports intensity variable usually yield the highest pseudo- R^2 estimates.

One main assumption of PHM is the "proportional hazard" assumption; that is, the chance for each economy to establish a swap line with China is proportional over time to any other economies in the sample. The time variability comes through the nonparameteric baseline hazard rate. To ensure that our data do not violate the "proportional hazard" assumption, we conducted the Schoenfeld residuals test (Schoenfeld, 1982). The test results, which are not reported for brevity but are available upon request, indicate that the assumption is not rejected; that is, the results reported in Tables 8, 9, and 10 are valid.

In sum, the semiparametric PHM framework qualitatively affirms the findings derived from the Heckman two-stage framework, with the gravity effect being the exception. It is noted that the latter framework allows us to extract information on both the establishment and the value of swap line agreements, while the former gives information mainly on the (conditional) probability of signing a swap line agreement.

4. Concluding Remarks

In the wake of the dollar shortage experienced in the midst of the global financial crisis, China initiated its program of establishing bilateral local currency swap lines to alleviate its dependences on the US dollar for international transactions. Since then, the currency swap arrangement has evolved to be part of the general effort to promote the cross-border use of the RMB. China's status in the global economy is arguably attested by its pre-eminence in the international trade arena. A global RMB definitely propelled China to another high level of international recognition. Against this backdrop, we study the factors affecting China's currency swap agreements that facilitate overseas uses of the RMB.

Our empirical results show China's swap line arrangements are not only affected by pure economic considerations - political and institutional factors also have their roles. The level of trade interactions; especially measured by either total trade or exports, exhibits a consistently positive impact on the choice of setting up a swap line and the decision on the swap line value. A partner's economic size shows similar positive effects. Decisions about swap lines are also influenced by the degree of common political and economic interests captured by strategic partnership and free trade agreements; good political and economic connections enhance the formation of swap lines. On the other hand, the effects of a partner economy's characteristics such stability and corruption varies across specifications. Our results also indicate that the gravity effect may be present in the early phase of the local currency swap line program though the effect is not too robust across different model setups.

Despite China's ongoing efforts to liberalize its financial markets, the conversion between offshore and onshore RMBs is typically conducted within designated channels including free trade zone, RQFII, and authorized RMB clearing bank overseas, foreign central banks' access to domestic central banks, ..., etc. Thus, moving forward, the bilateral local currency swap line agreement will continue its role in promoting the global use of the RMB – both as a symbolic endorsement of offshore RMB activities in the partner's market, and as a RMB backstop liquidity facility.

Appendix

A. Variable Definitions and their Sources

Trade:	The ratio of an economy's trade with China over its total trade [Directions of Trade (DOT), IMF]; the volume of trade is given by the sum of exports and imports
Exports:	The ratio of an economy's exports to China over its total exports. [Directions of Trade (DOT), IMF]
Imports:	The ratio of an economy's imports from China over its total imports. [Directions of Trade (DOT), IMF]
ODI:	The ratio of China's ODI stock to an economy over the economy's total inward FDI. [ODI stock data: the Statistical Bulletin of China's Outward Foreign Direct Investment; Economy specific inward FDI: UNCTAD]
GDP:	The log value of an economy's nominal gross domestic production in current US dollars [World Development Indicators, World Bank]
FTA:	A dummy variable, equals to 1 if China and the counterpart have a Free Trade Agreement and equals 0 otherwise. [China's Ministry of Commerce]
Default:	A dummy variable, equals to 1 if the economy has a sovereign debt default record since 1970 and equals 0 otherwise. [The Wiki and The Moody's "Special Comment: Sovereign Default and Recovery Rates, 1983–2010"]
Distance:	The distance between China and the host economy (capital to capital) [http://privatewww.essex.ac.uk/~ksg/data-5.html]
Law:	The Rule of Law index reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. If the value is higher, it will indicate a better government. [http://info.worldbank.org/governance/wgi/index.aspx#home , The World Bank, Worldwide Governance Indicators.]
Corruption:	The Control of Corruption index reflects perceptions of the extent to which public power is exercised for private gains, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. The higher of the index, the better the government controls the corruption. [http://info.worldbank.org/governance/wgi/index.aspx#home , The World Bank, Worldwide Governance Indicators.]
Politics:	The Political Stability and Absence of Violence/Terrorism index reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. A higher value reflects better political stability. [http://info.worldbank.org/governance/wgi/index.aspx#home , The World Bank, Worldwide Governance Indicators.]

B. Economies that have a Free Trade Agreement with China, as of December 2014

	Sign Date	Effective Date
Hong Kong (CEPA)	29 Jun. 2003	1 Jan. 2004
Macau (CEPA)	17 Oct. 2003	1 Jan. 2004
ASEAN	4 Nov. 2002 (Framework Arrangement); 29 Nov. 2004 (Trade in Goods Arrangement)	20 Jul. 2005
Pakistan	24 Nov. 2006	1 Jul. 2007
Chile	18 Nov. 2005	1 Jul. 2006
New Zealand	7 Apr. 2008	1 Oct. 2008
Singapore	23 Oct. 2008	1 Jan. 2009
Peru	28 Apr. 2009	1 Mar. 2010
Costa Rica	8 Apr. 2010	1 Aug. 2011
Iceland	15 Apr. 2013	1 Jul. 2014
Switzerland	6 July 2013	1 Jul. 2014

Notes: Compiled by authors.

C. Economies that have a Partner Relationship with China, as of December 2014

Comprehensive strategic (cooperative) partners (29)	Strategic (cooperative) partners (22)	Comprehensive (cooperative) partners (13)
Argentina	Afghanistan	Bangladesh
Algeria	African union	Belgium
Australia	Angola	Bulgaria
Belarus	ASEAN	Congo
Brazil	Canada	Croatia
Cambodia	Chile	East Timor
Denmark	India	Ethiopia
European Union	Ireland	Kenya
France	Kyrgyzstan	Maldives
Germany	Nigeria	Nepal
Greece	Peru	Netherlands
Indonesia	Poland	Romania
Italy	Qatar	Tanzania
Kazakhstan	Serbia	
Laos	South Korea	
Malaysia	Sri Lanka	Cooperative partners (5)
Mexico	Tajikistan	Albania
Mongolia	Turkey	Fiji
Myanmar	Turkmenistan	Hungary
New Zealand	Ukraine	Jamaica
Pakistan	United Arab Emirates	Singapore
Portugal	Uzbekistan	
Russia		
South Africa		
Spain		
Thailand		
United Kingdom		
Venezuela		
Vietnam		

Notes: Compiled from website of the Ministry of Foreign Affairs, People's Republic of China.

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Table 1. China's Bilateral Local Currency Swap Agreements, as of end of 2014

Partner Economies	Swap line size	Effective Date	Expiration Date	Duration (year)
South Korea	RMB 180 bn/KRW 38,000 bn	12 Dec. 2008	Dec. 2011	3
renewed	RMB 360 bn/KRW 64,000 bn	11 Oct. 2011	Oct. 2014	3
renewed	RMB 360 bn/KRW 64,000 bn	11 Oct. 2014	Oct. 2017	3
Hong Kong	RMB 200 bn/HKD 227 bn	20 Jan. 2009	Jan. 2013	3
renewed	RMB 400 bn/HKD 490 bn	22 Nov. 2011	Nov. 2014	3
renewed	RMB 400 bn/HKD 505 bn	27 Nov. 2014	Nov. 2017	3
Malaysia	RMB 80 bn/MYR 40 bn	8 Feb. 2009	Feb. 2012	3
renewed	RMB 180 bn/MYR 90 bn	8 Feb. 2012	Feb. 2015	3
Belarus	RMB 20 bn/BYR 8,000 bn	11 Mar. 2009	Mar. 2012	3
Indonesia	RMB 100 bn/IDR 175,000 bn	23 Mar. 2009	Mar. 2012	3
renewed	RMB 100 bn/IDR 175,000 bn	1 Oct. 2013	Oct. 2016	3
Argentina	RMB 70 bn/ARS 38 bn	2 Apr. 2009	Apr. 2012	3
renewed	RMB 70 bn/ARS 90 bn	18 Jul. 2014	Jul. 2017	3
Iceland	RMB 3.5 bn	10 Jun. 2010	Jun. 2013	3
renewed	RMB 3.5 bn/ISK 66 bn	30 Sep. 2013	Sep. 2016	3
Singapore	RMB 150 bn/SGD 30 bn	23 Jul. 2010	Jul. 2013	3
renewed	RMB 300 bn/SGD 60 bn	7 Mar. 2013	Mar. 2016	3
New Zealand	RMB 25 bn/NZD 5bn	18 Apr. 2011	Apr. 2014	3
renewed	RMB 25 bn/NZD 5bn	25 Apr. 2014	Apr. 2017	3
Uzbekistan	RMB 0.7 bn	19 Apr. 2011	Apr. 2014	3
Mongolia	RMB 5 bn	6 May 2011	May 2014	3
renewed	RMB 10 bn	20 Mar. 2012	Mar. 2015	3
renewed	RMB 15 bn/MNT 4.5 tn	21 Aug. 2014	Aug. 2017	3
Kazakhstan	RMB 7 bn	13 Jun. 2011	Jun. 2014	3
renewed	RMB 7 bn/KZT 200 bn	14 Dec. 2014	Dec. 2017	3
Thailand	RMB 70 bn/THB 320 bn	22 Dec. 2011	Dec. 2014	3
renewed	RMB 70 bn/THB 370 bn	22Dec. 2014	Dec. 2017	3
Pakistan	RMB 10 bn/PKR 140 bn	23 Dec. 2011	Dec. 2014	3
renewed	RMB 10 bn/PKR 165 bn	23 Dec. 2014	Dec. 2017	3
UAE	RMB 35 bn/AED 20 bn	17 Jan. 2012	Jan. 2015	3
Turkey	RMB 10 bn/TRY 3 bn	21 Feb. 2012	Feb. 2015	3
Australia	RMB 200 bn/AUD 30 bn	22 Mar. 2012	Mar. 2015	3
Ukraine	RMB 15 bn/UAH 19 bn	26 Jun. 2012	Jun. 2015	3
Brazil	RMB 190 bn/BRL 60 bn	26 Mar. 2013	Mar. 2016	3
England	RMB 200 bn/GBP 20 bn	22 Jun. 2013	Jun. 2016	3
Hungary	RMB 10 bn/HUF 375 bn	9 Sep. 2013	Sep. 2016	3
Albania	RMB 2 bn/ALL 35.8 bn	12 Sep. 2013	Sep. 2016	3
EU	RMB 350 bn/EUR 45 bn	9 Oct. 2013	Oct. 2016	3

Switzerland	RMB 150 bn/CHF 21 bn	21 Jul. 2014	Jul. 2017	3
Sri Lanka	RMB 10 bn/LKR 225 bn	16 Sep. 2014	Sep. 2017	3
Russia	RMB 150 bn/RUB 815 bn	13 Oct. 2014	Oct. 2017	3
Qatar	RMB 35 bn/QAR 20.8 bn	3 Nov. 2014	Nov. 2017	3
Canada	RMB 200 bn/CAD 30 bn	8 Nov. 2014	Nov. 2017	3

Notes: Information collected by authors from news and the PBoC website

Table 2. Signing up a bilateral local currency swap agreement

	Column 1	Column 2	Column 3	Column 4
Trade(-1)	39.721*** (7.434)	27.637*** (5.465)	18.744*** (3.725)	25.443*** (4.666)
ODI(-1)	6.561 (1.396)	1.812 (0.459)	0.448 (0.123)	
GDP(-1)	3.214*** (7.345)	1.871*** (5.535)	1.230*** (3.059)	2.028*** (5.185)
Distance		-0.148 (-1.161)	-0.059 (-0.458)	
I*Distance		-0.127*** (-3.534)	-0.124*** (-3.485)	-0.093** (-2.532)
Partner			1.099** (2.412)	1.081** (2.074)
FTA			2.470** (2.162)	4.191*** (2.631)
Default			-0.358 (-0.400)	-2.538* (-1.741)
Rule of Law(-1)				
Corruption(-1)				-1.577*** (-2.714)
Stability(-1)				
Constant	-96.742*** (-7.680)	-56.153*** (-5.939)	-38.790*** (-3.388)	-61.236*** (-5.582)
pseudo-R ²	0.444	0.460	0.476	0.491

Notes: Results of estimating equation (1) are summarized. The trade intensity variable is constructed based on the sum of exports and imports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 3. The Size of Swap Lines

	Column 1	Column 2	Column 3	Column 4
Trade(-1)	8.233* (1.895)	9.571*** (2.736)	6.032** (1.997)	3.732** (2.161)
FDI(-1)	-0.103 (-0.073)	-0.856 (-0.801)	-0.282 (-0.170)	
GDP(-1)	1.415*** (4.441)	1.511*** (6.268)	1.255*** (5.256)	1.071*** (6.677)
Distance		-0.077** (-2.234)	-0.030 (-0.609)	
I*Distance		-0.041** (-2.406)	-0.034 (-1.619)	
Partner			0.401** (2.048)	
FTA			1.646*** (3.091)	1.143*** (2.991)
Default			-0.044 (-0.096)	
Mills	0.217** (1.976)	0.399*** (2.885)	0.388** (2.319)	0.120* (2.221)
Constant	-36.347*** (-3.755)	-38.833*** (-5.336)	-32.199*** (-4.483)	-26.019*** (-5.639)
Adjusted-R ²	0.574	0.619	0.644	0.704

Notes: Results of estimating equation (2) are summarized. The trade intensity variable is constructed based on the sum of exports and imports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 4. Exports Intensity and the signing of a bilateral local currency swap agreement

	Column 1	Column 2	Column 3	Column 4
Export(-1)	38.191*** (8.222)	20.852*** (7.662)	16.942*** (3.413)	21.717*** (4.439)
ODI(-1)	11.141*** (3.401)	4.090 (0.960)	2.428 (0.595)	
GDP(-1)	3.529*** (7.024)	1.968*** (6.886)	1.434*** (3.254)	2.243*** (6.660)
Distance		-0.161* (-1.662)	-0.077 (-0.566)	
I*Distance		-0.137*** (-3.777)	-0.128*** (-3.568)	-0.099*** (-2.661)
Partner			1.116** (2.240)	1.159** (2.235)
FTA			2.951** (2.428)	5.036*** (2.646)
Default			-0.561 (-0.554)	-3.106** (-2.234)
Rule of Law(-1)				
Corruption(-1)				-1.905*** (-3.042)
Stability(-1)				
Constant	-106.809*** (-7.518)	-57.507*** (-7.148)	-44.096*** (-3.610)	-66.311*** (-6.846)
pseudo-R ²	0.442	0.467	0.480	0.496

Notes: Results of estimating equation (1) are summarized. The trade intensity variable is constructed based on the volume of exports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 5. Exports Intensity and the Size of Swap Lines

	Column 1	Column 2	Column 3	Column 4
Export(-1)	4.676*** (3.138)	4.648*** (3.478)	4.448*** (3.707)	4.047*** (4.653)
ODI(-1)	0.693 (0.772)	0.590 (0.975)	0.403 (0.591)	
GDP(-1)	1.150*** (7.456)	1.215*** (8.057)	1.141*** (6.860)	1.107*** (7.455)
Distance		-0.043 (-1.471)	-0.000 (-0.006)	
I*Distance		-0.022** (-2.428)	-0.021* (-1.920)	
Partner			0.260 (1.310)	
FTA			1.551*** (3.170)	1.306*** (3.650)
Default			-0.234 (-0.626)	
Mills	0.118** (2.574)	0.236*** (3.168)	0.267*** (2.829)	0.140*** (3.365)
Constant	-28.425*** (-6.204)	-29.857*** (-6.914)	-28.672*** (-5.882)	-27.166*** (-6.513)
Adjusted-R ²	0.596	0.614	0.705	0.759

Notes: Results of estimating equation (2) are summarized. The trade intensity variable is constructed based on the volume of exports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 6. Imports Intensity and the signing of a bilateral local currency swap agreement

	Column 1	Column 2	Column 3	Column 4
Import(-1)	34.894*** (10.580)	17.583*** (4.353)	12.012*** (3.256)	14.600*** (3.090)
ODI(-1)	7.791*** (3.465)	2.720 (1.005)	1.196 (0.446)	
GDP(-1)	3.117*** (12.657)	1.272*** (3.879)	0.807*** (2.675)	1.241*** (2.646)
Distance		-0.134 (-1.403)	-0.048 (-0.502)	
I*Distance		-0.148*** (-4.355)	-0.134*** (-4.125)	-0.115*** (-3.248)
Partner			1.267*** (3.008)	1.278*** (2.788)
FTA			1.895** (2.325)	2.997** (2.426)
Default			-0.356 (-0.487)	
Rule of Law(-1)				
Corruption(-1)				-1.146* (-1.818)
Stability(-1)				0.779* (1.765)
Constant	-93.841*** (-13.442)	-38.292*** (-4.112)	-26.016*** (-3.085)	-38.221*** (-2.953)
pseudo-R ²	0.412	0.441	0.463	0.476

Notes: Results of estimating equation (1) are summarized. The trade intensity variable is constructed based on the volume of imports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 7. Imports Intensity and the Size of Swap Lines

	Column 1	Column 2	Column 3	Column 4
Import(-1)	4.523 (1.101)	4.795 (1.486)	0.871 (0.269)	-0.469 (-0.291)
ODI(-1)	1.704 (0.920)	1.036 (0.564)	1.578 (0.729)	
GDP(-1)	1.317*** (4.734)	1.331*** (7.803)	1.080*** (4.365)	0.850*** (5.293)
Distance		-0.097** (-2.000)	-0.042 (-0.673)	
I*Distance		-0.049* (-1.903)	-0.026 (-0.686)	
Partner			0.407 (1.388)	
FTA			1.406** (2.175)	0.712* (1.773)
Default			0.049 (0.099)	
Rule of Law(-1)				
Corruption(-1)				0.267** (2.164)
Stability(-1)				
Mills	0.178 (1.614)	0.408** (2.424)	0.300 (1.097)	0.027 (0.417)
Constant	-33.022*** (-3.869)	-32.956*** (-6.421)	-26.245*** (-3.478)	-19.100*** (-4.302)
Adjusted-R ²	0.509	0.532	0.589	0.634

Notes: Results of estimating equation (2) are summarized. The trade intensity variable is constructed based on the volume of imports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 8. China's bilateral local currency swap agreements – PHM, and trade intensity

	Column 1	Column 2	Column 3	Column 4
Trade	7.267*** (4.195)	5.984*** (2.801)	5.952*** (2.968)	3.816** (2.331)
ODI	-3.631 (-0.994)	-5.875 (-1.285)	-9.850* (-1.936)	
GDP	0.331*** (3.475)	0.294*** (2.767)	0.199* (1.811)	0.198* (1.854)
Distance		-0.014 (-0.215)	-0.046 (-0.639)	
I*Distance		-0.198 (-1.189)	-0.120 (-0.784)	
Partner			1.652*** (3.394)	1.518*** (3.131)
FTA			1.201** (2.059)	1.444*** (2.763)
Default			-0.580 (-1.164)	-0.850* (-1.825)
pseudo-R ²	0.102	0.130	0.208	0.180

Notes: Results of estimating equation (3), the proportional hazard model, are summarized. The trade intensity variable is constructed based on the sum of exports and imports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 9. China's bilateral local currency swap agreements – PHM, and exports intensity

	Column 1	Column 2	Column 3	Column 4
Export	4.846*** (4.755)	3.938*** (3.023)	3.958*** (3.107)	3.433*** (3.473)
ODI	-0.704 (-0.287)	-3.295 (-0.904)	-7.234* (-1.714)	
GDP	0.353*** (3.849)	0.317*** (3.008)	0.220* (1.897)	0.200* (1.869)
Distance		-0.007 (-0.101)	-0.048 (-0.639)	
I*Distance		-0.212 (-1.199)	-0.124 (-0.773)	
Partner			1.624*** (3.296)	1.470*** (3.044)
FTA			1.360*** (2.600)	1.528*** (3.260)
Default			-0.546 (-1.165)	-0.914* (-1.947)
pseudo-R ²	0.106	0.134	0.214	0.190

Notes: Results of estimating equation (3), the proportional hazard model, are summarized. The trade intensity variable is constructed based on the volume of exports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.

Table 10. China's bilateral local currency swap agreements – PHM, and imports intensity

	Column 1	Column 2	Column 3	Column 4
Import	6.999*** (3.632)	5.603** (2.126)	6.609** (2.483)	3.487** (1.962)
ODI	-3.515 (-0.866)	-5.218 (-1.011)	-10.190 (-1.612)	
GDP	0.301*** (3.219)	0.271*** (2.607)	0.151 (1.426)	0.175 (1.638)
Distance		-0.021 (-0.303)	-0.032 (-0.444)	
I*Distance		-0.211 (-1.161)	-0.129 (-0.766)	
Partner			1.705*** (3.361)	1.562*** (3.156)
FTA			1.094* (1.759)	1.469*** (2.706)
Default			-0.732 (-1.359)	-0.876* (-1.880)
pseudo-R ²	0.088	0.121	0.199	0.173

Notes: Results of estimating equation (3), the proportional hazard model, are summarized. The trade intensity variable is constructed based on the volume of imports. See the text and data appendix for definitions of the variables. The notations ***, **, and * denote significance at, respectively, the 1%, 5% and 10% level.