Redback Rising: China's Bilateral Swap Agreements and RMB Internationalization*

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For several years now China has implemented policies to promote the international use of its national currency, the Renminbi (RMB). As part of these efforts, the People's Bank of China (PBC) has negotiated 24 bilateral currency swap agreements (BSAs) with foreign central banks that make it easier for firms in both China and its partner countries to settle cross-border trade and direct investment in RMB. We seek to explain why China and these countries are cooperating via BSAs. We theorize that trade and direct investment interdependence are linked to dyadic BSA cooperation via two mechanisms: financing insulation from international liquidity shocks and reduced transaction costs of cross-border exchange for local firms. Additionally, we expect the presence of preferential trade agreements (PTAs) and bilateral investment treaties (BITs) will increase the probability of dyadic BSA cooperation. BSAs are natural extensions of these existing agreements representing an additional layer of state-level formal cooperation further reducing barriers to cross-border trade and direct investment. Our empirical analysis finds that both *de facto* trade interdependence and *de jure* economic integration via PTAs and BITs increase the probability of BSA cooperation between China and partners. These findings are robust to alternative measures, model specifications, and methods.

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Introduction

There is an emerging debate among scholars of the international monetary system over whether the dollar can continue to maintain its dominant position as top currency and to what extent the Chinese Renminbi (RMB), also known as the yuan, might challenge the greenback for this role in coming years. On one hand are those who argue that a multipolar monetary system is very likely on its way. In his recent book, economic historian Barry Eichengreen echoes this sentiment stating, "The world for which we need to prepare is thus one in which several international currencies coexist" (Eichengreen 2011:8). Similarly, Nouriel Roubini has posited that "we may now be entering the Asian century, dominated by a rising China and its currency" (Roubini 2009). On the other hand, there are skeptics who do not believe the RMB represents an imminent threat to the dollar's dominance. For instance, Cohen (2012:371) cautions that RMB internationalization "is unlikely to be as smooth or as swift as many have predicted." One reason for the ignition of this debate has been recent steps taken by China to promote the internationalization of the RMB. Beginning in the middle of the previous decade, China began taking steps to promote the the use of the RMB outside of China, a process that picked up considerable steam in the midst of the global financial crisis of 2008. These efforts have resulted in sizable gains for the currency, especially as a vehicle for trade settlement. For instance, China's RMB-based trade has increased from essentially nil in 2009 to more than $300 billion in the first three quarters of 2012.

A key element of China's strategy to internationalize "the people's currency" has been the negotiation of bilateral currency swap agreements (BSAs) between the People's Bank of China (PBC) and a growing number of partner central banks designed to promote the currency's use in cross-border trade and direct investment settlement. Since initiating the scheme in December of 2008, China has signed BSAs with a total of 24 foreign central banks to participate in its BSA program.[1] The scheme enables Beijing to make RMB available

in partner economies while still maintaining a considerable degree of control over the use of the currency outside of national borders. The primary goal of this paper is to explain why China and these countries are cooperating via BSAs. Employing a range of economic and political variables, we develop an empirical model of BSA cooperation between the PBC and potential partner central banks. While some have characterized RMB internationalization as a predominantly supply-side story–emphasizing Beijing's efforts to promote the currency's use–we contend that both supply and demand-side factors are driving the spread of the PBC's BSAs. We theorize that China is not the lone beneficiary of BSAs. Partner countries also benefit from settling cross-border trade and investment in local currencies as opposed to a third party currency like the dollar. In brief, we argue that both *de facto* economic interdependence and *de jure* economic integration between China and potential partner countries should be associated with higher probabilities of BSA cooperation. By *de facto* economic interdependence, we are referring to bilateral trade and direct investment *flows* between country dyads. By *de jure* economic integration, we are referring to the occurrence of formal international *agreements* country dyads are both parties of–specifically, preferential trade agreements (PTAs) and bilateral investment treaties (BITs).

We theorize that trade and direct investment interdependence between China and potential partner countries is linked to BSA cooperation via two mechanisms: (i) financing insulation from international liquidity shocks and (ii) reduced transaction costs of cross-border exchange for local firms. In other words, we hypothesize that countries heavily dependent on China in the areas of international trade and direct investment are more likely to seek a BSA with the PBC because they stand to benefit via the two aforementioned mechanisms the most. Similarly, we expect China will be more likely to approve BSAs with countries that are important cross-border trade and direct investment partners. In addition, we hypothesize that the presence of formal international agreements such as PTAs and BITs between China and potential partner countries will also increase the probability of BSA cooperation. PTAs and BITs lock participating countries into bilateral economic liberalization commitments

which generate joint anticipation of future gains from cross-border trade and investment. We expect participants will seek to layer BSAs on top of these existing agreements since the BSA further enhances the basic purpose of PTAs and BITs, namely, the reduction of barriers to cross border trade and investment while signaling a deeper commitment to future cooperation.

Controlling for a number of other potentially relevant covariates, the empirical results show strong support for our *de facto* trade interdependence and *de jure* economic integration hypotheses and partial support for the *de facto* direct investment interdependence hypothesis. In particular, the probability that a country will negotiate a BSA with the PBC increases as it becomes increasingly trade dependent on China. However, this effect is most robust when China is also highly trade dependent on the partner country. Similarly, the probability of BSAs also increase as direct investment interdependence increases, albeit with certain caveats. Finally, countries that have PTAs and BITs with China are also associated with higher probabilities of BSA cooperation. In short, both varieties of economic integration matter and the findings are robust to several alternative measures, model specifications, and methods.

Our findings are significant from an economic and political economic perspective and inform the current debate over the prospects for the RMB to rival to dollar as an international currency. Broadly, our findings suggest that the current phenomenon of RMB internationalization is not just a supply-side process being driven by Beijing as some have argued. Rather, there is an underlying market driven element to it as well: countries more economically dependent on China are more likely to sign BSAs giving their domestic firms access to RMB for settlement purposes. Consequently, the RMB's prospects at becoming a key international currency–at least as a settlement vehicle–are perhaps better than some skeptics have suggested. Ultimately, RMB internationalization in trade and direct-investment settlement promises not only economic efficiency gains for the Chinese economy and its partners, it also enhances China's international economic status while marginalizing the role of the dollar.

Finally, our paper sheds light on BSAs as a new type of formal international economic cooperation among countries which can be layered on top of existing bilateral agreements in order to further mitigate barriers to cross-border trade and investment and promote deeper economic integration.

The outline of this paper is as follows. In section 2, we briefly explain what "currency internationalization" is and review the growth of cross-border RMB trade settlement and direct investment since 2009. Then we report the growth of the PBC's BSA scheme and explain how these arrangements work in practice. In section 3, we present our main argument and derive two sets of testable hypotheses of BSA cooperation: *de facto* economic interdependence and *de jure* economic integration. In section 4, we discuss in detail the data sources and measurements of our outcome variable of interest and covariates. Then we discuss the models we use to fit the data, report our findings, and conduct robustness checks. Section 5 concludes the paper.

RMB Internationalization

Currency internationalization, put simply, is the process by which a local currency becomes increasingly used outside of its national borders. In lieu of a single world currency, the global economy needs at least one internationalized currency to function efficiently, otherwise, countries would be forced to barter with one another to settle any cross-border transactions (Cohen 2013b). International money, like local currency, must serve three roles: a medium of exchange, a unit of account, and a store of value. Additionally, international money must prove useful to both private market actors as well as foreign governments. Based on these parameters, the accepted typology for the roles of an international currency is presented in Table 1 (Kenen 1983; Chinn and Frankel 2005; Cohen 2013a).[2]

[Table 1 about here.]

This study focuses on the roles that reside in the upper left and upper right cells of Table 1: the use of the RMB in settling cross-border trade and direct investment. While detailed time-series data on the global use of currencies in trade settlement are not available, a relatively recent study finds (unsurprisingly) that the dollar is the most widely used currency for trade invoicing (Goldberg and Tille 2008:184).[3] The dollar's dominance as the top global currency in trade is the consequence of America's large market size, its historically predominant role in global trade, and the fact that financial markets tend to take advantage of scale economies (Cohen 2013a). In short, because trade financing is either unavailable or difficult to come by in the majority of national currencies, the dollar's dominance in international financial markets is directly related to its dominance in trade. Outside of the greenback, Goldberg and Tille (2008) find that invoicing in domestic currencies (other than the dollar) is more common for exports than imports across a sample of 24 industrial and emerging markets. Other studies have found similar home-country currency invoicing in exports but also a tendency to invoice and settle imports in the producer's currency (Friberg and Wilander 2008; Ito, Koibuchi, Sato, and Shimizu 2010) or that trade between industrial and developing countries tends to be denominated in the former's currency (Kawai 1996).[4]

Historically, the international use of a currency in trade, as well as other roles, has tended to corresponded with the rise and fall of a country's overall economic power (Bergsten 1975; Eichengreen 1994). However, the RMB's international use has lagged far behind China's growing global economic clout as the world's top official creditor, second largest economy, and top trading state.[5] The RMB's limited international role is no accident, however. Rather, it is a direct consequence of Chinese policies such as its controlled exchange rate, capital controls, capital account inconvertibility, underdeveloped domestic financial markets, and a domestic policy regime of financial repression via the government's control of interest rates and credit allocation through state-owned banks. However, things have recently started to change. A 2006 PBC study entitled "The Timing, Path, and Strategies of RMB Internationalization" explained that the time had come to lengthen the RMB's leash. In the paper, the

authors argue that it was now time to begin the "inevitable" process of internationalizing the currency, arguing that doing so would "enhance China's international status and competitiveness significantly [and] will increase its influence in the international economy" (quoted in Cohen 2012).[6] Since then China has embarked upon a so-called "two-track" strategy to promote RMB internationalization (Subacchi 2010). The first track, which is outside the scope of this paper, focuses on promoting the use of the RMB in financial markets.[7] The second track, which is the principal focus of this study, efforts to increase the currency's use in international trade and direct investment settlement.

Since the introduction of this strategy, the RMB has made some impressive gains in these areas.[8] For the entire year of 2009, the volume of RMB-based trade totaled a meager $570 million. This has steadily increased in the years since. According to the PBC's reports, in the fourth quarter of 2012 roughly $135 billion–or about 13 percent–of Chinese trade was settled in RMB. Figure 1 reports the quarterly growth in cross-border trade settlement since 2009.[9]

[Fig 1 about here.]

Besides the overall growth in cross-border RMB settlement over the past three years, there is evidence that the currency is beginning to play a more balanced role in terms of financing imports from abroad as well as serving as a payment currency for overseas buyers of Chinese goods. While the PBC does not report a detailed export-import breakdown of RMB settlement, it does regularly report the ratio of "receipts to payments" (or use of renminbi to settle exports and imports). Early on, the renminbi was most widely used by Chinese firms to *pay for imports*–precisely the opposite of what most theory and empirical work on the subject tends to expect.[10] For instance, the 2010 receipts to payment ratio was 1:5.5. In other words, the amount of renminbi used to pay for imports was more than than five and a half times the amount accepted as payment for exports. However, this trend has started to reverse itself over the intervening years. For the entire year of 2012, the ratio fell to 1:1.2

suggesting a far more balanced role for the renminbi in China's trade settlement (People's Bank of China 2012:17).

Besides trade, the RMB has also seen increased use in cross-border direct investment in recent years. The PBC did not begin releasing quarterly data on the RMB's use in inward and outward foreign direct investment (FDI) until 2011. However, the totals they have reported do show increased RMB use in these areas as well. Figure 2 reports available data on RMB use in Chinese ODI and FDI in China. As the figure shows, the growth in RMB use for these purposes has not been as consistent as it has in trade. Additionally, while the currency's use in trade has tended to favor RMB outflows, the opposite has been true in direct investment with the currency seeing its widest use in the form of FDI.

[Fig 2 about here.]

So, what explains the increased international use of the RMB in trade and investment? At least part of the answer has to do with Chinese policy. As we mentioned above, the PBC recently began promoting wider use of the RMB in these types of international transactions. It has aimed to accomplish this through two channels. First, the monetary authority has successfully phased in a trade and direct investment invoicing and settlement program.[11] The second channel, which is the central focus of this paper, is China's growing cooperation with a select group of foreign central banks via BSAs.

The PBC's Swap Scheme

The PBC is in the process of building a system of BSAs with a select (and growing) group of foreign central banks. BSAs are not a new technique in the world of central banking. In fact, lines of credit between central banks have their roots in the 19th century and the U.S. Federal Reserve negotiated a central bank currency swap network between the major industrial economies in the early 1960s that lasted for decades. More recently, the Fed used BSAs to provide dollar liquidity to a number of foreign central banks during the worst months of the

2008 global financial crisis and continues to maintain a handful of lines today (McDowell 2012). However, the way that the PBC is employing the method is different. In the past, BSAs have always been used as a way to deliver foreign exchange from one sovereign to another facing a liquidity crisis. The PBC swaps are not explicitly designed for this purpose. Rather, they have been crafted specifically for the purpose of RMB internationalization–as a method to promote bilateral trade and direct investment between China and each partner in local currencies as opposed to the U.S. dollar.

As we show above, RMB-based cross-border trade and investment had been virtually non-existent until recently since the currency is not yet fully convertible and because China strictly limits RMB outflows. Rather than fully liberalize its monetary policy and capital account to promote RMB internationalization in trade and direct investment, Beijing has opted for a more targeted, incremental approach. BSAs enable trading enterprises in partner economies to settle trade in RMB either by acquiring the currency to pay for Chinese imports or accepting RMB as payment and then exchanging it for their local currency. This last point is especially important since there are currently only a few ways foreigners can invest RMB. Most investment options are in the offshore RMB hub of Hong Kong where a number of investment products are being developed, including RMB-denominated CDs, bonds, and other structured instruments. Only on a restricted basis, however, are non-residents allowed to invest funds in mainland China.[12] Consequently, being able to convert RMB into local currency is important if China wants to encourage its use in cross border trade and investment. This is where the BSAs come in handy.

By way of a simplified example, let us take a hypothetical case of trade between merchants in China and Malaysia (see Figure 3) which signed their first BSA in April 2009. A Chinese manufacturer that buys widgets from a Malaysian firm can now use RMB to pay for its purchases. The Malaysian widget producer, then, can take these RMB to a local bank and exchange them for ringgits, the local currency. The bank, then, can exchange these RMB for ringgits with the the Malaysian central bank (Bank Negara Malaysia) which can easily

recycle the RMB for ringgits when it reverses the swap with the PBC. The logic would work the same way if the roles were reversed with a Malaysian merchant exchanging ringgits for RMB with a local participant bank and then paying for Chinese goods directly in RMB. BSAs also make it easier for local currencies to be used for FDI. For example, in the case of inbound RMB-based FDI, a Malaysian firm can use RMB instead of dollars to pay for capital investments in China since ringgits can now be easily exchanged for RMB in light of the BSA between the two central banks.

[Fig 3 about here.]

Since December 2008, China has negotiated a total of 24 new BSAs as of October 2013.[13] Table 2 lists the partner countries, the date of the initial swap agreement, extension or expiration date, and the size of the agreement (second amount listed if swap was expanded upon being extended).[14] All of China's swap agreements have been designed to last three years before expiration or renewal. Presently, five of the BSAs have been renewed and in each case the size of the line was doubled or more. Only one is confirmed to have expired; two others may have expired though we have not located any reports to confirm this. Figure 4 visualizes how BSAs rapidly expanded across countries and size from 2009 to 2012.

[Table 2 about here.]

[Fig 4 about here.]

What explains why China and these partner countries have negotiated BSAs? One perspective in the limited but growing literature on the subject is that the present process of RMB internationalization is primarily a supply-side story, i.e. the RMB's international footprint is growing not because of substantial market demand for an alternative to currencies such as the dollar and euro, but rather because China is embarking on an aggressive campaign to promote wider use of its currency. For instance, Subacchi (2010:5) acknowledges that China has to create "incentives to expand the international use of the RMB." Cohen (2013a)

asks, regarding the strategy: "Can demand-side preferences be successfully altered by state-led measures on the supply side?"

There is no doubt that China reaps some exclusive benefits from BSAs that help explain the existence and expansion of the scheme. First, RMB internationalization should generate earnings opportunities for Chinese banks and financial institutions (Cohen 2013a:17). As one recent industry white paper put it, "Chinese banks see [RMB internationalization] as a strategic opportunity to follow their clients abroad and develop their international payments clearing business" (SWIFT 2012:1). Second, BSAs and the attendant increase in RMB trade and direct investment settlement can help reduce Chinese dependence on the dollar and U.S. Treasury securities by reducing the flow of dollars into the country.[15] Yet, while a supply-side story may help us understand some of Beijing's underlying motivations for promoting the BSA scheme, it cannot explain which countries are most likely to cooperate with China because it tells us nothing about *their* preferences. In the next section, we present our own explanation of BSA cooperation.

Explaining BSA Cooperation

BSAs are by definition *bilateral* agreements. Since they necessarily take two parties to tango, any study seeking to explain BSA cooperation must also consider the preferences of China's partners–the *demand-side* factors that might help explain the spread of the BSA scheme and, consequently, wider international use of the Chinese currency. Statements in recent PBC Monetary Policy Reports are suggestive of demand-side factors, if still a bit vague. In two instances the PBC notes that BSAs were designed "to respond to the needs of neighboring countries and regions" (People's Bank of China 2009a:15, 2009c).[16] Accordingly, we assume that China as well as potential partner countries *voluntarily* enter into BSAs because of the perceived benefits they provide each participant. These benefits may be economic or geopolitical in nature, but the fundamental point is we assume BSAs are Pareto improving for participating countries. Furthermore, unlike many bilateral economic agreements–including

standard preferential trade agreements (PTAs)–there are no clear, direct domestic losers from BSAs. When two countries sign a PTA, export oriented interests gain while import competing interests lose. Conversely, China's BSAs are akin to public goods.[17] For instance, they can enhance stability and efficiency by making cross-border RMB-based trade settlement possible (or easier) for *both* export-oriented and import-competing firms, but they do not require it. The same goes for inbound and outbound direct investment. In other words, while PTAs discriminate between domestic interests and prescribe a particular behavior, BSAs do neither. Firms may continue to invoice and settle an exchange as they always have; or, they may now choose to use RMB. The choice is theirs.

This, however, begs the question: If BSAs only provide benefits to participating economies, why are there so few? The answer here is twofold. First, BSA growth is dependent on the speed with which the PBC is willing to expand the program. As noted in the introduction, BSAs are one part of China's *incremental* strategy to internationalize the RMB. The broader internationalization strategy–as well as the BSA program–is still in the early stages, thus its limited (yet growing) range. In this light, a little more than 20 agreements in less than five years is actually quite substantial. Second, even though BSAs are mutually beneficial arrangements there are some up-front costs associated with the negotiations that necessarily accompany their signing (as is the case with any international agreement) including how large the swap line should be, when it should commence, when it should expire, and getting domestic banks on board to exchange the new currency. As small as these costs may be, the PBC likely has less interest in spending the time and resources necessary to seal BSAs with countries it conducts little to no cross-border trade and investment with. The same goes for countries that have limited economic relations with China. In short, the benefits derived from signing a BSA with China vary across country-dyads. It is precisely this variation which informs our argument.

We hypothesize that both *de facto* economic interdependence and *de jure* economic integration between China and potential partner countries should increase the probability of

BSA cooperation. By *de facto* economic interdependence, we are referring to bilateral trade and direct investment *flows* between country dyads. By *de jure* economic integration, we are referring to the existence of formal international agreements country dyads are both parties of such as preferential trade agreements (PTAs) and bilateral investment treaties (BITs). Below, we further develop each of these hypotheses.

De Facto Interdependence

We expect that higher trade and direct investment interdependence between China and potential partner countries should be associated with a higher probability of BSA cooperation. We argue that such economic interdependence is linked to BSA cooperation via two mechanisms. Theoretically, BSAs should provide at least two important economic benefits for both China and partner countries: (i) financing insulation from international liquidity shocks and (ii) reduced transactions costs of cross-border exchange for local firms.

First, BSAs provide insulation from exogenous liquidity shocks. The BSA scheme originated in late-2008/early-2009 in the midst of the worst international financial crisis in 80 years. Estimates suggest that in 2008, China settled about 70 percent of its annual trade in U.S. dollars with the remaining 30 percent being settled in euro, yen, and other major currencies (Hongbin and Junwei 2009). The crisis forced economic policymakers in China and its major trading partners to recognize that relying so heavily on the dollar for trade invoicing and settlement put commerce at risk. After the collapse of Lehman Brothers in September 2008, Chinese exports fell dramatically. While this was largely the consequence of falling global demand in light of the crisis it was made worse in light of the "global dollar shortage" as international credit markets seized on fears of exposure to U.S. mortgage backed securities (McGuire and Von Peter 2009). As financial institutions in the U.S. and around the world became increasingly reluctant to lend, trade financing in dollars became scarce, contributing to the collapse of international trade in 2009 (Bottelier and Dadush 2011).[18] Indeed, in one of its Monetary Policy Reports, the PBC specifically notes demand for RMB

settlement in response to these developments:

> Affected by the global financial crisis, major international settlement currencies such as the US dollar and the euro experienced large exchange-rate volatility *and trade financing decreased*, posing substantial risks for Chinese enterprises and enterprises in neighboring countries and regions when settling trade transactions in a third currency. Some enterprises, both in China *and other countries*, hoped to use the RMB as a payment instrument (People's Bank of China 2009b:14; emphasis added).

While there has been less research into the impact of the 2008 crisis on FDI financing, anecdotal evidence suggests that it was also adversely impacted by the dollar shortage. For instance, a presentation by the chief economist of the Bank of China–one of China's four big domestic banks–points out that both trade and FDI financing faced liquidity shortages during the crisis due to dependence on the dollar (Yuanzheng 2012). In sum, BSAs provide alternative trade and direct investment financing channels for China and its partners that are insulated from such exogenous shocks.

Second, BSAs reduce transactions costs of cross-border trade and direct investment for firms in participating countries. Invoicing and settling cross-border trade and investment in a third party currency, like the dollar or euro, carries an added degree of foreign exchange risk.[19] Indeed, the PBC quote above highlights exchange risk concerns as another motivation behind BSAs.[20] By way of example, consider the transaction between the Malaysian trading firm and a Chinese counterpart mentioned in the previous section. Relying on a third-party currency adds an additional mathematical step when invoicing and settling a transaction. The two firms cannot calculate the price of a particular good in terms of how the Malaysian ringgit and the RMB relate to one another; instead, they have to consider how the ringgit-dollar exchange rate compares to the RMB-dollar exchange rate at a particular moment in time. Volatility in any of the three exchange rates can impact the price of goods being exchanged and, consequently, the profits of the firms involved. Thus, Chinese and Malaysian

enterprises must hedge against such risks, which carries added costs thereby decreasing competitiveness.[21]

Finally, relying on a third party currency for settlement also adds an additional step to the transaction itself by forcing *both* the Malaysian firm and the Chinese firm to convert their local currency into dollars to settle the deal. Again, this increases the transaction costs to cross border trade and direct investment. On the other hand, invoicing and settling trade in RMB reduces transaction costs by eliminating the added exchange risk and removing the need to convert local currencies into dollars (or another third party currency) for one of the parties in the exchange. A brochure produced by the Malaysian central bank on RMB settlement spells out these specific benefits to local firms:

> "Settlement in RMB may reduce the foreign exchange risk for exporter and importers from China and this can result in better pricing of goods and services transactions for Malaysian companies. Malaysian companies will also benefit from savings from the currency conversion spreads as it is now a direct quote from RMB to Ringgit."[22]

Both mechanisms–insulation from exogenous shocks and reduced transaction costs–directly benefit local firms in China as well as partner economies. While firms may lobby their governments to negotiate BSAs, we do not believe lobbying must be present in order for governments to have a preference for cooperation. Rather, we assume that governments and central banks are aware of the potential insurance and efficiency gains BSAs can provide their economies and should seek out BSAs independent of lobbying if the perceived national gains are substantial.[23] We theorize that perceived national gains from BSAs increase as bilateral trade and investment interdependence increases and that this is true from the perspectives of China as well as partner countries. Thus, where China is increasingly important to a partner country (and vice versa) as a source and/or destination for trade and/or direct investment, BSA occurrences should be more likely as the perceived economic efficiency and insulation gains should increase. A set of hypotheses are summarized below:

Hypothesis 1a: *Holding all else equal, higher* trade *interdependence between China and a potential partner country increases the probability of BSAs occurring between the dyads.*

Hypothesis 1b: *Holding all else equal, higher* direct investment *interdependence between China and a potential partner country increases the probability of BSAs occurring between the dyads.*

De Jure Economic Integration

In the last decade, scholars of political economy have generated a substantial amount of research regarding international formal cooperation on *goods* and *capital* flows such as PTAs and BITs. Specifically, PTAs are formal agreements "designed to foster economic integration among member-states by improving and stabilizing each member's access to other participants' markets" (Mansfield and Milner 2012:1). Similarly, BITs are formal agreements that "set the rules of investment between a pair of states and establish a course of action for the settlement of investment-related disputes" (Allee and Peinhardt 2010:2). BSAs can be seen as natural extensions to PTAs and BITs in which they provide an additional layer of state-level formal cooperation in the international economy, i.e. formal cooperation on *currency* flows. In other words, while PTAs reduce tariffs and non-tariff barriers to trade and BITs reduce risks of host government expropriating foreign investment, BSAs reduce the remaining liquidity and exchange rate risks when engaging in trade and direct investment by eliminating the need to use a third party currency.

PTAs and BITs lock country dyads into bilateral economic liberalization commitments by raising the costs of reneging on said agreements, thereby reducing the likelihood that important trade and investment partnerships today will breakdown in the face of protectionist pressures tomorrow (Fernandez 1997; Mansfield 1998; Mansfield, Pevehouse, and Bearce 1999; Elkins, Guzman, and Simmons 2006; Allee and Peinhardt 2010). Thus, entering into a BSA is strategically beneficial since it both enhances the functions of existing PTAs and

BITs and also credibly signals a deeper commitment to future bilateral economic or political cooperation. However, the same benefits should not apply equally to country dyads absent PTAs and BITs. All else equal, reducing liquidity and exchange rate risks to trade and direct investment via a BSA will be more beneficial to firms in countries where flows of goods and capital face fewer restrictions as a result of PTAs or BITs. Therefore, we expect country dyads with PTAs and BITs to have a higher probability of entering into a BSA compared to those without these agreements. A second set of hypotheses are summarized below:

Hypothesis 2a: *Holding all else equal, the presence of a preferential trade agreement (PTA) between China and a potential partner country increases the probability of BSAs occurring between the dyads.*

Hypothesis 2b: *Holding all else equal, the presence of a bilateral investment treaty (BIT) between China and a potential partner country increases the probability of BSAs occurring between the dyads.*

Empirics

To test our argument, we compile a balanced panel dataset that covers 172 countries from 2008-2011. The dataset includes all independent states in a year as defined in Gleditsch (2004). Hong Kong and Macao are included as independent entities due to the former's important role in the swaps and the fact that both Special Administrative Regions (SARs) maintain their own currencies.[24] In the following section, we first discuss the operationalization and data sources of our main outcome of interest and key covariates. Next, we discuss the rare events models and methods used to fit our data and report the empirical findings. Finally, we address concerns about measurement, omitted variables, sample selection, and temporal dependence in the robustness checks.

Data and Measurement

Outcome of Interest

Bilateral Swap Agreement (BSA) *occurrences* between China and partner countries is our main outcome of interest. We measure BSA occurrences as whether a bilateral currency swap agreement *occurred* between the PBC and its partner central bank in a given year. This dichotomous variable is coded as 1 when a BSA occurred and 0 otherwise. As mentioned previously, all BSAs are three-year deals and so they are coded as 1 for all the years they are active. Even though these are three-year agreements, all BSAs can be terminated at any time by either party. Therefore, we treat BSAs as independent processes across years and relax this assumption later in the robustness checks. BSA data is coded by the authors based on PBC announcements and reports.

Covariates

De facto Economic Interdependence. To test the effect of *de facto* trade and direct investment interdependence on the probability of BSA occurrences (Hypothesis 1a and 1b), we employ six different measures: (i) partner country$_i$'s trade dependence on China; (ii) China's trade dependence on country$_i$; (iii) China and country$_i$'s trade interdependence; (iv) partner country$_i$'s FDI dependence on China; (v) China's FDI dependence on country$_i$; and (vi) China and country$_i$'s FDI interdependence.

Parnter country$_i$'s trade dependence is measured as country$_i$'s total trade (sum of exports and imports of goods) with China divided by country$_i$'s total trade with the world in year$_t$. Following our two mechanisms, i.e. insulation from exogenous shocks and reduced transaction costs, we expect BSAs to benefit both imports and exports. Therefore, even if two partner countries A and B had the same level of export dependence on China, if country A had an additional higher import dependence on China than country B, we would expect a higher probability of a BSA between China and country A than country B. Therefore,

we choose to aggregate export and import dependence for our trade dependence measure. Similarly, China's trade dependence is measured as China's total trade with country$_i$ divided by China's total trade with the world in year$_t$. We rely on UN Comtrade for export and import data (Classification HS96).[25] We expect both higher China's trade dependence on country$_i$ and higher country$_i$'s trade dependence on China to increase the probability of BSA occurrences. In addition, since BSA outcomes result from agreements between China and a partner country, higher levels of trade *interdependence* are expected to further increase the probability of swaps since the aforementioned benefits would increasingly apply to both sides. To capture this effect, we interact the two trade dependence terms.

Consistent with the way trade dependence measures are constructed, partner country$_i$'s FDI dependence is measured as country$_i$'s total FDI flows (absolute net inflows and outflows) with China divided by country$_i$'s total FDI flows with the world in year$_t$. China's FDI dependence is measured as China's total FDI flows with country$_i$ divided by China's total FDI flows with the world in year$_t$. We rely on the China Statistical Yearbook for dyadic Chinese FDI inflows and outflows data and UNCTAD for partner total FDI flows with world data. We expect both measures of FDI dependence to increase the probability of BSA occurrences. Again, higher levels of FDI *interdependence* is expected to further increase the probability of BSAs, and we capture this by interacting the two FDI dependence terms.

De jure Economic Integration. To test the effect of *de jure* economic integration on the probability of BSA occurrences (Hypotheses 2a and 2b), we employ two different measures: (i) preferential trade agreement (PTA) and (ii) bilateral investment treaty (BIT).

In contrast to *de facto* economic interdependence, PTAs and BITs signal both the potential importance of future trade and direct investment between signatories and their commitments to such agreements. Moreover, layering BSAs on top of these existing arrangements enhances the primary goal of such formal agreements, namely, reducing barriers to trade and investment. PTA is a dichotomous variable and coded as 1 when China either has a PTA

or a free trade agreement (FTA) with country$_i$ in year$_t$ in force and 0 otherwise.[26] BITs is a dichotomous variable coded as 1 when China has a BIT with country$_i$ in year$_t$ in force and 0 otherwise. We expect that BSAs are more likely to occur between China and countries that China has PTAs and BITs with. We rely on China's Ministry of Commerce for trade agreement data and UNCTAD for BITs data.[27]

Other Covariates. China's BSA scheme may be related to *geopolitical* factors such as concerns for security or natural resources that cause both higher economic interdependence and higher probability of BSAs. As a result, this may bias our estimates for the effect of economic interdependence or integration on BSA occurrences as illustrated in Figure 5. Below we discuss geopolitical factors that are included in our models as controls.

[Fig 5 about here.]

First, a number of studies find that trade is affected by military alliances (Gowa 1994; Gowa and Mansfield 1993, 2004; Mansfield and Bronson 1997; Powers 2004; Long and Leeds 2006). Applied to our case, China may be more inclined to sign BSAs with allies in order to further strengthen those economies and build better partnerships via economic cooperation. Conversely, China's strategic allies may be more likely to seek out BSAs as a way to signal their solidarity with Beijing by adopting its currency in trade settlement while dumping the dollar. In other words, security concerns may cause both higher trade or direct investment between China and its partner while also increasing the probability of BSAs, which leads to biased estimates for our key *de facto* and *de jure* integration covariates. Though China does not have any formal military alliances, it is a member of the Shanghai Cooperation Organization (SCO), which is an inter-governmental organization founded in 2001 primarily concerned about mutual security. Therefore, we include SCO participation status to control for the effect of security concerns on the probability of BSA occurrences. SCO is a dichotomous variable measured as 1 if country$_i$ is either a member or observer of SCO in year$_t$ and 0 otherwise. We rely on the SCO's official website for participant data.[28]

Second, access to natural resources is now central to both China's economic and security interests. China moved from an energy net exporter to importer around 2000, and as its economy continues to grow, so too will its demand for energy. Negotiating BSAs with countries that are significant oil and coal producers could help ensure easier access to vital energy in the future and may eventually pave the way for settling oil exchange in RMB.[29] For these reasons, China may have incentives to enter into BSAs with top oil or coal producing countries. Conversely, top oil or coal producing countries may value BSAs with China as an agreement that may enhance access to the Chinese national market which is the second largest in terms of both oil consumption and imports behind only the US. We measure oil production as country$_i$'s oil production (million barrels) per day in year$_t$ while coal production is measured as country$_i$'s coal production (billion short tons) in year$_t$. Both oil and coal production measures rely on US Energy Information Administration (EIA) data.[30]

In addition to these geopolitical controls, we include a standard set of gravity model variables such as GDP (constant 2000 US dollars), GDP per capita (2005 international dollars), annual GDP growth rate, and distance (thousand kilometers) in our models. We rely on World Bank's World Development Indicators (WDI) for GDP data, Penn World Table (PWT) 7.1 for GDP per capita data, and CEPII's GeoDist for dyadic distance data.[31]

Table 4 summarizes the operationalization and data sources for all covariates while Table 5 shows the descriptive statistics in Appendix 1.

Models and Methods

Since BSAs only occur in 7.3% (or 50) of our 688 total country-years, we fit a set of rare events logit models suggested by King and Zeng (2001) to evaluate the performance of our hypotheses. In contrast to standard logit regression models, this approach corrects for bias when one outcome is much more prevalent than the other in a dichotomous dependent variable. Furthermore, we compute Heteroskedastic and Autocorrelation Consistent (HAC) standard errors due to problems with clustering in countries and years. To address issues

with missing data, we create ten multiply imputed datasets using the **R** package `Amelia II` (Honaker, King, and Blackwell 2011), fit rare events logit models to each of the datasets, and combine the results using Rubin's Rules (**?**).[32] In terms of model specification, we fit three different rare events logit models: a first model with only *de facto* economic interdependence and control covariates, a second model with only *de jure* economic integration and control covariates, and a third full model with all covariates. The three models are expressed formally as follows:

$$
\begin{aligned}
f_{defacto}(BSA_{it+1}|\boldsymbol{X_{it}}, \theta_{defacto}) &= \text{logit}^{-1}(\beta_0 + \beta_1 PTradeDep_{it} \times CNTradeDep_{it} \\
&\quad + \beta_2 PTradeDep_{it} + \beta_3 CNTradeDep_{it} \\
&\quad + \beta_4 PFdiDep_{it} \times CNFdiDep_{it} \\
&\quad + \beta_5 PFdiDep_{it} + \beta_6 CNFdiDep_{it} \\
&\quad + \boldsymbol{\beta_7 Z_{it}}) \qquad (1) \\
f_{dejure}(BSA_{it+1}|\boldsymbol{X_{it}}, \theta_{dejure}) &= \text{logit}^{-1}(\gamma_0 + \gamma_1 PTAs_{it} + \gamma_2 BITs_{it} + \boldsymbol{\gamma_3 Z_{it}}) \qquad (2) \\
f_{full}(BSA_{it+1}|\boldsymbol{X_{it}}, \theta_{full}) &= \text{logit}^{-1}(\lambda_0 + \lambda_1 PTradeDep_{it} \times CNTradeDep_{it} \\
&\quad + \lambda_2 PTradeDep_{it} + \lambda_3 CNTradeDep_{it} \\
&\quad + \lambda_4 PFdiDep_{it} \times CNFdiDep_{it} \\
&\quad + \lambda_5 PFdiDep_{it} + \lambda_6 CNFdiDep_{it} \\
&\quad + \lambda_7 PTAs_{it} + \lambda_8 BITs_{it} + \boldsymbol{\lambda_9 Z_{it}}) \qquad (3)
\end{aligned}
$$

where $f_{defacto}$ and f_{dejure} denote statistical models implied by *de facto* and *de jure* economic integration hypotheses, respectively, and f_{full} denotes a full model that includes all covariates. i and t index countries and years, respectively. BSA occurrence is the outcome variable of interest measured at time $t+1$. $\boldsymbol{X_{it}}$ is a vector of predictors for each model measured at time t. Leading the dependent variable allows us to to address problems with simultaneity and also

maximizes variation in our outcome variable since there were more BSAs in 2012.[33] $\theta_{defacto}$, θ_{dejure}, and θ_{full} are vectors of parameters for each model. All other potential covariates that we control for are included in the vector $\boldsymbol{Z_{it}}$. Predicted signs for key predictors in our full model are summarized in Table 3. Rare events logit models are fitted using the **R** package `Zelig` (Imai, King, and Lau 2007, 2008).

[Table 3 about here.]

Results

Figure 6 plots the parameter estimates and 95% confidence intervals for all three fitted models. Further parameter estimate details are summarized in Table 6 in Appendix 2. Focusing first on key trade dependence covariates, we find that both higher partner country trade dependence on China and higher trade interdependence between China and partner country are statistically significant and associated with higher probabilities of BSAs occurrence across models, which suggests support for our *de facto* trade interdependence Hypothesis 1a. China's trade dependence, however, is not statistically significant with a slightly larger p-value (0.082). We suspect that this is because China's trade dependence on any given country is extremely low with a mean of 0.01 and maximum of only 0.14. Therefore, there may not be enough variation in the data to distinguish the effect of higher Chinese trade dependence on partner countries.

[Fig 6 about here.]

To avoid the well known issues with directly interpreting interaction term coefficients in non-linear models (Ai and Norton 2003; Gelman and Pardoe 2007) and to illuminate the magnitude of trade dependence and interdependence effects on BSAs, we graph in Figure 7 the simulated predicted probabilities of BSAs as a partner country's trade dependence on China increases while also increasing China's trade dependence on the country, but holding constant all other covariates.[34] The bottom panel shows predicted probabilities when China's

trade dependence on a country is *low* (one standard deviation below the mean) while the top panel shows predicted probabilities when China's trade dependence on a country is *high* (one standard deviation above the mean.) Additionally, instead of plotting 95% confidence intervals, we create the figure so that the visual weight of the lines reflect uncertainty (Hsiang 2013): denser colors indicate higher certainty while lighter colors indicate lower certainty.

[Fig 7 about here.]

As shown in the bottom panel, partner country's trade dependence on China is in general negatively correlated with BSA occurrences when China's trade dependence on the country is *low*. However, when China's trade dependence on the country is *high*, as shown in the top panel, partner country's trade dependence on China becomes positively correlated with BSA occurrences. Furthermore, denser lines suggest higher levels of certainty in the latter case than the more spread-out lines in the former case. In particular, moving from one standard deviation below the mean of partner country's trade dependence (1.47%), e.g. Luxembourg's trade dependence on China in 2011, to one standard deviation above the mean of partner country's trade dependence (15.14%), e.g. Peru's trade dependence on China in 2009, increases the probability of BSA occurrences by on average 15.56% when all other covariates are held constant. In short, the probability that a country enters into a BSA with China increases as it becomes more trade dependent on China. However, this relationship exists only when China is also highly trade dependent on the partner country, which shows strong support for our trade interdependence hypothesis.

Turning to key *de facto* FDI dependence covariates, although the coefficient for the FDI dependence interaction term is statistically significant across models, the coefficients for the constitutive terms are not. Further investigation with simulated predicted probabilities, as shown by the top panel in Figure 8, indicate that partner's FDI dependence on China actually has a U-shaped relationship with BSA occurrence probabilities even when China's FDI dependence on the partner country is high. Therefore, our FDI interdependence hypothesis finds support only when China's FDI dependence on partner is high and that partner's

FDI dependence on China also exceeds a certain threshold, i.e. around 5%, which is higher than the median value of partner country FDI dependence on China (1.31%). Furthermore, levels of uncertainty also increase at higher levels of partner's FDI dependence as indicated by the more widely spread-out lines. Therefore, this partial support for our *de facto* direct investment Hypothesis 1b should be read with caution due to higher levels of uncertainty.

[Fig 8 about here.]

[Fig 9 about here.]

Shifting focus to key *de jure* integration covariates, we find that PTAs are positively associated with BSA occurrences and statistically significant across model specifications while BITs are positively associated with BSA occurrences and statistically significant in the full model, which suggests support for our Hypotheses 2a and 2b. In particular, simulated first differences based on the fitted full model suggest that countries having PTAs with China are on average 16.41% more likely to have BSAs with China compared to countries that do not. Countries having BITs with China are on average 17.58% more likely to have BSAs with China.

In terms of our control covariates, we find that SCO membership or observer status, GDP per capita, and GDP growth are all positively correlated with the probability of BSA occurrences. In particular, SCO members or observers are 26.1% more likely to have BSAs with China than non-members or non-observers indicating that geopolitical factors may also play an important role in BSA partnerships. Countries with GDP per capita one standard deviation above the mean (30122) are 15.9% more likely to have BSAs with China than those with GDP per capita one standard deviation under the mean (231). Countries with GDP growth levels one standard deviation above the mean (6.12) are 15.79% more likely to have BSAs with China than those with GDP growth levels one standard deviation under the mean (-17.55). Figure 9 summarizes and plots all covariate simulated first difference

estimates with 95% confidence intervals while Table 9 in the Appendix 2 provides further details of the estimates.[35]

Finally, Figure 10 compares the Receiver Operating Characteristic (ROC) curves for the *de facto* versus full model and the *de jure* versus full model, respectively. The ROC plot summarizes how well models for binary dependent variables fit the data.[36] Since curves closer to the upper right corner indicate better fit, the figure shows that the full model (solid curve) does a relatively better job fitting the data than both the *de facto*-only and *de jure*-only models (dashed curves).[37]

[Fig 10 about here.]

Robustness Checks

Alternative Resource Measures

In our models above, we included covariates for partner oil and coal production to address the potential bias created by China's demand for energy resources. One potential critique is that partner countries may not be willing or capable of exporting all the energy resources it produces. As a result, energy export statistics may be a more appropriate supply measure than production statistics. Additionally, China's demand for resources may not be limited to energy. China's demand for *raw materials* such as copper, iron, and potash may also bias our results in the same way as energy. To address these concerns, we fit a set of models using oil and coal export statistics instead and a set of models including partner copper, iron, and potash export as additional controls. All export statistics rely on UN Comtrade data. As shown in the first five columns of Table 7 in Appendix 2, all substantive results for our key covariates remain the same compared to the original full model.

Excluding Special Administrative Regions

In our dataset, we included Hong Kong and Macao as independent entities due to the former's important role in BSAs and the fact that both Special Administrative Regions (SARs) maintain their own currency. However, the level of autonomy the two SARs enjoy in terms of monetary policy may be debatable. Furthermore, since both SARs are also highly economic integrated with China, one may suspect that SARs are driving the results. To address this concern, we fit models excluding Hong Kong and Macao. As shown in columns 6 and 7 of Table 7, all substantive results for our key covariates remain the same.

Disaggregating Total Trade Dependence

In our operationalization, we choose to aggregate export and import dependence for our trade dependence measure. One potential critique is that it may be just export dependence or import dependence instead of total trade dependence that is driving BSA probabilities in dyadic relationships. For example, BSAs may be driven by China's import dependence on energy and raw material exporters or export dependence on large markets. To tease out the nuance, we fit models with trade dependence disaggregated by exports and imports. In specific, with two disaggregate measures (export and import dependence) and two parties (China and partner country), we fit four different models: export interdependence, import interdependence, partner's import dependence*China's export dependence, partner's export dependence*China's import dependence. As shown in columns 1 to 4 of Table 8 in Appendix 2, all substantive results remain consistent with our main findings regardless using measures of export dependence or import dependence. In particular, the probability that a country enters into a BSA with China increases as it becomes more export or import dependent on China. Furthermore, this relationship becomes even stronger when China is also highly export or import on the partner country, which again shows clear support for our trade interdependence hypothesis.

Temporal Dependence and Dynamic Probit Model

One potential critique about our use of rare events logit models is that the outcome of interest was treated as an independent data generating process across years. Our justification was that even though BSAs were usually signed as three-year agreements, BSAs could be terminated at any time by either party and thus BSA status between dyads can be assumed to be independent across years. However, one may also argue that the probability of having a BSA in the current year would be *conditional* on the existence of a BSA in the previous year, which violates the assumption of temporal independence. For example, a partner country that had BSAs with China in the previous year may be *more* likely to have a BSA with China in the current year due to the continuance of three-year BSAs that have not expired or the renewal of BSAs for those that have. On the other hand, a partner country that does not have a BSA with China in the previous year, may be *less* likely to have a BSA with China in the current year due to costs of negotiation. Furthermore, explanations for the two dynamic processes, i.e. *transitions* to BSAs and BSA *continuance*, may be very different and should be modeled separately instead of lumped together as done in the rare events logit models.

To address such concerns, we employ dynamic probit models, which are standard in the democracy literature for modeling various transition probabilities into and out of democracy (Przeworski, Alvarez, Cheibub, and Limongi 2000; Ahlquist and Wibbels 2012). Parallel to discussions about explaining democratization and democratic survival, our outcome of interest can also be subsetted into explaining *transition* to BSAs versus BSA *continuance*. If one is more interested in explaining the former than the latter, presumably because all of China's BSAs were extended up to this point except the agreement with Belarus, then one can treat transitions to BSAs as a first-order Markov processes with the dynamic probit model formally specified as the following:

$$Pr(BSA_{it+1} = 1|BSA_{it}, \boldsymbol{X_{it}}) = \Phi(\boldsymbol{\beta X_{it}} + \boldsymbol{\alpha X_{it}} BSA_{it}) \tag{4}$$

where the probability that a country has a BSA with China given the country not having a BSA with China in the previous period is the outcome of interest with i and t indexing countries and years, respectively. $\boldsymbol{X_{it}}$ is a vector of key covariates. Φ is the standard Normal Cumulative Density Function (CDF). $\boldsymbol{\beta}$ and $\boldsymbol{\alpha}$ are coefficient vectors associated with vector $\boldsymbol{X_{it}}$ in equation (4).

The intuition of using dynamic probit models is that $\boldsymbol{\beta}$ describes the effect of a covariate on the probability of transition to BSAs, i.e. the probability a country has a BSA with China given that it did not have a BSA with China in the previous period. This is because the second term on the right-hand side of equation (4), the term with $\boldsymbol{\alpha}$ coefficients, drops out when a country did not have a BSA with China in the previous period due to $\text{BSA}_{it} = 0$. Alternatively, the probability of BSA continuance is derived from $\boldsymbol{\beta} + \boldsymbol{\alpha}$ since $\text{BSA}_{it} = 1$. Other transition probabilities such as BSA expiration can also be easily derived from the model.

As shown in column 5 of Table 8, if we narrow the main outcome of interest from BSA ocurrences to just transitions to BSAs, substantive findings for key trade dependence covariates remain the same while *de jure* economic integration covariates disappear. This suggests that while both *de facto* trade interdependence and *de jure* economic integration represented by PTAs and BITs are associated with higher probabilities of BSA occurrences, if one examines the subset of countries in our dataset that *transitioned* to BSAs, trade interdependence is the main predictor.

Concluding Remarks

This paper's primary goal has been to explain why China and its partner countries have negotiated bilateral currency swap arrangements (BSAs) designed to promote cross-border trade and direct investment in RMB. We develop and test a joint supply and demand side model of BSA cooperation where both *de facto* economic interdependence and *de jure* economic integration increase joint gains to participants and, therefore, increase the probability of dyadic BSA occurrences. Our empirical analysis finds strong support for *de facto* trade interdependence and *de jure* economic integration hypotheses while finding partial support for *de facto* FDI interdependence.

These results are important from both an economic and a political economic perspective. As we discussed in our introduction, there is a growing debate in the literature on the international currency system about the likelihood that the RMB will one day challenge the dollar's dominance. This study finds evidence of a demand-side component to RMB internationalization by showing that countries increasingly reliant on China as a trading or direct investment partner and those with existing preferential trade and investment agreements are more likely to sign BSAs with the PBC. While the process is still in its early stages, evidence of demand for international use of the RMB in trade is a positive sign for the currency's prospects as a key global currency and a potential rival to the dollar. However, these findings should still be interpreted with care as currency internationalization encompasses far more than simply a trade settlement role. Our findings say nothing about the RMB's potential in global financial markets or as an international reserve currency. Regardless of the broader internationalization debate, China stands to benefit if RMB-based trade continues to grow over the rest of this decade as a result of supply and demand-side factors. Specifically, Chinese banks will benefit from increased trade and direct investment financing opportunities and firms in China will benefit from the increased efficiency that comes with invoicing and settling trade in their home currency. Such gains may become increasingly important to

offset the effects of the PBC's exchange rate regime liberalization efforts (an issue of great interest to U.S. policymakers) which have allowed the RMB to gradually appreciate recently, adversely impacting these firms' international competitiveness.

Finally, to our knowledge, this study is the first of its kind investigating the factors that contribute to BSA cooperation for the purpose of promoting trade and investment settlement in local currencies. As we discussed in the paper, by reducing additional barriers to trade and investment such as liquidity and exchange rate risks, BSAs can be layered onto existing PTAs and BITs as natural complements to the goals of these arrangements. While China has built the largest system of BSAs for these purposes, there are signs other countries may be catching on to the benefits of BSAs. For instance, from 2009 to 2012 Brazil and Argentina maintained a $1.5 billion local currency BSA. In 2012, India signed a $2 billion local currency BSA with the South Asian Association for Regional Cooperation (SAARC) countries.[38] As China continues to expand its use of BSAs, other country pairs with close trade and direct investment ties will likely take note of the benefits of such agreements and explore the possibility of initiating their own schemes.

Notes

[1]As of October 2013.

[2]An alternative way to typologize the private use of international currencies is to divide up its use into three general categories. The first is in the area of international trade where a currency may be used for trade pricing, invoicing, and settlement. A second area is in international debt markets where a currency may be used for financing and investment purposes. The final area is international use of a currency in foreign exchange markets as a payment vehicle (Hongbin and Junwei 2009:3).

[3]Although trade invoicing and trade settlement represent two distinct international roles for a currency (unit of account and medium of exchange) and, hence, there is no guarantee that a firm invoicing its goods in a particular currency will use the same money to settle cross-border trade, in most cases that is the practice (Yu 2012:8; Friberg and Wilander 2008:68). Consequently, patterns of trade invoicing and settlement tend to be highly correlated.

[4]Unfortunately, we were unable to locate a comparable study or even basic data on the currency composition of FDI.

[5]According to data from the U.S. Commerce Department released February 2013, China surpassed the U.S. to become the world's largest trading state in 2012.

[6]Moving to a more market based currency policy is something that has been on Beijing's mind for more than just a few years now, however. In fact, it was all the way back in 1993 when China first hinted that it planned to achieve full RMB convertibility, at the time even specifying when the goal would be achieved: the year 2000. Slowly, the government began implementing measures that moved toward achieving this goal. However, this lasted only a few years until the Asian Financial Crisis in 1997-1998 which ultimately led the government to back off its timeline (Bottelier and Dadush 2011).

[7]The aim of this track is to encourage foreigners to hold RMB. Central to this component of Beijing's currency policy is the maturation of Hong Kong as an offshore financial hub for RMB trading and deposits. For more detail on this, see (Prasad and Ye 2012).

[8]Data on cross-border RMB use gathered from the PBC's quarterly monetary policy reports (MPRs). For full text of all cited MPRs, please see `http://www.pbc.gov.cn/publish/english/957/index.html`.

[9]Data representing the percentage of Chinese trade settled in RMB based on authors' calculations using data reported by the PBC and U.N. Comtrade quarterly data.

[10]This may have been related to the PBC's concerns about inflation in 2009 and 2010 which were quite high. The monetary authority was concerned that an influx of RMB receipts from overseas importers of Chinese goods would further increase the volume of currency sloshing around the economy and increase the inflationary pressures. According to Bottelier and Dadush (2011) this explains why China waited so long to expand a pilot invoicing and settlement program (described in the next footnote) beyond its second phase of 20 provinces. Concerns about inflation abated somewhat in 2011 which may have led the PBC to relax its position on inbound RMB receipts. It may also be related to the fact that foreigners are especially eager to accept RMB as payment since the currency is expected to appreciate (Garber 2011).

[11]The program was designed to phase in a process whereby foreign importers and exporters are permitted to settle their trade transactions in RMB with mainland Chinese trading partners. The program initially included five major trading cities in mainland China which together accounted for 45 percent of China's total trade in 2008. At its start, only companies in Hong Kong and Macao were allowed to settle trade in RMB with several hundred selected firms in these cities via a select number of participant banks in mainland China. After a period of incremental expansion the program fully matured to include all of China's provinces in August 2011 (People's Bank of China 2011:11). Under this program, any foreign trading enterprise can receive RMB as the trade settlement currency when it exports to Chinese firms; conversely, a foreign firm can also choose to use RMB to pay for imports from China. Three channels exist through which RMB cross-border trade can be settled: one via the Chinese mainland and two via off-shore hubs. Via the first channel, any foreign bank that acts as an overseas importer and/or exporter can serve as a participating bank (PB) and conduct an RMB settlement transaction with a Mainland Correspondent Bank (MCBs). MCBs are incorporated banks selected by the PBC to conduct international settlement business. MCBs are permitted to buy and sell RMB to PBs within a set quota determined by the PBC. The second and third channels available are off-shore options where PBs can conduct an RMB settlement transaction with the two official clearing banks: Bank of China, Hong Kong (BOCHK) and the Industrial and Commercial Bank of China (ICBC) in Singapore.

[12]Beginning in December 2011, China took one small step in this direction when it launched the so-called "Renminbi Qualified Foreign Institutional Investor" (RQFII) scheme which has since been incrementally expanded. In short, RQFII allows foreign portfolio investment in renminbi securities issued in mainland China with funds raised in Hong Kong. Chinese authorities enforced a strict aggregate investment quota of 20 billion RMB or about $3 billion. This quota has since been increased to 270 billion RMB, or around $43 billion. Still, the strictly enforced quota as well as the approval process has resulted in relatively tiny sums of renminbi securities issued inside China. Based on the PBC's 2012 Q3 Monetary Policy Report, the first

three-quarters of the year saw Chinese authorities approve a mere $9.18 billion under the RQFII scheme.

[13]The China-Japan swap line has technically been in existence since 2000 as part of ASEAN+3's Chiang Mai Initiative. However, in February 2012 the two countries reached a special agreement to use a portion of the existing BSA to settle trade in local currencies which is why we include it in our analysis here.

[14]While the PBC reported reaching a swap agreement with Russia on June 23, 2011, the announcement did not specify the size of the arrangement. This is the only BSA where the PBC did not make such information public.

[15]In light of several years of expansionary monetary policy from the Federal Reserve, Chinese authorities have expressed concern about the long-term value of these investments. These concerns came to a head in early 2009 when Chinese Premier Wen Jiabao publicly fretted: "We have made a huge amount of loans to the United States. Of course we are concerned about the safety of our assets. To be honest, I'm a little bit worried. I would like to call on the United States to honor its words, stay a credible nation and ensure the safety of Chinese assets" (Branigan 2009).

[16]Similarly, regarding the trade and investment invoicing and settlement program mentioned above, the PBC explains "The pilot program was expanded in response to calls from domestic and overseas markets" (People's Bank of China 2010:17).

[17]We are indebted to Jerry Cohen for this analogy.

[18]In a recent study on this topic, Chor and Manova (2012) find that tighter national credit conditions during the crisis were associated with a decline in exports to the U.S. This provides some of the first empirical support for the claim that tightening credit contributed to the collapse of world trade in 2009.

[19]Of course, this risk would be greater if China did not so carefully manage the RMB's exchange rate relative to the dollar. For Chinese enterprises, using the dollar to settle trade carries less exchange risk because of the PBC's exchange rate policy. Nonetheless, the RMB has once again entered a period of managed appreciation against the dollar, so the relationship is not entirely stable and exchange risk–however muted–is present and increasing.

[20]In 2008, the dollar's exchange rate spiked dramatically during the crisis. This volatility added to the exchange risk associated with using the dollar as a third party invoicing and settlement currency (McCauley and McGuire 2009).

[21]Studies on how firms mitigate foreign exchange risk have identified two main types of hedges used by firms: financial and operational. The former relies on financial market instruments including foreign currency

debt and exchange rate derivatives; the latter through the organization of the exporting firm. For more on this topic see Allayannis, Ihrig, and Weston (2013) and Ito, Koibuchi, Sato, and Shimizu (2013).

[22]This brochure can be found at the following address: http://www.bnm.gov.my/documents/2011/Renminbi_Brochure.pdf.

[23]In other words, lobbying–if it occurs–is epiphenominal to our explanation. The brochure quoted above is an instrumental example of a central bank explaining the benefits of RMB settlement to local firms. This is a *top down* promotion of the program and anecdotally supports our assumption.

[24]The Hong Kong Dollar (HKD) and the Macau Pataca (MOP), respectively.

[25]For UN comtrade data, please see http://comtrade.un.org/.

[26]We lump FTAs under PTAs. China currently has FTAs with ASEAN members, Chile, Costa Rica, New Zealand, Pakistan, Peru, Singapore, Hong Kong, and Macao. China has PTAs with Bangladesh, India, Lao, South Korea, and Sri Lanka.

[27]Please see http://fta.mofcom.gov.cn/english/index.shtml for trade agreement data and http://www.unctadxi.org/templates/DocSearch____779.aspx for BITs data.

[28]SCO members currently includes China, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, and Uzbekistan while observers include Afghanistan, India, Iran, Mongolia, and Pakistan. Please see http://www.sectsco.org/EN123/ for details.

[29]This is precisely what most analysts believe was behind a $20 billion loan from China to Venezuela in 2010, half of which was denominated in RMB. Venezuela's repayment of the debt, according to the terms of the loan, was to be made in oil. In short, this amounted to an RMB-based oil invoicing and settlement scheme.

[30]Please see http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=53&aid=1.

[31]For data sources, please see http://data.worldbank.org/data-catalog/world-development-indicators for GDP, https://pwt.sas.upenn.edu/ for GDP per capita, and http://www.cepii.fr/anglaisgraph/bdd/distances.htm for distance.

[32]Please see http://gking.harvard.edu/amelia/.

[33]The most recent BSAs between China and the United Kingdom (June 2013), Hungary (September 2013), and Albania (September 2013) are not included in our analysis since most 2012 data for our covariates are not available yet. This brings the total number of partner countries included in our analysis down to 21.

[34]In particular, a non-SCO country that does not have PTAs and BITs with China while holding all continuous variables at their mean.

[35]Calculations based on simulated first differences for the full rare event logit model. If one standard deviation below the mean of a variable doesn't exist in the data, it is replaced with the minimum value of the variable.

[36]"The ROC plot evaluates the fraction of 0's and 1's correctly predicted for every possible threshold value at which the continuous Prob($Y = 1$) may be realized as a dichotomous prediction." (Imai, King, and Lau 2007)

[37]If we arbitrarily set 0.5 as the threshold value in which predicted probabilities greater than 0.5 is counted as predicting BSAs while predicted probabilities equal or less than 0.5 is counted as predicting absent of BSAs, our percentage correctly predicted (PCP) is 93.46% with the full model.

[38]These include Afghanistan, Bangladesh, Bhutan, Maldives, Nepal, Pakistan and Sri Lanka.

Appendix 1: Data Operationalization, Sources, Descriptive Statistics

[Table 4 about here.]

[Table 5 about here.]

Appendix 2: Fitted Model Parameter Estimate Details

[Table 6 about here.]

[Table 7 about here.]

[Table 8 about here.]

[Table 9 about here.]

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	Medium of Exchange	*Unit of Account*	*Store of Value*
Private	trade settlement, foreign exchange trading	invoicing trade financial transactions	investment currency substitution
Official	vehicle for foreign exchange intervention	anchor for pegging local currency	reserve currency

TABLE 1. The Roles of International Currency

Country	*Signature Date*	*Extension Date*	*Expiration Date*	*Amount (bn RMB)*
Korea	December 2008	October 2011		180; 360
Hong Kong	January 2009	November 2011		200; 400
Argentina	March 2009		(?)	70
Indonesia	March 2009		(?)	20
Belarus	March 2009		August 2012	20
Malaysia	April 2009	February 2012		80; 180
Iceland	June 2010			3.5
Singapore	July 2010	March 2013		150; 300
New Zealand	April 2011			25
Uzbekistan	April 2011			0.7
Mongolia	May 2011	March 2012		5; 10
Kazakhstan	June 2011			7
Russia	June 2011			*unknown*
Thailand	December 2011			70
Pakistan	December 2011			10
U.A.E.	January 2012			35
Japan	February 2012			20
Turkey	February 2012			1.6
Australia	March 2012			200
Ukraine	June 2012			15
Brazil	June 2012			190
United Kingdom	June 2013			200
Hungary	September 2013			10
Albania	September 2013			2

TABLE 2. List of PBC's BSA Partner Countries

Hypothesis	*Covariate*	*Coef.*	*Predicted Sign*
De facto	Partner Trade Dependence*China Trade Dependence	λ_1	+
	Partner Trade Dependence	λ_2	+
	China Trade Dependence	λ_3	+
	Partner FDI Dependence*China FDI Dependence	λ_4	+
	Partner FDI Dependence	λ_5	+
	China FDI Dependence	λ_6	+
De jure	PTAs	λ_7	+
	BITs	λ_8	+

TABLE 3. Predicted Relationship Between Key Predictors and BSA Occurrence Probability

Variable	*Operationalization*	*Source*
Bilateral Swap Agreements	BSA occurred between China and partner country in a given year? 1 = yes, 0 = no	People's Bank of China
Partner's Trade Dependence	Log partner's total trade (goods exports and imports) with China divided by partner's total trade with the world in given year	Constructed by authors based on UN Comtrade data
China's Trade Dependence	Log China's total trade (goods exports and imports) with partner country divided by China's total trade with the world in given year	Constructed by authors based on UN Comtrade data
Partner's FDI Dependence	Log partner's total FDI flows (absolute net inflows and outflows) with China divided by partner's total FDI flows with the world in given year	Constructed by authors based on China Statistical Yearbook and UNCTAD data
China's FDI Dependence	Log China's total FDI flows (absolute net inflows and outflows) with partner countries divided by China's total FDI flows with the world in given year	Constructed by authors based on China Statistical Yearbook data
PTAs	FTA or PTA in effect between China and partner country in a given year? 1 = yes, 0 = no	Ministry of Commerce, China
BITs	Bilateral Investment Treaties (BIT) in effect between China and partner in a given year? 1 = yes, 0 = no	UNCTAD
SCO	Partner country member or observer status in SCO? 1 = yes, 0 = no	SCO website
Oil Production	Log partner country oil production (million barrels per day)	US EIA
Coal Production	Log partner country coal production (billion short tons)	US EIA
Oil Exports	Log partner country oil exports to the world (billion USD; commodity code 27)	UN Comtrade, Classification HS96
Coal Exports	Log partner country coal, briquettes, ovoids etc., made from coal exports to the world (billion kg; commodity code H1-2701)	UN Comtrade, Classification HS96
Copper Exports	Log partner country copper ores and concentrates exports to world (million kg; commodity code H1-2603)	UN Comtrade, Classification HS96
Iron Exports	Log partner country iron ores and concentrates, roasted iron pyrites exports to world (billion kg; commodity code H1-2601)	UN Comtrade, Classification HS96
Potash Exports	Log partner country potassium hydroxide (caustic potash) exports to world (million kg; commodity code H1-281520)	UN Comtrade, Classification HS96
GDP	Log GDP in constant 2000 US dollars	WDI, World Bank
GDP per capita	Log PPP Converted GDP Per Capita (Chain Series), at 2005 constant prices	PWT 7.1
GDP Growth Rate	GDP annual growth (%)	WDI, World Bank
Bilateral Distance	Kilometers between China and partner country (thousands)	CEPII

TABLE 4. Variables, Operationalization, and Sources

Variable	*Mean*	*Min*	*Max*	*Obs.*	*#NA*
Bilateral Swap Agreements (by end of 2012)	0.07	0.00	1.00	688	0
Partner's Trade Dependence	0.08	0.00	0.48	522	166
China's Trade Dependence	0.01	0.00	0.14	685	3
Partner's Export Dependence	0.03	0.00	0.34	525	163
Partner's Import Dependence	0.06	0.00	0.36	528	160
China's Export Dependence	0.00	0.00	0.10	685	3
China's Import Dependence	0.00	0.00	0.06	685	3
Partner's FDI Dependence	0.14	0.00	3.92	325	363
China's FDI Dependence	0.01	0.00	0.59	338	350
PTAs	0.12	0.00	1.00	688	0
BITs	0.56	0.00	1.00	688	0
SCO Member or Observer	0.06	0.00	1.00	688	0
Oil Production (million barrels per day)	0.47	0.00	11.15	688	0
Coal Production (billion short tons)	0.03	0.00	1.17	590	98
Oil Exports (billion USD)	15.32	0.00	307.37	515	173
Coal Exports (billion kg)	12.10	0.00	323.59	329	359
Copper Exports (million kg)	237.10	0.00	3144.39	238	450
Iron Exports (billion kg)	13.12	0.00	465.22	302	386
Potash Exports (million kg)	6.18	0.00	167.44	260	428
GDP (billion USD)	225.73	0.21	11744.20	659	29
GDP per capita (2005 international dollar)	13477.80	230.69	136248.14	510	178
GDP Growth Rate	1.69	-17.55	24.12	655	33
Bilateral Distance (thousand km)	8.89	0.81	19.30	688	0

TABLE 5. Descriptive Statistics

	De facto	*De jure*	*Full Relogit*
Intercept	2.31 (11.21)	-15.18 (4.32)***	-3.06 (10.68)
log(P. Trade Dependence)	2.44 (0.77)**		3.01 (0.81)***
log(CN Trade Dependence)	0.93 (0.44)*		0.93 (0.53)$^{\wedge}$
log(P. Trade Dep.):log(CN Trade Dep.)	0.29 (0.09)**		0.37 (0.11)***
log(P. FDI Dep.)	0.40 (0.38)		0.44 (0.43)
log(CN FDI Dep.)	0.35 (0.34)		0.40 (0.30)
log(P. FDI Dep.):log(CN FDI Dep.)	0.07 (0.03)**		0.07 (0.03)*
PTAs		2.03 (0.48)***	1.60 (0.59)**
BITs		0.63 (0.58)	1.64 (0.71)*
SCO	1.98 (1.21)	1.92 (0.98)*	2.19 (1.04)*
log(Oil Production)	0.09 (0.11)	0.08 (0.12)	0.18 (0.12)
log(Coal Production)	0.06 (0.06)	0.05 (0.06)	0.04 (0.06)
log(GDP)	-0.03 (0.33)	0.16 (0.19)	0.04 (0.34)
log(GDP per capita)	0.46 (0.30)	0.76 (0.28)**	0.65 (0.29)*
GDP Growth Rate	0.10 (0.05)*	0.09 (0.05)$^{\wedge}$	0.10 (0.05)*
Bilateral Distance	-0.02 (0.09)	-0.03 (0.10)	0.01 (0.09)
Num obs.	688	688	688
AIC	260.51	260.53	237.78

(*Notes.*$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\wedge}p < 0.1$.
Bilateral Swap Agreements as dependent variable. HAC standard errors in parentheses.
Rare events logit weighting performed with tau = 0.08.
Results for key covariates are similar with or without HAC standard errors.)

TABLE 6. Parameter Estimates and Robust Standard Errors

	Oil Exp.	*Coal Exp.*	*Copper*	*Iron*	*Potash*	*Exclude HKG*	*Exclude MAC*
Intercept	−6.34 (11.36)	−5.21 (11.19)	−5.33 (11.26)	−2.58 (10.79)	−4.12 (10.59)	−4.67 (11.59)	−6.03 (11.19)
log(P. Trade Dependence)	3.16 (0.79)***	3.04 (0.83)***	2.95 (0.82)***	3.03 (0.80)***	2.91 (0.86)***	2.96 (0.86)***	2.79 (0.77)***
log(CN Trade Dependence)	0.82 (0.58)	0.88 (0.55)	0.90 (0.54)$^{\wedge}$	0.96 (0.56)$^{\wedge}$	0.95 (0.55)$^{\wedge}$	0.88 (0.56)	0.67 (0.57)
log(P. Trade Dep.):log(CN Trade Dep.)	0.36 (0.11)**	0.36 (0.11)**	0.37 (0.11)***	0.37 (0.11)***	0.36 (0.12)**	0.36 (0.12)**	0.31 (0.11)**
log(P. FDI Dep.)	0.33 (0.37)	0.46 (0.43)	0.44 (0.42)	0.46 (0.46)	0.43 (0.44)	0.43 (0.41)	0.43 (0.43)
log(CN FDI Dep.)	0.34 (0.32)	0.35 (0.33)	0.37 (0.30)	0.40 (0.29)	0.37 (0.31)	0.35 (0.33)	0.42 (0.30)
log(P. FDI Dep.):log(CN FDI Dep.)	0.06 (0.03)*	0.07 (0.03)*	0.07 (0.03)*	0.07 (0.03)*	0.07 (0.03)*	0.07 (0.03)*	0.07 (0.03)*
PTAs	1.46 (0.64)*	1.77 (0.62)**	1.59 (0.63)*	1.65 (0.61)**	1.61 (0.60)**	1.61 (0.59)**	1.70 (0.59)**
BITs	1.58 (0.73)*	1.55 (0.71)*	1.55 (0.70)*	1.65 (0.72)*	1.52 (0.71)*	1.67 (0.73)*	1.41 (0.69)*
SCO	2.19 (1.00)*	2.31 (1.00)*	2.16 (1.00)*	2.18 (1.03)*	2.11 (1.09)$^{\wedge}$	2.19 (1.02)*	2.16 (1.03)*
log(Oil Production)		0.16 (0.12)	0.16 (0.13)	0.21 (0.17)	0.17 (0.13)	0.19 (0.12)	0.18 (0.13)
log(Oil Exports)	0.16 (0.11)						
log(Coal Production)	0.05 (0.06)		0.02 (0.06)	0.05 (0.06)	0.04 (0.06)	0.04 (0.06)	0.04 (0.06)
log(Coal Exports)		0.05 (0.04)					
log(GDP)	0.06 (0.35)	0.06 (0.34)	0.09 (0.35)	0.02 (0.34)	0.10 (0.34)	0.08 (0.35)	0.08 (0.35)
log(GDP per capita)	0.58 (0.31)$^{\wedge}$	0.72 (0.32)*	0.67 (0.31)*	0.66 (0.29)*	0.66 (0.30)*	0.66 (0.29)*	0.75 (0.32)*
GDP Growth Rate	0.10 (0.05)*	0.10 (0.05)$^{\wedge}$	0.11 (0.05)*	0.10 (0.05)*	0.11 (0.05)*	0.10 (0.05)*	0.12 (0.05)*
Bilateral Distance	0.01 (0.10)	0.02 (0.09)	−0.01 (0.10)	0.02 (0.10)	0.01 (0.10)	0.01 (0.09)	0.00 (0.10)
log(Copper Exports)			0.05 (0.06)				
log(Iron Exports)				−0.02 (0.06)			
log(Potash Exports)					−0.04 (0.08)		
Num obs.	688	688	688	688	688	684	684
AIC	237.37	236.66	236.92	238.76	238.20	237.58	235.07

(*Notes.*$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\wedge}p < 0.1$.
Bilateral Swap Agreements as dependent variable. HAC standard errors in parentheses.
Rare events logit weighting performed with tau = 0.08.)

TABLE 7. Robustness Check Models I: Parameter Estimates and Robust Standard Errors

	Exp. Interdep.	*Imp. Interdep.*	*P. Imp*CN Exp*	*P. Exp.*CN Imp.*	*D.Probit*
Intercept	−9.61 (13.55)	−2.75 (13.28)	−3.70 (12.35)	−11.19 (13.95)	1.03 (5.18)
log(P. Trade Dependence)					1.31 (0.53)*
log(CN Trade Dependence)					0.43 (0.23)$^{\wedge}$
log(P. Trade Dep.):log(CN Trade Dep.)					0.15 (0.06)**
log(P. Exp. Dep.)	1.36 (0.47)**	0.36 (0.32)	0.34 (0.35)	0.98 (0.41)*	
log(CN Exp. Dep.)	0.00 (0.63)	−0.52 (0.56)	0.62 (0.54)	−0.46 (0.56)	
log(P. Import Dep.)	0.07 (0.50)	2.55 (1.17)*	2.93 (1.47)*	0.07 (0.49)	
log(CN Import Dep.)	0.13 (0.35)	1.18 (0.60)*	0.28 (0.37)	0.36 (0.42)	
log(P. Exp. Dep.):log(CN Exp. Dep.)	0.11 (0.04)**				
log(P. Imp. Dep.):log(CN Imp. Dep.)		0.29 (0.10)**			
log(P. Imp. Dep.):log(CN Exp. Dep.)			0.38 (0.18)*		
log(P. Exp. Dep.):log(CN Imp. Dep.)				0.06 (0.03)*	
log(P. FDI Dep.)	0.56 (0.43)	0.58 (0.45)	0.58 (0.44)	0.65 (0.41)	0.01 (0.30)
log(CN FDI Dep.)	0.53 (0.36)	0.55 (0.34)	0.50 (0.30)$^{\wedge}$	0.67 (0.34)$^{\wedge}$	0.22 (0.16)
log(P. FDI Dep.):log(CN FDI Dep.)	0.09 (0.03)**	0.09 (0.03)**	0.09 (0.03)**	0.11 (0.03)***	0.01 (0.03)
PTAs	1.41 (0.63)*	1.45 (0.65)*	1.51 (0.65)*	1.52 (0.63)*	0.49 (0.34)
BITs	1.22 (0.65)$^{\wedge}$	1.23 (0.64)$^{\wedge}$	1.32 (0.69)$^{\wedge}$	1.14 (0.61)$^{\wedge}$	0.54 (0.40)
SCO	2.19 (1.13)$^{\wedge}$	2.29 (1.12)*	2.19 (1.09)*	2.21 (1.15)$^{\wedge}$	0.94 (0.46)*
log(Oil Production)	0.09 (0.15)	0.09 (0.15)	0.07 (0.15)	0.10 (0.15)	0.07 (0.06)
log(Coal Production)	0.05 (0.07)	0.04 (0.07)	0.07 (0.07)	0.06 (0.07)	0.03 (0.03)
log(GDP)	0.27 (0.42)	0.15 (0.41)	0.21 (0.40)	0.30 (0.43)	−0.07 (0.16)
log(GDP per capita)	0.50 (0.27)$^{\wedge}$	0.57 (0.28)*	0.55 (0.28)$^{\wedge}$	0.49 (0.26)$^{\wedge}$	0.27 (0.16)$^{\wedge}$
GDP Growth Rate	0.10 (0.05)*	0.11 (0.05)*	0.10 (0.05)*	0.10 (0.05)*	0.04 (0.04)
Bilateral Distance	−0.01 (0.10)	−0.02 (0.11)	−0.01 (0.10)	−0.02 (0.10)	0.00 (0.04)
Num obs.	688	688	688	688	688
AIC	235.99	235.13	235.92	240.85	189.88

(*Notes.*$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\wedge}p < 0.1$.
Bilateral Swap Agreements as dependent variable. HAC standard errors in parentheses.
Rare events logit weighting performed with tau = 0.08.)

TABLE 8. Robustness Check Models II: Parameter Estimates and Robust Standard Errors

Covariate	*Estimates*	*2.5%*	*97.5%*
Log(Partner's Trade Dependence)	0.160	0.001	0.635
Log(China's Trade Dependence)	0.086	-0.885	0.859
Log(Partner's FDI Dependence)	0.034	-0.760	0.457
Log(China's FDI Dependence)	0.085	-0.297	0.375
PTAs	0.163	0.003	0.482
BITs	0.175	0.004	0.504
SCO	0.250	0.002	0.681
Log(Oil Production)	0.123	-0.007	0.598
Log(Coal Production)	0.025	-0.131	0.228
Log(GDP)	-0.009	-0.726	0.660
Log(GDP per capita)	0.157	0.001	0.629
GDP Growth	0.156	0.000	0.688
Distance (Thousand Km)	0.034	-0.089	0.266

(*Notes*. First difference as the difference in predicted probabilities when covariates are moved from one standard deviation under their mean to above their mean for continuous covariates or from 0 to 1 for dichotomous covariates while all other covariates are held constant.)

TABLE 9. First Difference Estimates with Simulated 95% Confidence Intervals

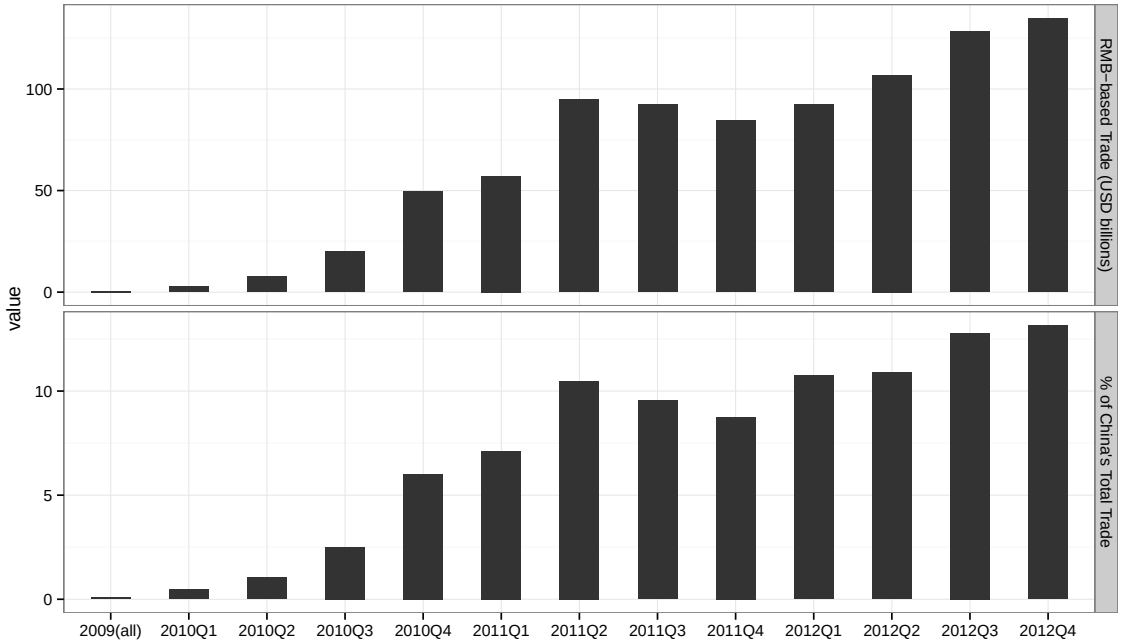

FIG 1. RMB Settlement of Cross-Border Trade

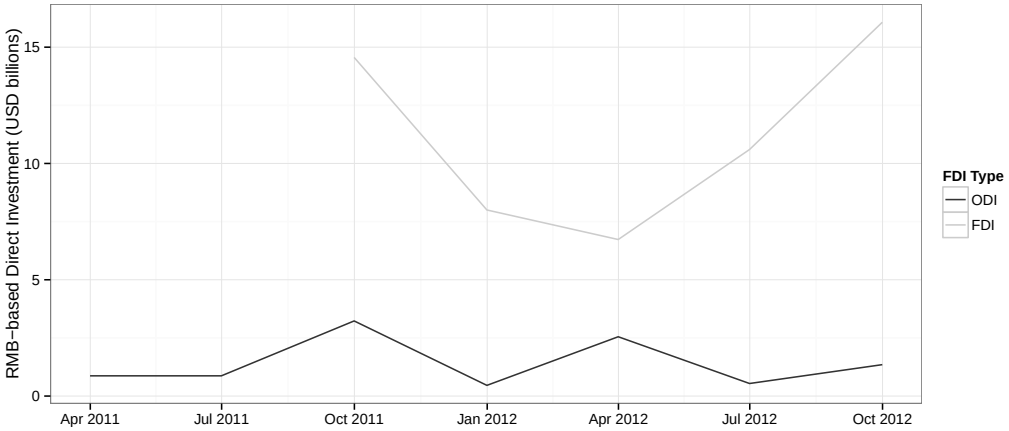

FIG 2. RMB Settlement of Outward and Inward Direct Investment

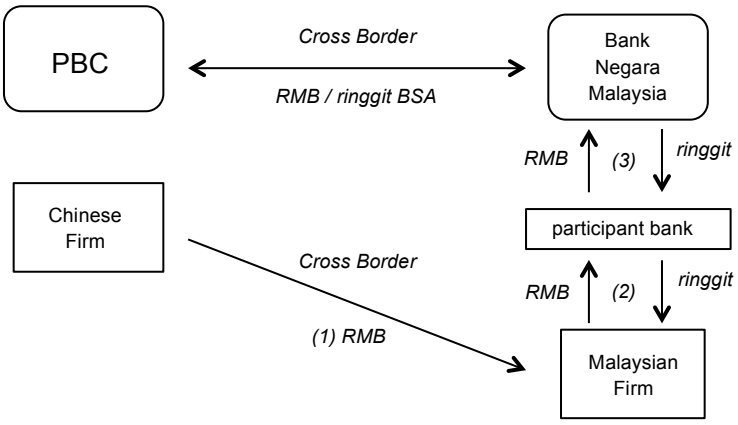

FIG 3. Mechanics of BSAs in RMB-based Trade Settlement

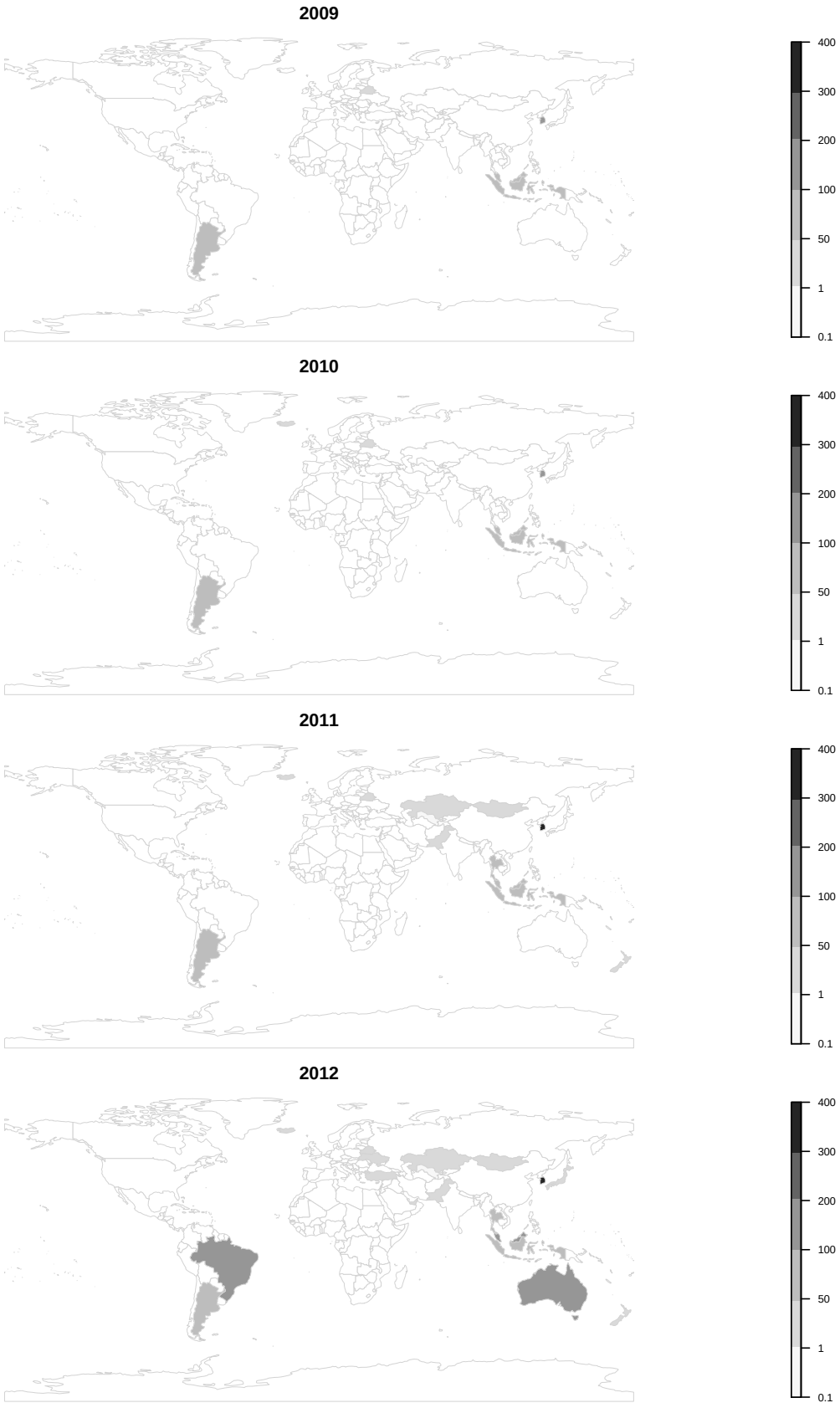

FIG 4. RMB Bilateral Swap Arrangement Countries by Swap Size (billions), 2009-2012

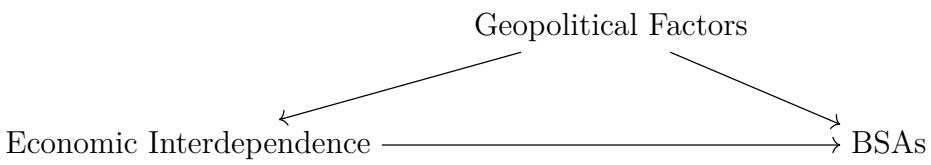

FIG 5. Directed Acyclic Graph

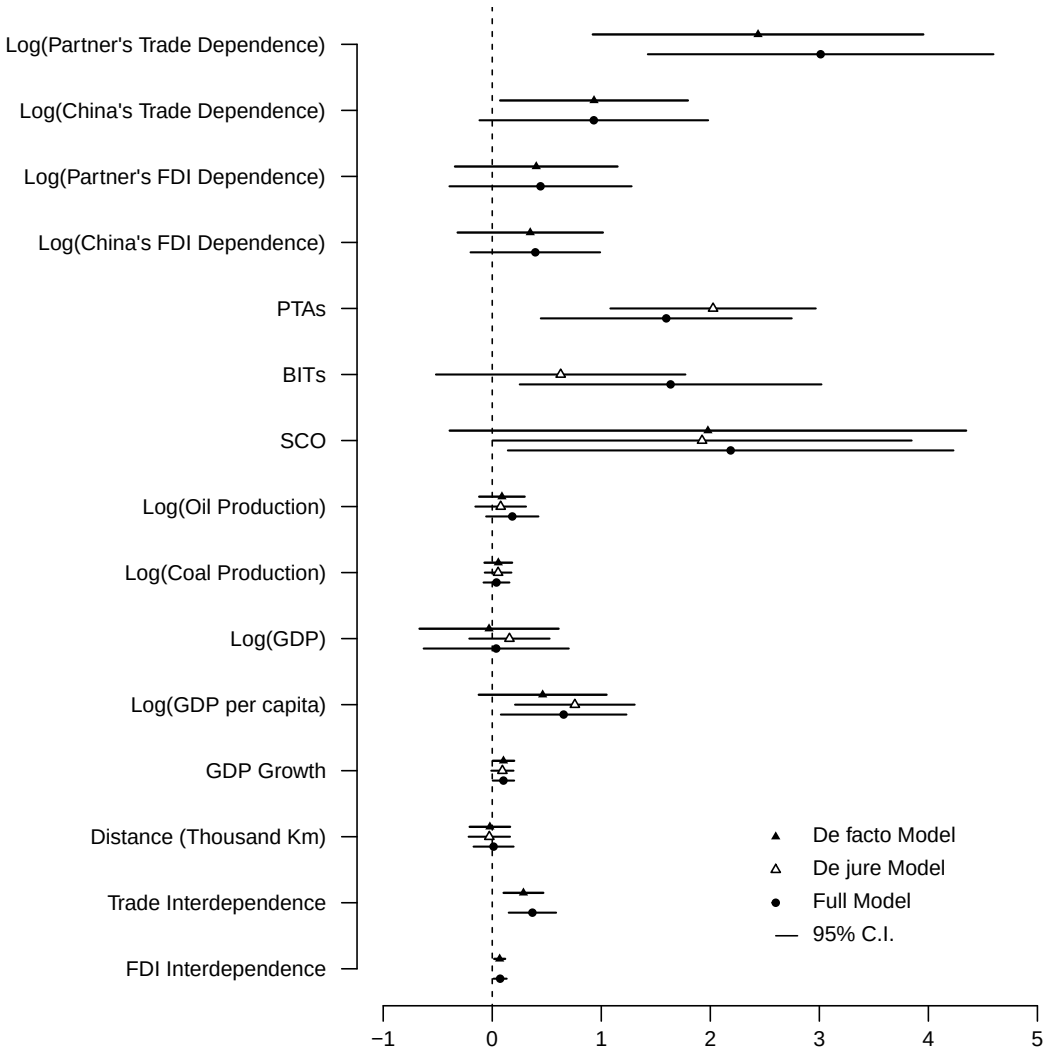

FIG 6. Coefficients Plot

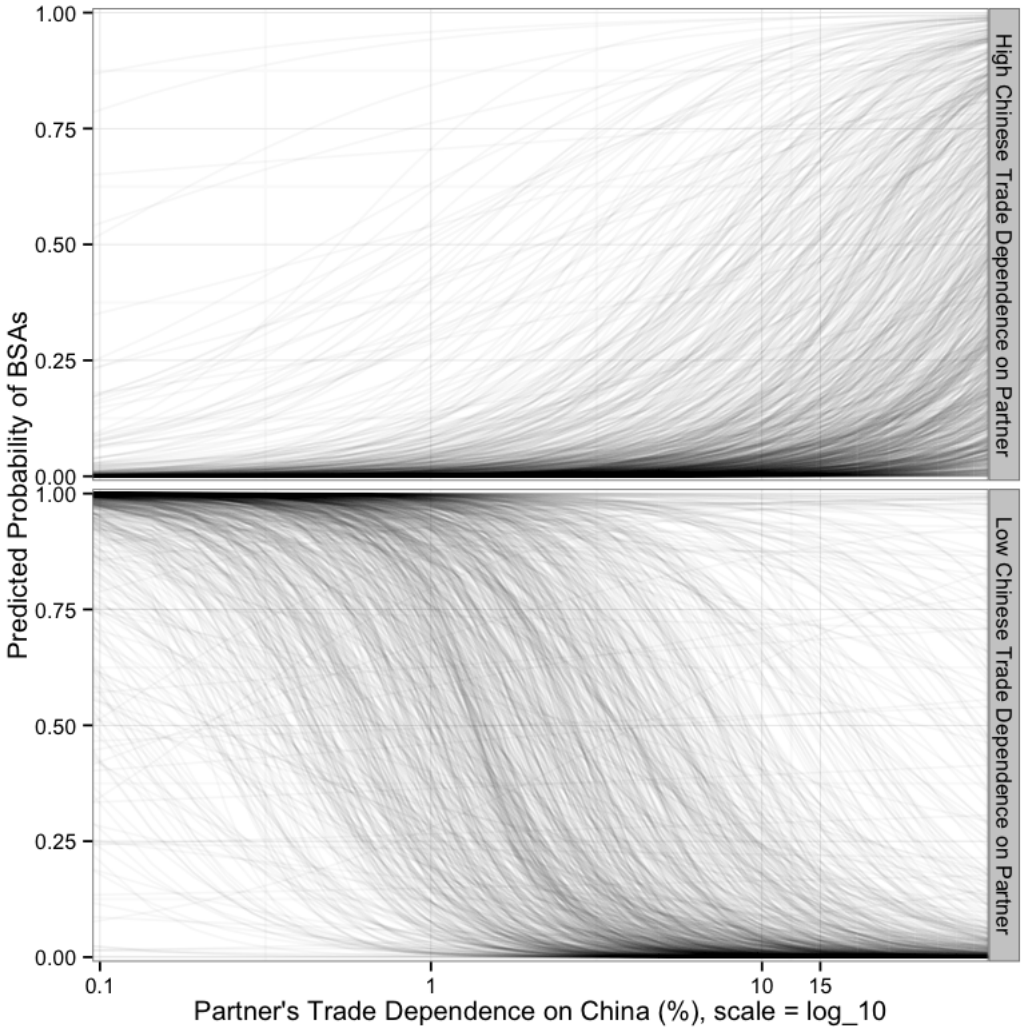

FIG 7. Partner's Trade Dependence on China and Simulated Predicted Probabilities of BSA Occurrences

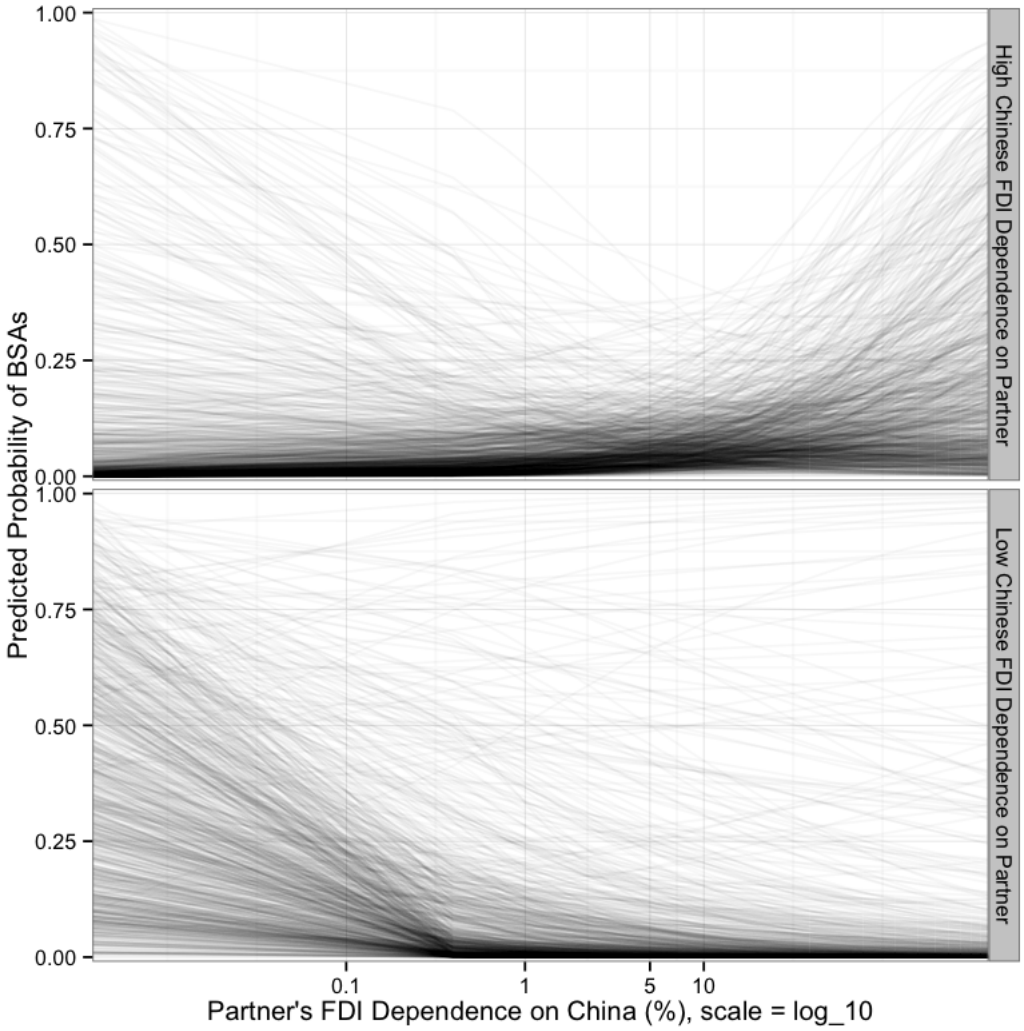

FIG 8. Partner's FDI Dependence on China and Simulated Predicted Probabilities of BSA Occurrences

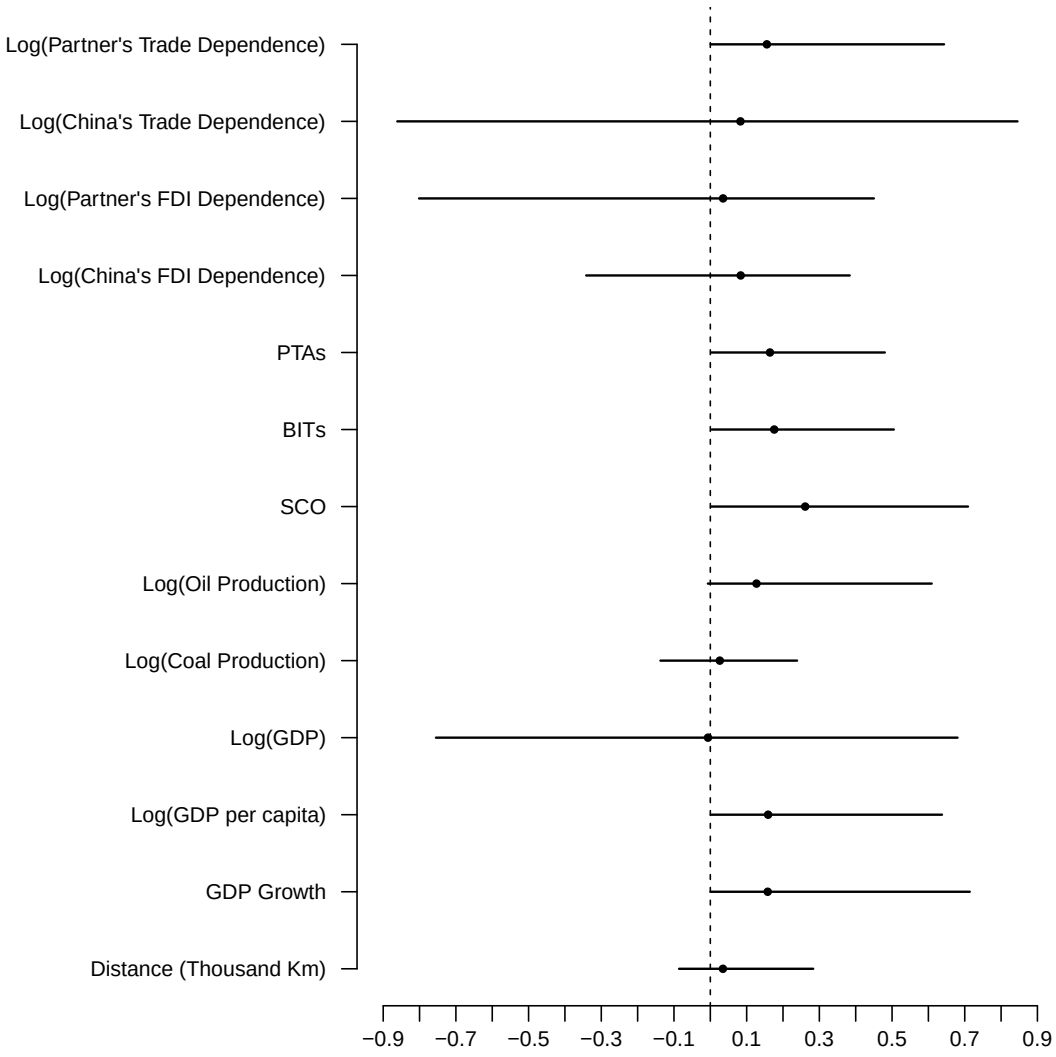

FIG 9. First Difference Estimates with Simulated 95% Confidence Intervals

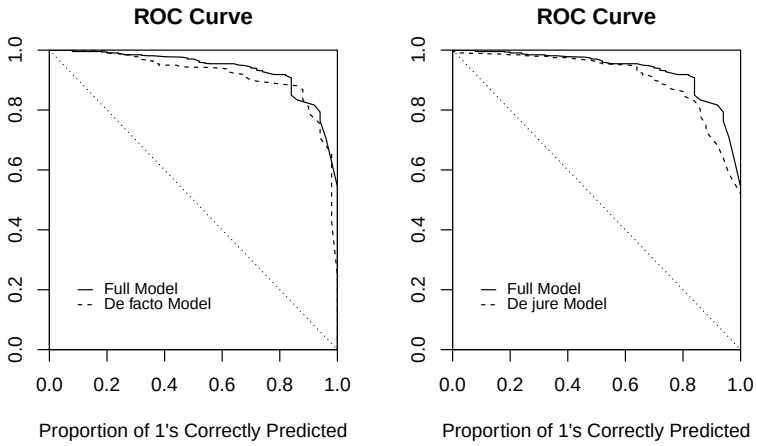

FIG 10. Rare Events Logit Model Fit: ROC Curve Comparisons