The Rise of the "Redback" and the People's Republic of China's Capital Account Liberalization: An Empirical Analysis of the Determinants of Invoicing Currencies

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Abstract

We investigate the determinants of currency choice for trade invoicing in a cross-country context while focusing on the link between capital account liberalization and its impact on the use of the renminbi (RMB). We find that while countries with more developed financial markets tend to invoice *less* in the US dollar, countries with more open capital accounts tend to invoice in either the euro or their home currency. These results indicate that financial development and financial openness are among the keys to challenging the US dollar dominance in general, and to internationalizing the RMB for the People's Republic of China (PRC). Our model also suggests that the share of the RMB in export invoicing should have been higher than the actually observed share of less than 10%. The underperformance of RMB export invoicing can be attributed to the inertia in the choice of currency for trade invoicing; once a currency is used for trade invoicing or settlements, it becomes difficult for traders to switch from one currency to another. This same phenomenon was also observed in the cases of the Japanese yen and the euro at their inceptions as international currencies. Our model predicts that the share of RMB invoicing for the PRC's exports will rise to above 25% in 2015 and above 30% in 2018, whether or not the PRC implements drastic financial liberalization. As the near future path of RMB use is also expected to be inertial, these forecasts are probably at the upper end of the actual path of RMB export invoicing.

JEL Classification: F32, F41

1. MOTIVATION

One of the key puzzles in international finance involves the question of which currencies are selected to be international currencies. In particular, the status of "international currency" confers both substantial privileges as well as burdens, although conventional wisdom places greater weight on the former. Before proceeding further, it is important to clearly identify what we mean by an international currency. Table 1 (adapted from Kenen [1983]) summarizes the various roles of an international currency.

Table 1: Roles of an International Currency

Function of Money	Governments	Private Actors
Store of value	International reserve holdings	Currency substitution (private dollarization)
Medium of exchange	Vehicle currency for foreign exchange intervention	Invoicing trade and financial transactions
Unit of account	Anchor for pegging local currency	Denominating trade and financial transactions

Source: Kenen (1983).

The table highlights the fact that there are several dimensions to consider in terms of the degree to which a currency fulfills the characterization of being international. One can distinguish between the roles of money, and to which actors these roles pertain to. Clearly, it is possible to fulfill some roles of an international currency while not fulfilling others.

With the rapid economic ascent of the People's Republic of China (PRC), in terms of sheer economic size and outsized role in trade flows, it is entirely natural that questions should arise regarding the evolution of the renminbi (RMB). The debate on the internationalization of the RMB has been largely speculative as the currency remained unconvertible, and capital controls were in place. With recent policy declarations and policy measures aimed at increasing the use of the RMB in trade invoicing and other transactions, the use of the RMB in international markets has risen significantly, making the goal of an international RMB increasingly less aspirational and more concrete.

That being said, it is clear that whatever progress is being made, it is of an uneven sort, with current initiatives focused on the medium of exchange dimension. As of the last quarter of 2012, 14% of the PRC's trade was settled in yuan, a significant increase from nil in 2009. As of the beginning of 2013, $1.9 billion of yuan-denominated bonds (i.e., "dim-sum" bonds) were in circulation. In 2012, the PRC accounted for 27% of the world's money supply, larger than the share of its GDP (in purchasing price parity [PPP]) of 8%. The PRC's borders are no longer sealed.

In contrast, in the dimension of use as a store of value, the rise of the RMB or "redback" is a potential challenge to the current international monetary system, which is heavily dependent on the US dollar. While the United States accounts for 20% of global output, 11% of trade, and 30% of financial assets trade, about 60% of global foreign exchange reserves are held in US dollars.

Many argue that such a dollar-centric international monetary system creates an unstable environment for the world economy by providing the US with privileged access to funds ("exorbitant privilege"), while constraining developing economies with the opposite effect (i.e., "original sin," or the inability to issue sovereign debt in their

own currency). As Eichengreen (2011) argues, a new international monetary system with multiple reserve currencies—the dollar, the euro, and the RMB—might be more stable than the current unipolar system. That is because the loss of exorbitant privilege by the US would discipline the nation's public finance.

The conventional wisdom holds that the arrival of such a multipolar international currency system is a long way off, although there are dissenters. With the RMB the only viable competitor amongst emerging market economies (Chinn 2012), the issue of internationalization of the RMB is now a global issue. Nonetheless, because most observers believe that major *reserve currency* status for the RMB is a long way off, we will focus particularly on the private actor role of an international reserve currency—its use in trade invoicing.[1]

Whether and how fast the RMB will become an international currency depend on some key points. First, how soon and in what ways the PRC implements two policies: allowing greater market determination of the value of the RMB, and liberalizing transactions of capital across its borders. The value of the currency needs to be able to fluctuate freely so that international investors can read signals from the market and consider portfolio strategy accordingly. Investors also need to be able to find it easy to acquire or redeem yuan-denominated bonds at their convenience in terms of both time and location. Both these conditions appear far off.

The PRC has been extremely cautious in implementing both external and internal financial liberalization.[2] The global financial crisis of 2008 and the euro debt crisis that followed have naturally enhanced reservations regarding the wisdom of financial liberalization by emphasizing the potential short-term costs of financial liberalization over the long-term gains (Kaminsky and Schmukler 2002). However, observers have also long pointed out the high degree of financial repression and the potential risk of financial losses associated with gross inefficiencies in the current system, all of which may be mitigated by financial liberalization. Considering how the country's financial system, long dominated by state-owned financial institutions and the government, impedes smooth transformation of saving to productive investment, further capital account liberalization is an inevitable policy choice for the PRC in the medium run. The question, however, is how orderly liberalization can proceed in order to avoid the tumultuous fate of other emerging market economies.

Thus, one important key to the RMB becoming an international currency hinges upon the PRC's commitment to liberalizing capital account transactions, though its pace may not satisfy people both inside and outside the country.[3] In this paper, we are interested in the link between the inevitable path of financial globalization and the potential path for the RMB in becoming an international currency.

Against this backdrop, we investigate how the PRC's efforts to liberalize its capital account transactions would affect the use of the RMB for invoicing in international trade. An increased use of a currency as an invoicing currency is not a sufficient condition for it to become an international currency. In fact, while the RMB's use in trade has been rapidly growing in the last few years, the share of the RMB in average daily foreign exchange turnover was only around 2% as of April 2013.[4] (The RMB's share among

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[1] Use of the RMB as an anchor, either formally or informally, seems to have progressed more rapidly than along other dimensions. See Subramanian and Kessler (2012), and for a critique, Spencer (2013).

[2] See Huang et al. (2013) and Hung (2009), among others.

[3] Thus far, the PRC has attempted to foster use of the RMB via development of offshore markets in the yuan (sometimes referred to as the CNH).

[4] The BIS Triennial Central Bank Survey for 2013 reports as preliminary results as of April 2013 that the share of the RMB in average daily foreign exchange turnover is 2.2%, rising from 0.9% as of 2010. The

the reserve currencies is essentially zero.) However, we focus on the impact of the PRC's financial liberalization on the use of the RMB in invoicing for international trade for two reasons. First, it is practical for us to focus on currency invoicing simply because the data for currency invoicing for trade are relatively more available, albeit still quite limited. The data for currency denomination for securities transactions are even more limited, making a reasonable empirical analysis infeasible. Second, currency invoicing in trade is an important first step for a currency in becoming an international currency. Therefore, it is appropriate for us to forecast for the foreseeable future with more reasonable scenario analysis.

In this study, we first survey the literature regarding capital account liberalization and openness, and its impact on reserve holding, asset denomination, and currency invoicing in international trade.

We then empirically investigate the determinants of currency invoicing with special focus on capital account liberalization. Armed with estimates of the important relationships, we investigate the various scenarios for RMB use in currency invoicing based upon differing rates of progress in capital account liberalization.

The questions we address are the following:

1. What factors, including capital account liberalization, affect the use of currencies in terms of invoicing in international trade?

2. How does the RMB's recent experience differ from that of other currencies in terms of their use for invoicing exports?

3. How would foreseeable capital account liberalization implemented by the PRC affect the level of use of the RMB in international trade?

4. What can we expect for the internationalization of the RMB once the PRC furthers financial liberalization efforts? Would the RMB proceed smoothly toward the status of international currency, along other dimensions?

2. THEORY AND EVIDENCE ON THE LINK BETWEEN CAPITAL ACCOUNT OPENNESS AND THE USE OF A CURRENCY IN INTERNATIONAL FINANCIAL MARKETS

2.1 Capital Account Openness and Its Impact on Reserve Holding, Asset Denomination

The literature on developed country reserve currencies suggests that the increasing relative economic mass of key emerging market economies will lead to a greater role for their respective currencies. However, if previous empirical findings are relevant, GDP alone will not be the main determinant. Rather, financial market development and openness to the rest of the world will be the critical factors (Chinn and Frankel 2007, 2008).

Financial development involves the creation of institutions that are able to funnel large amounts of capital from savers to borrowers in an efficient manner. Empirical work suggests that institutional development (e.g., rule of law, a low degree of corruption) as

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volume of RMB turnover soared from $34 billion in 2010 to $120 billion as of April 2013, becoming the 9th most actively traded currency in 2013.

well as having open capital markets is important (Chinn and Ito 2006). To the extent that the largest emerging market countries with currencies that are candidates for reserve status have relatively closed and underdeveloped financial markets, the path forward is unclear.

As long as countries restrict capital flows in a heavy-handed fashion and limit convertibility, use of their respective currencies in international transactions—including financial transactions—is unlikely to increase rapidly. Financial repression would also limit the desirability of each currency in international transactions.

To make these points concrete, consider that many of the reserves are held in the form of government bonds. If it is difficult to purchase and sell government bonds across borders (and especially if there is no secondary market for the bonds), and agents are worried about the default risk associated with the bonds, then the currency those government bonds are denominated in will not be a good candidate for a reserve currency.

The nature of policy preferences is key to determining the pace of developments. In particular, policy authorities will determine when (and how much) they are willing to surrender the policy autonomy associated with capital controls and repressed financial systems in favor a more internationalized currency.[5]

2.2 Theory and Evidence on Trade Invoicing

The literature on trade invoicing goes back to the 1970s when the eurodollar markets started appearing and cross-border capital transactions became more active in the advanced economies despite tight capital controls under the Bretton Woods system. Especially in Europe, the absolute dominance of the dollar in international trade and finance ended, and the pound sterling, the French franc, and the deutsche mark started becoming the major currencies used in invoicing or for settling international trade transactions.

Grassman (1973) found that a much larger portion of Swedish exports are invoiced in Swedish kronor than are imports, and argued that exporters tended to invoice in their own currency because exporters usually have more bargaining power. While supporting the idea, Krugman (1984) argued that the relative sizes of trading partners matter so that when an importer is larger than an exporter, Grassman's law does not apply.

As the Bretton Woods system broke down in 1973, the uncertainty and the risk arising from exchange rate movements have become some of the issues that need to be incorporated in determining the currency in which to invoice international trade transactions. The question of the choice of currency for trade invoicing is essentially the question of whether the producer prices their products in their own currency—producer currency pricing—or whether the price of a product is "priced to the market"—the local currency price (Krugman 1987; Dornbusch 1987). Furthermore, whether to price in the producer's currency or the local currency is a question of whether to avoid demand uncertainty or price uncertainty. A producer who prices a product in their home country's currency would not face any price uncertainty, but the demand for the product

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[5] In the context of the "impossible trinity" or the "trilemma," even if a country removes capital controls, it could still retain monetary autonomy as long as it allows flexible movements in its currency's exchange rates (Aizenman et al. 2013; Obstfeld et al. 2005). However, if its currency becomes international, its use outside its borders increases, which means the amount of currency out of the reach of the monetary authority increases, as in the case of the US dollar (Goldberg 2010), and therefore the country loses its grip on monetary policy.

could be uncertain since it is subject to exchange rate fluctuations. Conversely, if they price the product in the local currency of the export destination, demand uncertainty can be minimized while the price or the revenue of her product can be uncertain.

Thus, not only bargaining power but also exchange rate volatility matter for trade invoicing, while the latter raises the issue of transactions cost for the currency. McKinnon (1979) focused on the impact of product differentiation on the choice of invoicing currency. He argued that exporters from European industrialized countries tended to price their products in their home countries because they tended to export differentiated manufactured goods. Facing the downward demand curve, the producers of differentiated goods can exercise more market power which allows them to avoid bearing the exchange rate risk. Conversely, exporters of relatively homogeneous primary goods, who are price takers in the market, tend not to price in their own home currency. In such a market, currencies with low transaction costs tend to be preferred. Given the tradition and the depth of the market, the dollar is usually a dominant vehicle currency in the commodity markets.

Goldberg and Tille (2008) argued in their seminal paper that when demand elasticity is high, or there are competitive substitutes in the export destination market, exporters will opt for pricing in the currency used by competitors so that they can limit the fluctuations of their prices relative to those of the competitors' goods—the so-called "coalescing effect." Bacchetta and Van Wincoop (2005) used a general equilibrium model and showed that exporters who have higher market shares in the export market or who produce more differentiated products tend to invoice in their own currency.

While microeconomic factors play an important role, researchers have also argued that the choice of invoicing currency can be affected by "inertia." Krugman (1980) argued that once a currency is established as the invoicing currency, it becomes difficult for users to switch to another currency.[6] This is more of a case if the currency is widely used and liquid. Rey (2001) examined this issue theoretically, and argued that if more than one currency is used in invoicing, it would yield higher transaction costs, which would be passed on to export prices. Hence, if a particular currency is dominantly used, it would lower the transaction cost as the market size gets bigger. Such a "thick market externality" leads the currencies of countries with higher levels of trade volumes and openness to be chosen as invoicing currencies. Similarly, Bacchetta and Van Wincoop (2005) predicted that the currency formed in a monetary union should be used more extensively than the sum of the currencies it replaces because of its enlarged market share.

The "thick market externality" or the inertia in the choice of currency invoicing may not be a sufficient condition for major currencies such as the US dollar to be dominantly used in international trade. The US, the issuer of the dollar, provides vast, liquid, and deep financial markets, which tremendously help reduce the transaction costs of the currency and increase the liquidity and usability of the dollar. In other words, the depth and openness of financial markets affect the transaction of the currency and matters for the choice of the invoicing currency. As Caballero et al. (2008), Chinn and Ito (2007), and Chinn et al. (2013) show, the level of financial development and the extent of financial openness matter for current account balances, and countries with deeper and more open financial markets tend to run a worsened current account or deficit. Hence, a country's financial development and openness can affect the availability and usability of its own currency abroad, and therefore the transaction cost of the currency.

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[6] Chinn and Frankel (2007, 2008) point out the inertia for the choice of reserve currencies. However, they also argue that there is a "tipping point" or threshold, above which the share of a currency in central banks' reserves would rise rapidly due to externality.

Goldberg and Tille (2008), however, find only a moderate role for transaction costs in the foreign exchange markets using data on bid–ask spread for each sample country's currency relative to the US dollar. Kamps (2006) finds that countries with forward markets tend to invoice more in their home currencies.

In contrast to the relatively rich theoretical literature on the choice of currency for trade invoicing, the empirical literature is thin. The paucity of empirical literature is due to data availability. Few countries tend to disclose currency invoicing data.[7] Hence, most empirical studies on currency invoicing have focused on individual countries, for example, Donnenfeld and Haug (2003) for Canada, Wilander (2004) for Sweden, Ligthart and Werner (2012) for Norway, Ito et al. (2010) for Japan, and Da Silva (2004) for the Netherlands. Goldberg and Tille (2008) and Kamps (2006) are the exceptions, conducting cross-country analysis on the determinants of trade invoicing, though the scope of country coverage tends to be small and highly unbalanced.

For more literature reviews, refer to Goldberg and Tille (2008), Kamps (2006), Aubion (2012), Maziad et al. (2011), and ECB (2005).

3. EMPIRICAL ANALYSIS ON THE SHARE OF MAJOR CURRENCIES IN TRADE INVOICING

3.1 Currency Shares in Trade Invoicing: Stylized Facts

The Augmented Currency Invoicing Dataset

In this study, we update and expand the dataset constructed by Goldberg and Tille (2008) and Kamps (2006). For that, we rely upon data provided on the websites of central banks and other government agencies, as well as other past and more recent studies that looked into the issue of trade invoicing. Appendix 1 reports the data availability and data sources of our dataset. Hence, although a large portion of our dataset relies on the data compiled by Kamps (2006), the coverage of currency shares in export and import invoicing are considerably expanded, especially with respect to the use of the euro. Hence, our analysis relies upon longer, more complete time series than were utilized in Goldberg and Tille (2008) or Kamps (2006).

Regarding our data collection efforts, we must make one important note. While we focus on analyzing the determinants of currency use for trade invoicing, our dataset on the shares of invoicing currencies for exports and imports, namely, the US dollar, the euro, and the domestic currencies, mix data on currencies used for invoicing or settlements for trade transactions. Strictly speaking, the currency for trade invoicing and that for actual settlements may differ. However, reporting government agencies often do not make it clear whether they are reporting the currency of invoicing or settlement. Although the differences in the invoicing or settlement currencies is sometimes negligible, as Page (1977, 1981) finds, for a newly internationalized currency such as the RMB, the difference can be large. In fact, the PRC only publishes the data on RMB settlements, not invoicing. Yu (2012) argues that although the amount of RMB use in settlements for PRC's imports has been rising, a large bulk of the imports settled in RMB is initially invoiced in dollars. This scheme reflects the persistent

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[7] Exceptions are the European Union and several Asian countries. The ECB has been reporting the share of euro use in trade invoicing for euro and non-euro countries since the early 2000s and the currency share data are available in Eurostat. Japan, Thailand, and Indonesia have been relatively consistent in reporting currency share data for the country's trade. The Republic of Korea used to report consistently, but seem to have stopped publicizing the data in 2006.

appreciation expectations for the RMB. Conceptually, in order to become an international currency, a candidate currency should be used for trade invoicing rather than settlements. Hence, we must keep in mind that the PRC's data on settlements may overstate the actual use of the currency as an invoicing currency. Thus, due to data limitations we are forced to rely on a dataset that includes both invoicing and settlement currencies, and use the phrase "currency for invoicing" interchangeably with "currency for trade settlements."

Our dataset covers 50 countries, including the PRC, but with a varying extent of coverage depending on the type of invoiced currency and whether the data are for exports or imports. While Japan provides the most extensive data, going back to 1969 for both exports and imports, the data availability varies among countries, with data available for only a single year or a single currency (often the US dollar or the euro) for some countries.[8]

Stylized Facts

Using our augmented and updated dataset on trade invoicing, we now discuss how the choice of currency for trade invoicing has changed over time and differs among countries or regions.

First, Figure 1—the share of the use of the US dollar in export invoicing against the share of exports to the US of total exports—makes it clear that the dollar retains a dominant role. Conceptually, the dollar invoicing share in export transactions of countries should be proportional to the share of the US as a destination of countries' exports if the US dollar did not play a dominant role or the role of the vehicle currency. However, the figure clearly shows that countries invoice their exports in dollars much more than proportionally to the share of their exports to the US.

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[8] Goldberg and Tille (2008) cover 25 countries, whereas Kamps (2006) expands the former dataset and covers 42 countries. Our dataset updates the share of euro invoicing in both exports and imports to 2012, using a series of the European Central Bank's reports on the role of the euro (ECB 2005; 2007–2012) and Eurostat. We also augment the dataset with longer time series for Australia (2000–2003, 2006–2011), Indonesia (1991–2012), the Republic of Korea (1976–2005), Thailand (1993–2012), and Japan (1969–2012), as well as data from earlier years (e.g., 1970s) for several advanced economies using earlier papers (such as Scharrer [1981], Tavlas [1993], Tavlas and Ozeki [1992], Magee and Rao [1980], and Page [1977]). For more details, refer to the Appendix.

Figure 1: US Dollar as the Vehicle Currency
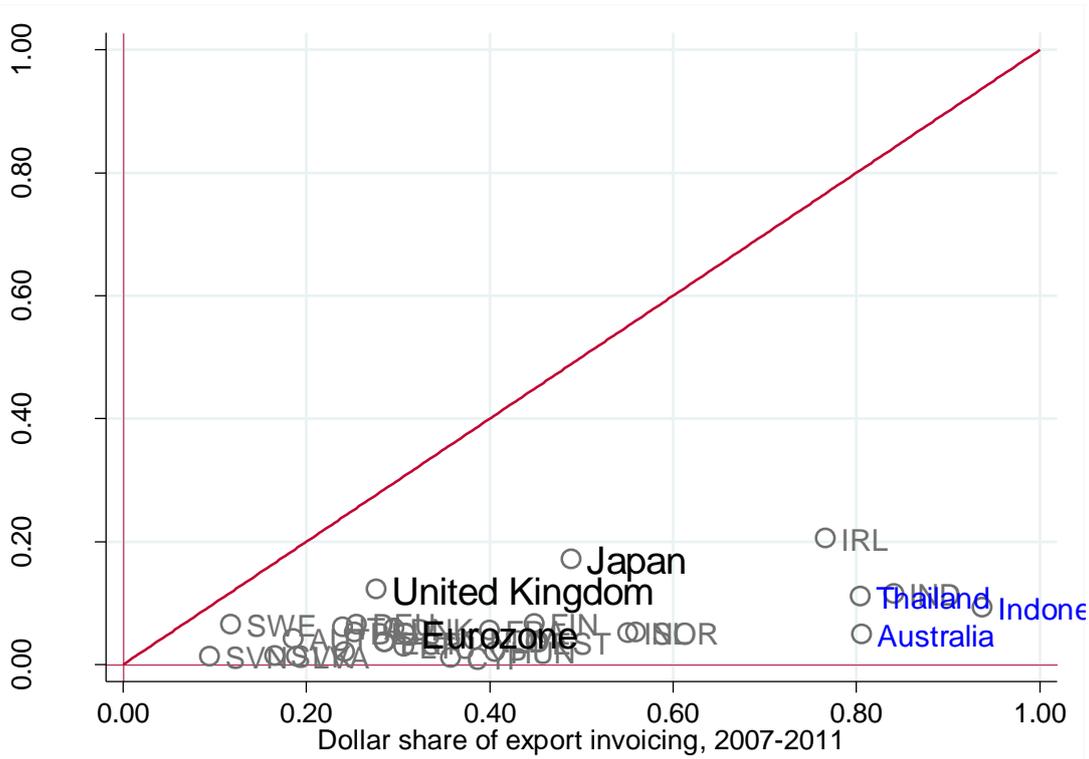
Source: Authors' calculations.

Figure 2 shows the share of exports invoiced in the home currency against the share of exports in world exports. We can see that the PRC, which provides about 10% of the world's exports, is an outlier given its low level of export invoicing with its home currency. Excluding the PRC, there is a moderate positive correlation between the shares of exports invoiced in the home currency and the shares of exports in the world exports. Although the other two large exporters, Germany and Japan, also appear to be off the fitted line, the PRC's deviation dwarfs the other deviations, indicating that the level of home currency invoicing is much lower than what its export share in the world's exports suggests.

Figure 2: Shares of Home Currencies in Export Invoicing versus Shares of Exports in World Exports
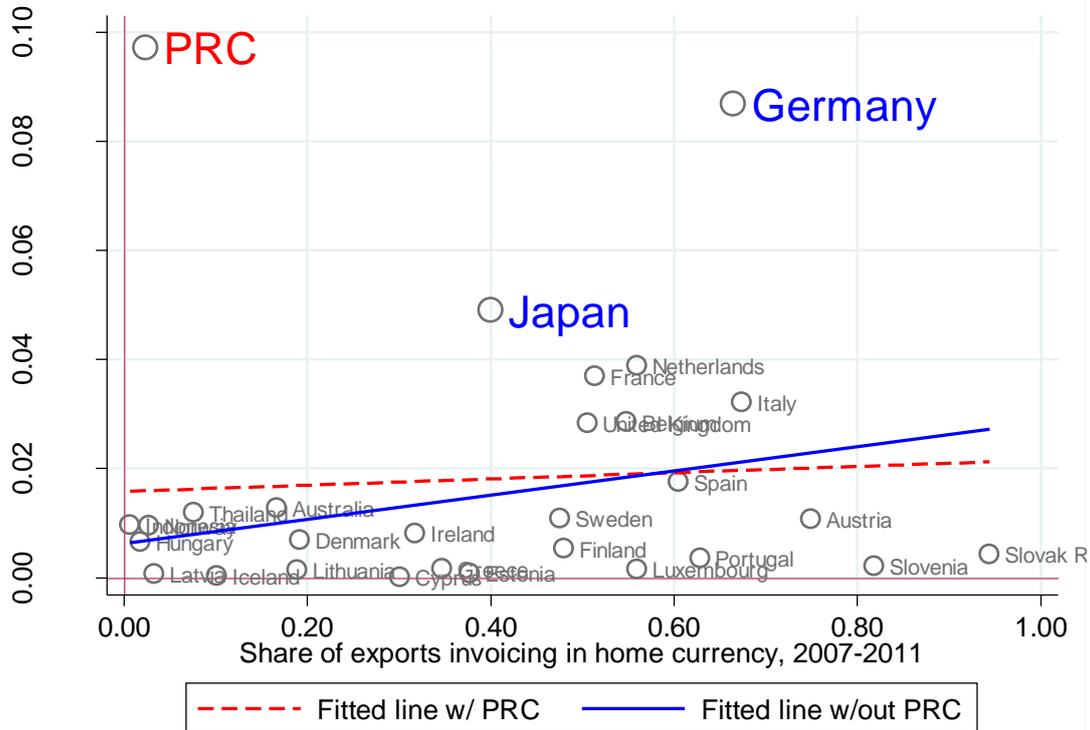
PRC = People's Republic of China.

Source: Authors' calculations.

Figures 3 and 4 further illustrate the dominant role of the dollar in trade invoicing. These two figures show the sample-average shares of the dollar, the euro, and the home country's currency for the invoicing of exports (Figure 3) and imports (Figure 4).[9] We must note that when calculating the share of the US dollar in trade invoicing, we do not include the use of the US dollar by the United States, but include it in the share of the home currency. Similarly, the euro share does not include the use of the euro by the eurozone countries; it is included in the share of the home currency.[10]

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[9] Because the dataset is highly unbalanced, annual averages of the currency shares are highly subject to data availability. To mitigate this, we report 5-year averages of the currency shares.

[10] These rules are applied throughout the paper including the estimation exercises.

Figure 3: Shares of Currencies Invoiced in Exports
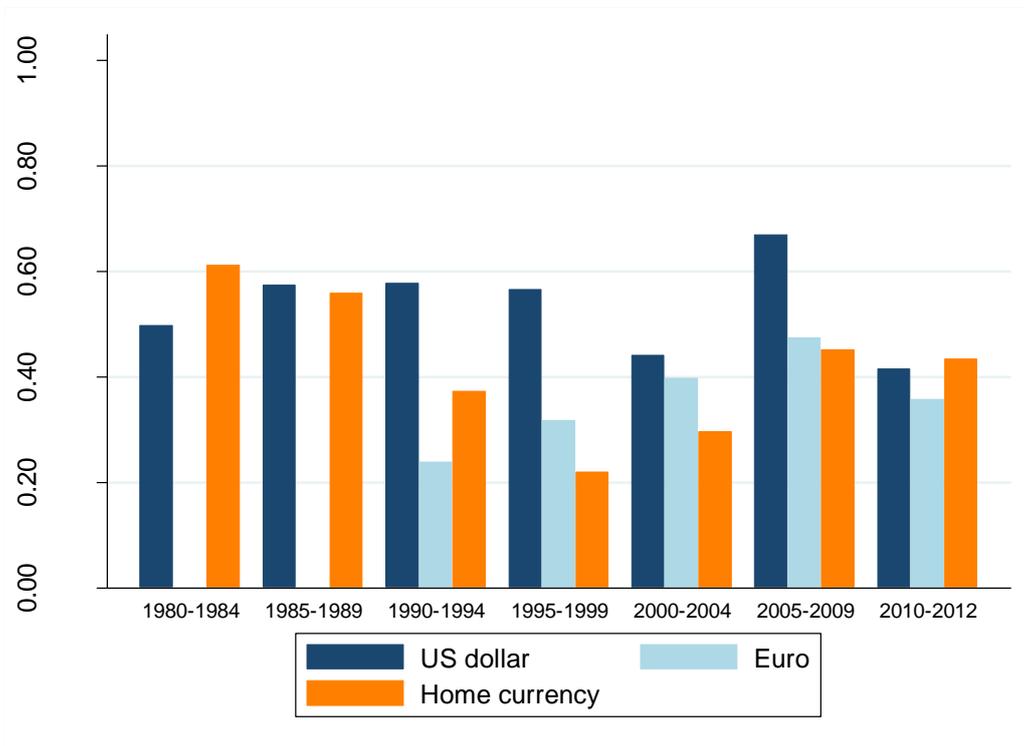
Source: Authors' calculations.

Figure 4: Shares of Currencies Invoiced in Imports
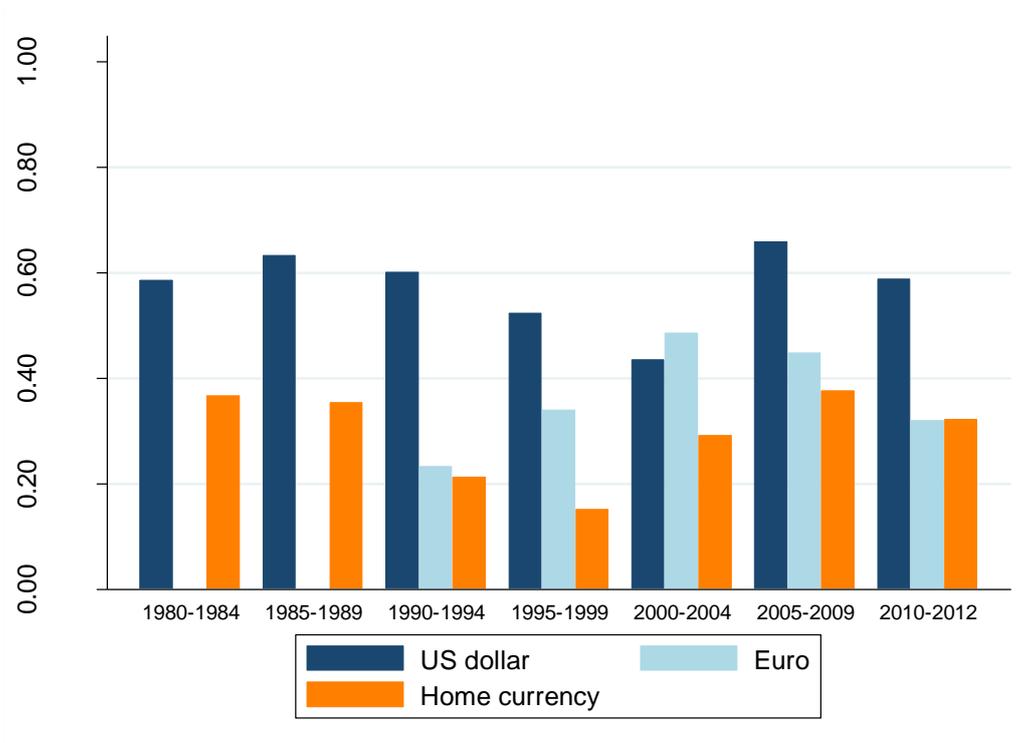
Note: The use of the US dollar in trade invoicing by the United States is not included in the average share of the US dollar, but it is included in the share of the home currency. Similarly, the use of the euro by the eurozone countries is not included in the euro share, but included in the share of the home currency.

Source: Authors' calculations.

In both export and import transactions, we can observe that the US dollar has the highest share, although it was on the declining trend until the mid-2000s. The recent rise in the dollar share may reflect the effects of the global financial crisis and the euro debt crisis. In both instances, there was "flight to quality," which benefitted dollar-denominated assets, leading to more dollar invoicing in international trade. Conversely, the share of the euro—by non-eurozone countries—in both export and import transactions was on a steadily rising trend until the mid-2000s, followed by a decline in the share in the last years of the sample period.[11] The use of the home currency has been increasing for both exports and imports, but it mainly reflects the use of the euro by the eurozone countries. In general, we see evidence of the so-called "Grassman's Law" (Grassman 1973); the share of home currency invoicing is higher for exports than for imports.

The extent of reliance on the dollar as a major invoicing currency seems to differ across regions. Figure 5 illustrates the shares of currencies in export invoicing for the EU countries.[12] For this group of countries, the euro is the most commonly invoiced currency. Considering that the home currency in the figure also includes the use of the euro by the euro member countries, the share of the euro invoicing overall is even higher. The share of the US dollar for this group of countries has been stable at around 30%–35% in the sample period.

Figure 5: Shares of Currencies in Export Invoicing, European Union Countries
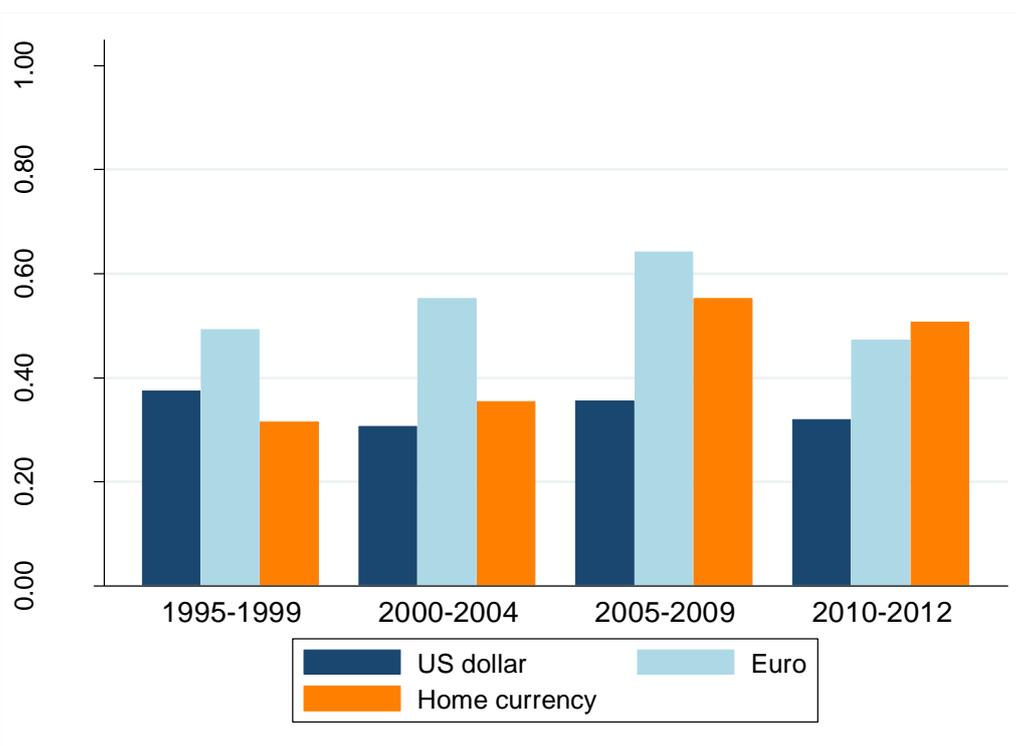
Note: The countries in the European Union subsample are: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, and the United Kingdom.

[11] The euro share before the introduction of the euro in 1999 reflects the sum of the uses of the "legacy currencies" before they were replaced by the euro (Kamps 2006).

[12] The figure shows the averages of currency shares for the current 27 EU countries regardless of the year of accession to the union. Hence, strictly speaking, the average is calculated for the EU member countries and candidates.

Figure 6 shows the shares of invoicing currencies for a selection of Asia and Pacific countries, excluding Japan. It is clear that the countries in this region have relied heavily on the US dollar as the vehicle currency. The main cause for the high reliance on the dollar is the regional supply chain network that primarily uses the US dollar as the currency for transactions. Also, the main export market for products from the Asian supply chain is the US. As Goldberg and Tille (2008) and Ito et al. (2010) argue, firms tend to price to market, i.e., invoice their exports in the importer's currency, the US dollar, so as to protect their competitiveness in the destination market.[13] The Asian dollar bloc therefore stands as a big challenge to the PRC's ambitions for the RMB to become the regional international currency.[14]

Figure 6: Shares of Currencies Invoiced in Exports, Asia and Pacific Countries (excluding Japan)
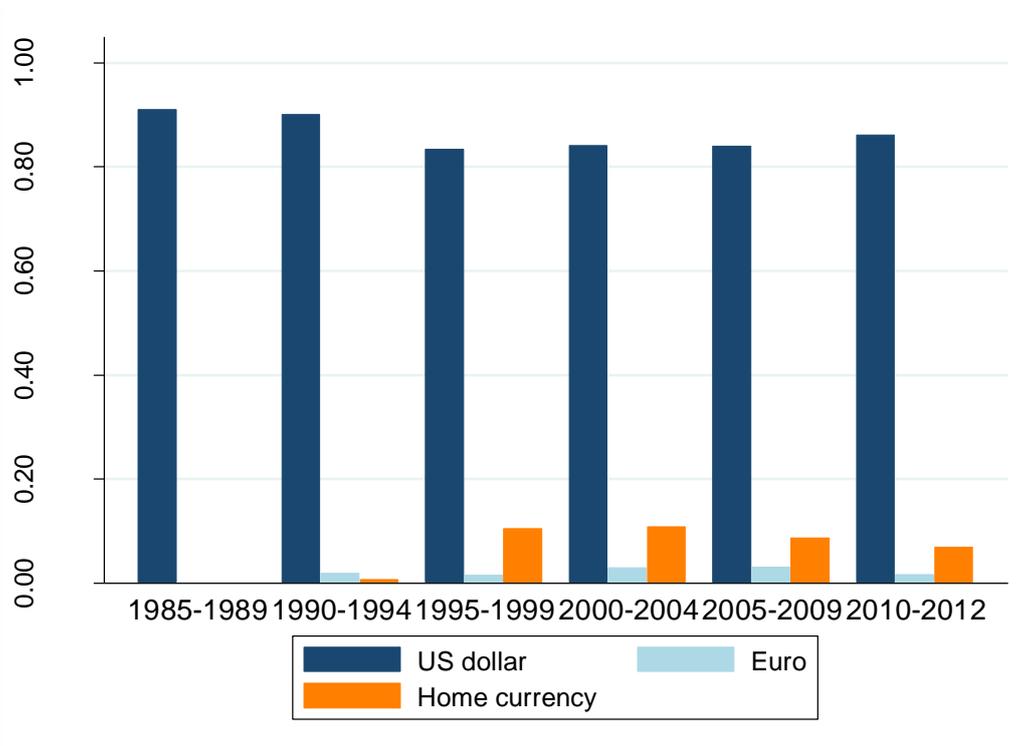
Note: The countries in this subsample are: Australia, the PRC, India, Indonesia, the Republic of Korea, Malaysia, Pakistan, and Thailand.

For the PRC, we have only 4 years of observations, but they reflect the country's financial liberalization policy. In the immediate aftermath of the global financial crisis of 2008, the PRC government became active in promoting RMB trade settlements, with the hope that firms would be able to lessen exchange rate risk if they could invoice trade transactions in yuan. The People's Bank of China (PBC) prepared the environment for RMB settlements by signing currency swap agreements with countries.

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[13] Takagi (2009) argues that established practices of pricing and invoicing trade in US dollar in Asia hampered the internationalization efforts of the Republic of Korea's won despite the country's increased presence as a major exporter.

[14] We could also argue that given the imperative role of the PRC in the Asian supply chain network, if the RMB could replace the dollar as the major invoicing currency in the Asian region, the use of the RMB could rise dramatically.

By the spring of 2013, the PBC had signed swap agreements with the monetary authorities of 20 countries and areas for the total amount of CNY1,936.2 billion ($317.9 billion).[15] In July 2009, the government started a policy of allowing several pilot firms to settle trades using the RMB through designated domestic banks and banks in offshore markets in Hong Kong, China. By fall 2013, the scope of the policy had been expanded to the national level, and banks in other economies (such as Singapore; Taipei,China; the PRC; Japan; Australia; and New Zealand) became allowed to deal with offshore RMB (i.e., RMH) for trade settlements. As of the end of 2012, about 80% of RMB trade settlement is conducted through the offshore market in Hong Kong, China, while other economies such as the United Kingdom are eager to become offshore RMB markets.[16]

The data on RMB use for trade settlement reflect this short history of the liberalization of RMB trade settlement. As of the end of 2009, the first year of policy implementation, a mere 0.02% of total trade was settled in RMB. According to the Annual Report of the People's Bank of China, the ratio only grew to 2.2% in 2010. In 2011 it started taking off; the share of RMB use in trade settlements rose to about 6.6% and 8.4% in 2012.[17]

Let us look at the development of RMB trade settlement in a global context. In Figure 5, we first compare the experience of RMB invoicing with that of a previous challenger for the international currency, the Japanese yen. As of the end of the 1960s, a few years after the currency became convertible in 1964, only 0.6% of Japan's exports were invoiced in yen, while essentially none of Japan's imports were invoiced in the currency. The share of yen invoicing for exports peaked in 1983, hitting 42%, although that of imports only reached 3%. Figures 6 and 7 show that since the mid-1980s the share of yen in export invoicing has hovered around 35%–40%, with that of the US dollar around 50%. In contrast, the share of yen in import invoicing has stabilized at around 20%–25%; the US dollar has maintained higher levels around 70%. After all, despite all the discussions and initiatives about the internationalization of the yen, the currency has failed to become a dominant currency, even for the country's own trade.[18]

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[15] The economies and areas the PRC signed currency swap agreements with are as follows: the Republic of Korea (CNY180 billion in 2008, renewed to CNY360 billion in 2011); Hong Kong, China (CNY200 billion in 2008, renewed to CNY400 billion in 2011); Malaysia (CNY80 billion in 2009); Belarus (CNY20 billion in 2009); Indonesia (CNY100 billion in 2009); Argentina (CNY70 billion in 2009); Iceland (CNY3.5 billion in 2010); Singapore (CNY150 billion in 2010); New Zealand (CNY25 billion in 2011); Uzbekistan (CNY0.7 billion in 2011); Mongolia (CNY5 billion later expanded to CNY10 billion in 2011), Kazakhstan (CNY7 billion in 2011), Thailand (CNY70 billion in 2011); Ukraine (CNY15 billion in 2012); Brazil (CNY190 billion in 2011); Pakistan (CNY10 billion in 2011); United Arab Emirates (CNY35 billion in 2012); Malaysia (CNY100 billion later expanded to CNY180 billion in 2012); Turkey (CNY10 billion in 2012); and Australia (CNY200 billion in 2012). For more details on the PRC's swap agreements, refer to Garcia-Herreno and Xia (2013), Huan et al. (2013), and Yu (2013).

[16] Many authors have produced in-depth reviews and analyses of the PRC's financial liberalization efforts and internationalization of the RMB, including Chen and Cheung (2011), Prasad and Ye (2012), Ito (2011), Subramanian (2012), Huang et al. (2013), Vallée (2012), and Yu (2012, 2013) among others.

[17] According to the Society for Worldwide Interbank Financial Telecommunication (SWIFT), the ratio of RMB settlement in the PRC's trade was 10% in 2011 and 14% in the first quarter of 2012.

[18] This is in sharp contrast with the German deutsche mark (DM). The share of DM invoicing for exports remained consistently around 80% for the entire 1980s. That for imports increased from 43% in 1980 to 53% in 1988 (Tavlas 1993). Frankel (2011) explains that both Japan and West Germany were reluctant to internationalize their currencies when these currencies began to gain shares in the 1980s, because internationalization of the currencies would help currency appreciation, and thereby possibly hurt the international competitiveness of exporting sectors. In the 1990s, Japan changed its policy stance and started promoting the internationalization of the yen. However, the economy soon fell into a long recession, thereby leading the general demand for the currency to fall.

Figure 7: Share of Currencies in Japan and the People's Republic of China's Trade
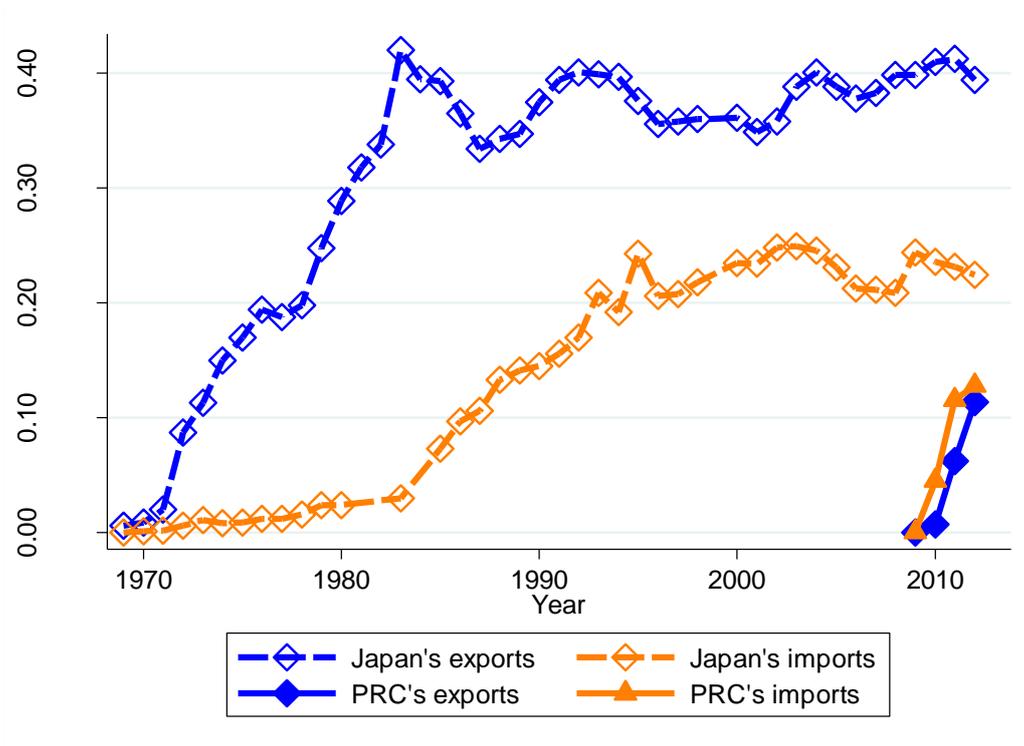
PRC = People's Republic of China.

Source: Authors' calculations.

Figure 8: Share of Currencies in Japan's Exports
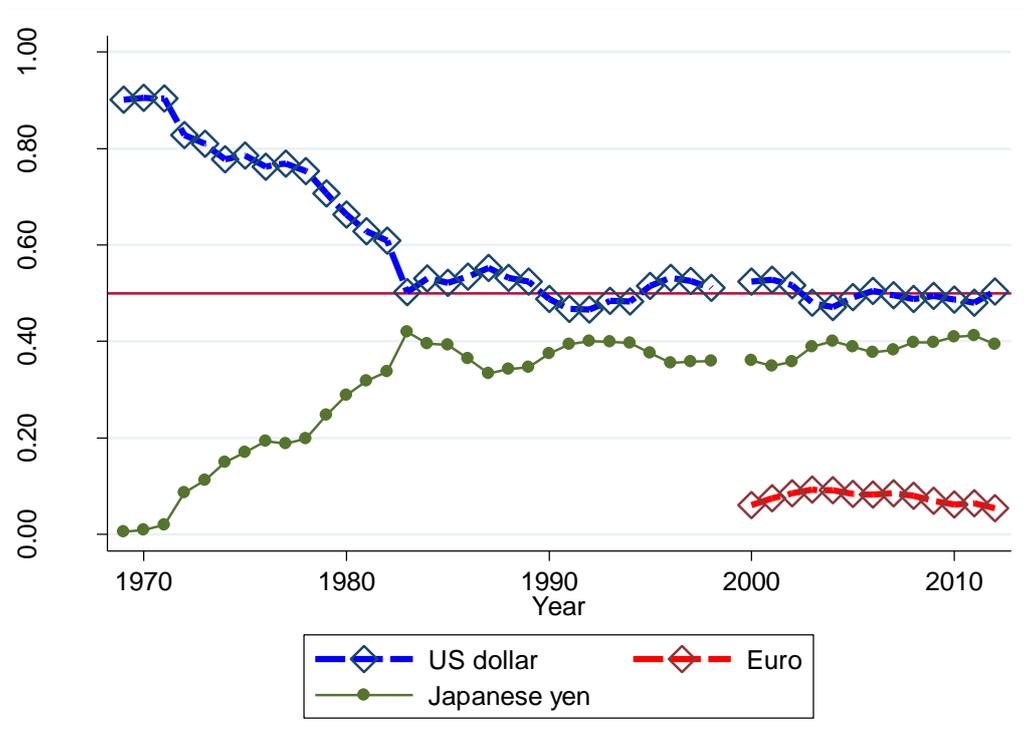
Source: Authors' calculations.

Figure 9: Share of Currencies in Japan's Imports
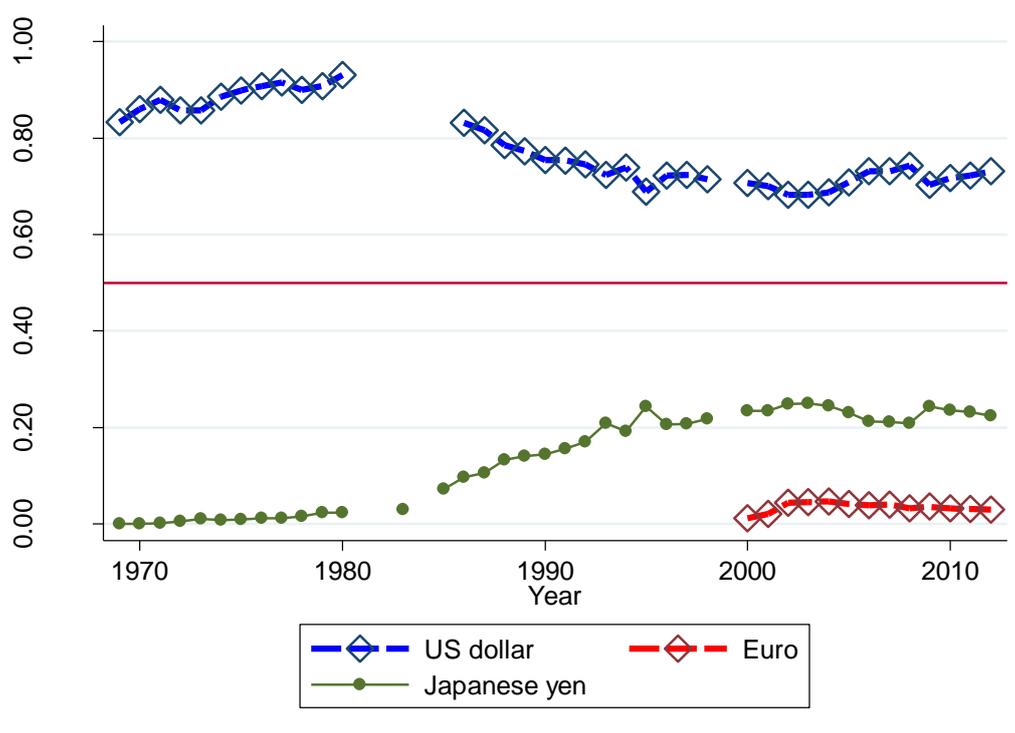
Figure 7 also illustrates the development of the ratio of RMB invoicing with respect to total exports and imports. The PBC only publishes the RMB settlement figures for total trade, so there is no break down for exports and imports. However, it also reports the ratios between RMB receipts and payments in international trade transactions. Using the ratios as well as the published total volumes of RMB trade settlements, we estimate the shares of RMB use for export and import settlements.[19]

Figure 7 shows a rapid rise in the share of RMB use for both export and import invoicing in recent years, though the government allowed RMB invoicing only in 2009. While the share of the yen for exports has always been higher than that for imports, consistent with Grassman's Law, the RMB has had an opposite experience. According to the PBC Annual Report, the ratio of the RMB receipts and payments was 1:5.5 in 2010, though it improved to 1:1.7 in 2011. This lopsidedness reflects the government's intention to increase the use of the RMB overseas.

Another, more recent challenger as an international currency is the euro. Figure 10 shows that the use of the euro for trade invoicing has had a moderately rising trend since its introduction in 1999. As was the case with the yen, the share of euro invoicing is higher for exports than for imports, and the gap between export and import invoicing seems to be widening in recent years, possibly reflecting the euro debt crisis. The larger-scale use of the euro for trade invoicing makes it clear that there is still a long way for the RMB to become international to the same extent.

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[19] The PBC's 2012 Annual Report does not report the ratio between RMB receipts and payments in international trade. However, given that the ratio improved from 1:9 in 2009 to 1:1.7 in 2011, it is reasonable to assume the ratio has become close to 1:1, as we do to calculate the shares of RMB in export or import invoicing for 2012.

Figure 10: Share of Currencies in the People's Republic of China and the Eurozone's Trade
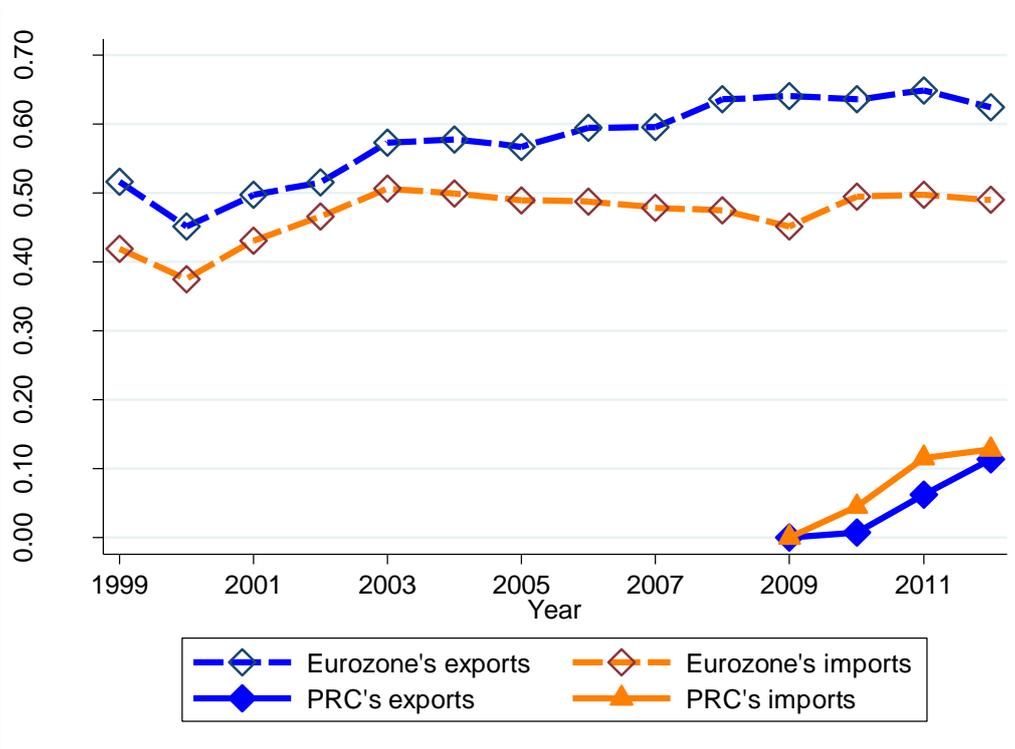
PRC = People's Republic of China.

Source: Authors' calculations.

3.2 Panel Analysis on the Determinants of Export Invoicing

The Model and Candidate Determinants of Exporting Invoicing Currencies

Now that we have observed different paths of development for the use of currencies in trade invoicing, we conduct a panel data analysis to investigate the determinants of trade invoicing. More specifically, we investigate the determinants of the use of three currencies, the dollar, the euro, and the home country's currency, by using the dataset that encompasses the 50 countries, including both advanced and emerging market economies, for which the currency share data are available. However, the data limitations for other variables reduce the number of countries included in our panel data analysis to about 33–43 countries, depending on the currency of focus, for the period 1970–2011. As we have already described, the data availability of the currency share data makes the dataset highly unbalanced.

We use an empirical specification similar to that used by Goldberg and Tille (2008) and Kamps (2006), but test other variables that have been suggested as contributors to the share of currency in trade invoicing including financial openness.

The specification relates the share of export invoicing in a specific currency to

$$\lambda_{EXit}^{C} = \beta_1 + \beta_2 X_{it}^{C} + \beta_3 D_{it}^{C} + \gamma_1 FL_{it}^{C} + \varepsilon_{it}^{C}. \tag{1}$$

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λ_{EXit}^C indicates the share of exports from country *i* in year *t* invoiced in currency *C* where *C* can be the dollar, the euro, or the home country's currency.[20] That is, we repeat this estimation for export invoicing in these three types of currencies. The vector X_{it}^C includes the economic factors of country *i* that affect the share λ_{EXit}^C. In X_{it}^C, we include $ShareEX_{it}^C$, the share of country *i*'s exports to the US or the eurozone when *C* is either the dollar or the euro, respectively, or country *i*'s export share in world exports when we run the estimation for the home currency's share in export invoicing. Vector X_{it}^C also includes the share of commodity exports in total exports (*Commd*); relative income level to the US (*Rel_inc*); exchange rate volatility ($ExVol_{it}^C$) and inflation differentials ($InfDif_{it}^C$) relative to the US, the eurozone, and the world, depending on the currency of interest; and a measure for financial development (*FD_{it}*).[21]

Because it is natural to assume each country is exposed to its own idiosyncratic shocks that are not systematically intrinsic to itself, we estimate a random effects model. We also run the estimations with fixed effects as a robustness check for the possibility of each country's intrinsic characteristics (such as institutional or regulatory environment) affecting the choice of invoicing currencies.

Vector D_{it}^C includes the dummies pertaining to currency arrangement (CA_{it}^C), such as pegs to the dollar or the euro (or the deutsche mark prior to the introduction of the euro), and also pertaining to whether or not country *i* participates in the European Union (EU_i).[22] We also include a vector of time effects. One is the dummy for the Bretton Woods period (*BW*); it takes the value of one for all observations before 1973. The other is the dummy for the introduction of the euro (*Euro*); it takes the value of one for all observations after 2002, when the euro was introduced and the national "legacy currencies" ceased circulating in the market.

We focus on the estimate of the variable for capital account openness, FL_{it}^C. For the measure of capital account openness, we use the Chinn–Ito index of capital account openness (Chinn and Ito 2006, 2008, and updates). *KAOPEN* is based on information regarding regulatory restrictions on cross-border capital transactions reported in the International Monetary Fund (IMF) *Annual Report on Exchange Arrangements and Exchange Restrictions* (*AREAER*). Specifically, *KAOPEN* is the first standardized principal component of the variables that indicate the presence of multiple exchange rates, restrictions on current account transactions, on capital account transactions, and the requirement of the surrender of export proceeds (see Chinn and Ito 2006, 2008).[23]

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[20] Again, we do not include the use of the dollar by the United States in the share of the dollar use, but include it in the share of the home currency. Similarly, we do not include the use of the euro in trade invoicing by the eurozone countries in the euro share, but include it in the share of the home currency

[21] "Commodity" includes fuel, food, and metal products based on the *World Development Indicator* categorization. The exchange rate for the United States, which is included in the "home currency" estimation, is the one against the special drawing right (SDR).

[22] The dummy for the EU membership is time-invariant, i.e., the dummy is assigned for the entire sample period regardless of the year of entry to the union. This is due to stylized facts that the invoicing behavior would differ for EU member countries even before they actually become members, partly because of the existence of precursor organization such as the European Community and also of geographical reasons for other countries that did not participate in the precursor organizations (such as former communist states). We follow Kamps (2006) on this.

[23] The index is normalized to range between zero and one. High values indicate a more open capital account. The original index is available at http://web.pdx.edu/~ito/Chinn-Ito_website.htm.

The inclusion of these variables is based on the past literature on trade invoicing. Below, let us briefly discuss the theoretical rationales for testing the variables and what we should expect for the estimates of the variables.

Share of exports. Larger exporters are expected to have more bargaining power in the market. They can exploit externalities arising from the economies of scale for the use of the currency as well. Hence, we should expect a positive estimate for this variable, especially for the home currency. However, at the same time, for the estimation of the US dollar share, given that the US markets are quite competitive, we can expect the "coalescing effect"; exporters tend to invoice in the currency of the export market to minimize the fluctuations of their prices relative to those of their competitors. This prediction suggests the estimate would be positive.[24] We use data from the IMF's *Direction of Trade.*

Commodity exports as a percentage of total exports. Commodities are almost exclusively denominated in the US dollar, which is consistent with McKinnon's (1979) argument that homogenous goods tend to be invoiced in a single, low transaction cost currency. We should expect a positive effect on the dollar share, but a negative one on the euro and the home currency's shares.

Relative income. We use this variable as a proxy for the extent of differentiation in exported goods. When the extent of competitiveness is high in the destination market or there are other competitive substitutes available in the market, exporters tend to invoice in the local market's currency (i.e., the "coalescing effects" in Goldberg and Tille [2008]). That is, the more differentiated goods a country exports, the more likely it is to invoice its exports in its home currency. However, we do not have good measures in the cross-country context. Hence, we use the relative per capita income level to the US as a proxy. The expected sign is negative for both the dollar and euro estimations, but positive for the home currency estimation.[25]

Exchange rate volatility and inflation differentials. A more unstable macroeconomic environment would make investors shy away from holding the currency subject to such uncertainty. Higher inflation is also associated with an unstable macroeconomic environment. Volatile exchange rates or an unstable macroeconomic environment for a certain currency would make investors flee to hard currency or real assets. Hence, a country with a volatile exchange rate or high inflation tends to rely more on the US dollar, and less on its home currency as a medium of trade. For both variables, the estimates should take positive signs for the US dollar, and to a lesser extent the euro too. For the home currency, both variables should have negative estimates.[26]

Financial development/size. A currency for which large, liquid, and deep markets exist should face lower transaction costs, and therefore should be used more as an invoicing currency. Hence, we examine the impact of financial development on the invoicing currencies while incorporating the level of liquidity, the size, and the depth of the markets with respect to the world market. For that, we use a variable for "financial development/size" (*FD_SIZE*) which we define as the product of private credit creation (as a share of GDP: *PCGDP*) and the relative size of private credit creation of country *i*

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[24] This can be true for the euro share estimation.

[25] We use the data from *Penn World Table 7.1* for real per capita income.

[26] Inflation differentials are included as the differentials with the US rate of inflation in the estimations for the US dollar share and the home currency share. For the euro share estimation, inflation differentials with the eurozone rate of inflation are included. For exchange rate volatility, the estimations for the dollar share and the home currency share use the exchange rate against the US dollar while the estimation for the euro share uses the exchange rate against the euro.

to the world total private credit creation (*PRIV_SIZE*).[27] Because a currency associated with a larger and deeper market tends to be used more intensively for trade invoicing in that currency, we expect a negative estimate for the US dollar share coefficient, but a positive one for the home currency share coefficient while that for the euro can be ambiguous.

Financial openness. We consider the effect of financial openness as being similar to that of domestic financial development. Considering that full-convertibility of a currency is a necessary, if not sufficient, condition for that currency to become an international currency, the effect of financial openness has to be evaluated separately from that of domestic financial development. A currency of a more open financial market could provide more usability and investment opportunities for international investors. Hence, the more open the capital account is for the issuer country of a currency, the more likely it is for the country to invoice its trade in that currency. Therefore, the impact of financial openness on the shares of the dollar and the euro should be negative and the impact on the home currency share should be positive.

Monetary union and exchange rate arrangements. Bacchetta and van Wincoop (2005) show that the currency for a currency union can make the best use of economies of scale, and therefore tends to be used more extensively in trade than the sum of the currencies it replaces. If a country pegs its currency to another anchor currency such as the US dollar or the euro, it should surely tend to invoice its trade in the anchor currency.[28]

Estimation Results

Table 2 reports the results for both random and fixed effects. While both random and fixed effects models yield similar results, we focus our discussions on the results from the random effect models.

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[27] *PCGDP* is extracted from the World Bank's Financial Structure Database (first introduced by Beck et al. 2001).

[28] For the pre-euro period, the dummy is assigned for countries pegging their currencies to the deutsche mark.

Table 2: Determinants of Currency Shares in Export Invoicing

	US dollar Random 1970–2011 (1)	US Dollar Fixed 1970–2011 (2)	Euro Random 1990–2011 (3)	Euro Fixed 1990–2011 (4)	Home Random 1970–2011 (5)	Home Fixed 1970–2011 (6)
Share of exports	0.491	0.354	0.617	0.678	2.557	2.224
	(0.116)***	(0.164)**	(0.099)***	(0.131)***	(0.697)***	(0.791)***
Commodity exports (%)	0.270	0.198	-0.133	-0.127	0.232	0.331
	(0.086)***	(0.126)	(0.082)	(0.100)	(0.118)**	(0.140)**
Relative income	-0.153	-0.295	0.117	0.882	0.395	0.552
	(0.058)***	(0.120)**	(0.094)	(0.165)***	(0.088)***	(0.140)***
Exchange rate volatility	0.008	0.034	-0.025	-0.021	-0.016	-0.029
	(0.029)	(0.029)	(0.029)	(0.027)	(0.025)	(0.025)
Financial development/size	-0.406	-0.356	-0.080	-0.105	-0.047	-0.092
	(0.082)***	(0.094)***	(0.165)	(0.159)	(0.090)	(0.098)
Inflation differential	0.314	0.356	-0.107	-0.138	-0.213	-0.218
	(0.110)***	(0.114)***	(0.081)	(0.077)*	(0.172)	(0.175)
Financial openness	0.005	0.004	0.082	0.059	0.058	0.069
	(0.031)	(0.032)	(0.027)***	(0.026)**	(0.032)*	(0.034)**
European Union states	-0.259		0.068		0.207	
	(0.049)***		(0.062)		(0.080)***	
Years after 2002	-0.011	-0.012	0.066	0.037	0.010	0.004
	(0.011)	(0.012)	(0.011)***	(0.011)***	(0.012)	(0.012)
Bretton Woods	-0.013	-0.003			-0.089	-0.091
	(0.027)	(0.027)			(0.025)***	(0.026)***
Pegged to US dollar	0.055	0.048	0.017	-0.006	-0.045	-0.060
	(0.029)*	(0.030)*	(0.035)	(0.033)	(0.041)	(0.042)
Pegged to euro	-0.029	-0.030	0.105	0.082	-0.094	-0.092
	(0.023)	(0.024)	(0.022)***	(0.022)***	(0.021)***	(0.021)***
Constant	0.571	0.568	-0.041	-0.221	-0.156	-0.145
	(0.055)***	(0.074)***	(0.064)	(0.091)**	(0.082)*	(0.091)
N	336	336	285	285	326	326
Number of countries	43	43	34	34	37	37
Overall R²	0.73	0.27	0.67	0.20	0.59	0.38
W/in R²	0.25	0.26	0.39	0.45	0.26	0.27

Note: Standard errors are in parentheses, with ***, **, and * denoting statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' calculations.

First of all, for all the currencies, we find evidence that export market share matters. The larger the share of its exports that goes to the US or the eurozone, the more likely it is for a country to invoice in dollars or euros, respectively. In the case of the dollar share, the coalescing effect is in effect; given the vast size of the US market and its supposedly high degree of competition, exporters tend to invoice in the US dollar to minimize fluctuations in the prices of their products in the local market's currency (i.e., the US dollar) and to retain their market shares. The same observation is applicable to the euro share estimation. Also, if they have a larger export share in the world, exporters tend to invoice their exports in the home currency as well.[29]

If a country exports more commodities, it tends to invoice more in dollars and less in the euro, possibly suggesting that the dollar is a vehicle currency especially for

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[29] The findings that the variables for the shares of exports have positive signs for all of the three estimations may appear puzzling. However, while the share variables for the estimations for the US dollar share or the euro share refer to the share of country *i*'s exports to the US or the eurozone, respectively, the export share variable for the home currency estimation represents country *i*'s export share in *world* exports. In other words, as far as the exports share variable is concerned, the estimations for the dollar share or the euro share are not directly comparable with those for the home currency share, which makes all the export share variables having positive signs acceptable. As for the estimations for the dollar or the euro share, our findings suggest that if a country has greater presence in either the US or the eurozone area, exports from that country would face stronger need to invoice in the dollar or the euro to maintain their market presence. As for the estimations for the home currency, if a country has greater presence in the world, exporters from that country seem able to exercise greater bargaining power so that they can invoice in their home currency.

commodity exports. The positive estimates are obtained for the home currency share estimations, that is somewhat counterintuitive. The more differentiated products it exports (which we proxy for by using the relative income level to the US in PPP), the more likely it is to invoice in the home currency (and weakly in the euro) and the less likely to invoice in dollars. These results also provide evidence that the dollar functions as the vehicle currency in international trade. A country with higher inflation tends to invoice its exports in the dollars. The estimate on the inflation differential variable is negative in the euro and home currency share estimations, but only statistically significant in the euro share estimation with fixed effects. A country with volatile exchange rates tends to invoice its exports more in dollars and less in the euro or home currency, though none of the estimates is significant.

While financial openness does not affect the share of dollar invoicing, the size of domestic financial markets does matter for it; a country with deeper and larger financial markets is *less* likely to invoice its exports in dollars.[30] Although financial openness does not matter for the US dollar share, it does matter for the share of the euro or the home currency in export invoicing. The more open financial markets it has, the more a country tends to invoice in either the euro or the home currency. Since our measure of financial openness can refer to capital account openness in both directions of capital flow, our findings suggest that financial liberalization may allow countries to diversify investment instruments in international financial markets, which may make euro-denominated assets look more accessible to domestic investors and therefore make euro invoicing more acceptable. At the same time, greater financial openness may lead to more usability and investment opportunities of the home currency for international investors and therefore it may lead to more invoicing in the home currency.

On average, the EU countries have lower shares of dollar invoicing by 26 percentage points while they tend to have higher shares of their home currencies (including the euro for the eurozone countries) by 21 percentage points.

After the collapse of the Bretton Woods system in 1973, the share of home currency invoicing rose by 9 percentage points, though we do not detect any significant change in the US dollar share. After the euro entered circulation in 2002, the share of dollar invoicing declined by (an insignificant) 1 percentage point while the share of the euro for non-eurozone countries increased 4–7 percentage points.

Those countries that peg their currencies to the dollar tend to invoice their exports in dollars. A similar conclusion can be made for those countries that peg their currencies to the euro; those countries that peg their currencies to the euro tend to invoice in euros, while they tend to reduce their home currency invoicing.

3.3 Further Analyses

De Facto versus De Jure Measures of Financial Openness

We used the Chinn–Ito index to measure the extent of financial openness. This index reflects the regulatory environment for cross-border capital transactions. However, the

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[30] When we include *PCGDP* or *PRIV_SIZE* individually, *PCGDP* does not turn out to be a significant contributor to any of the currency share estimations, but *PRIV_SIZE* is found to be a negative contributor to the US dollar share estimation. These findings suggest that the relative size of financial markets, rather than their depth, matters for the choice of whether or not to invoice exports in the US dollar.

actuality of cross-border capital transactions is much more complex, and, therefore, can differ from the picture we depict through the lens of regulatory framework.[32]

According to the Chinn–Ito index, as Figure 11 (a) shows, the PRC and India have not made progress in opening markets for capital account transactions and have been lagging behind the Russian Federation and Brazil or other developing countries. If we measure the extent of capital account openness by the actual size of cross-border capital transactions, however, we get a different picture. In Figure 11 (b), we show the extent of financial openness by using another oft-used, quantity-based *de facto* measure of financial openness, namely, the sum of total stocks of external assets and liabilities as a ratio to GDP using the dataset compiled by Lane and Milesi-Ferretti (2007). According to this measure, the "BRIC" (Brazil, the Russian Federation, India, and the PRC) countries are generally progressing toward greater financial openness. The PRC appears to be steadily increasing the extent of financial openness and to be more financially open than Brazil.[33]

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[32] Researchers have constructed different de facto and de jure measures of financial openness. For more details on comparisons across different measures of financial openness, refer to Kose et al. (2006) and Quinn et al. (2011).

[33] This kind of de facto measure has its own drawbacks, however. For one, the extent of 'openness' can differ depending on how the sizes of the volumes of cross-border capital transactions are normalized. For example, normalizing the sum of total assets and liabilities as a ratio of GDP would make the index appear unnecessarily low for large economies such as the US, and make the one for an international financial center—such as Ireland; Luxembourg; Singapore; or Hong Kong, China—appear extremely high. Secondly, de facto measures can be susceptible to business cycles as well as ebb and flow of cross-border capital flows. In Figure 11 (b), the Russian Federation appears to be getting more 'financially open' in the late 1990s, but part of it is due to a shrinkage of the denominator, i.e., the country's GDP.

Figure 11: Financial Openness in Different Measures

(a) Chinn–Ito index
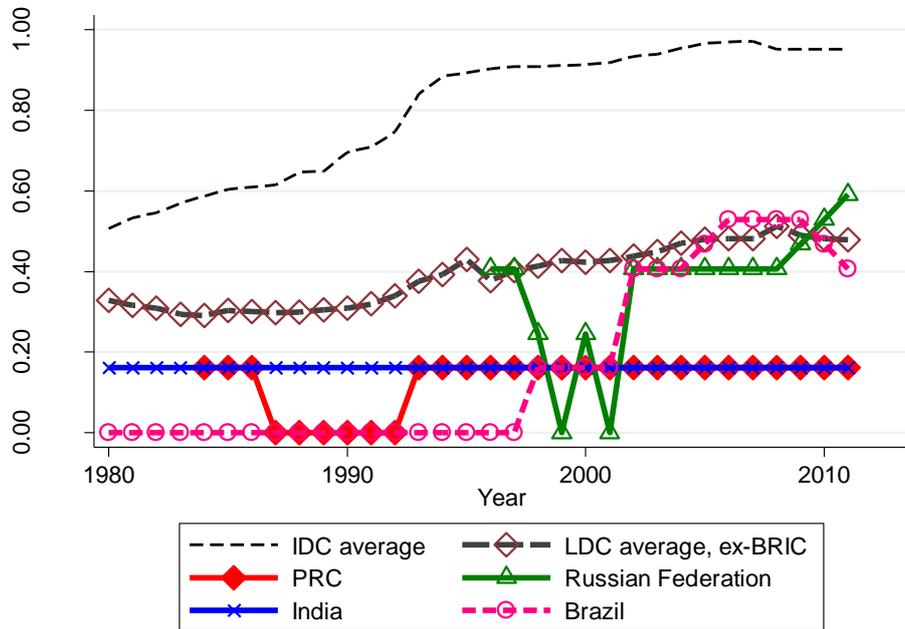
(b) De Facto Measure of Financial Openness
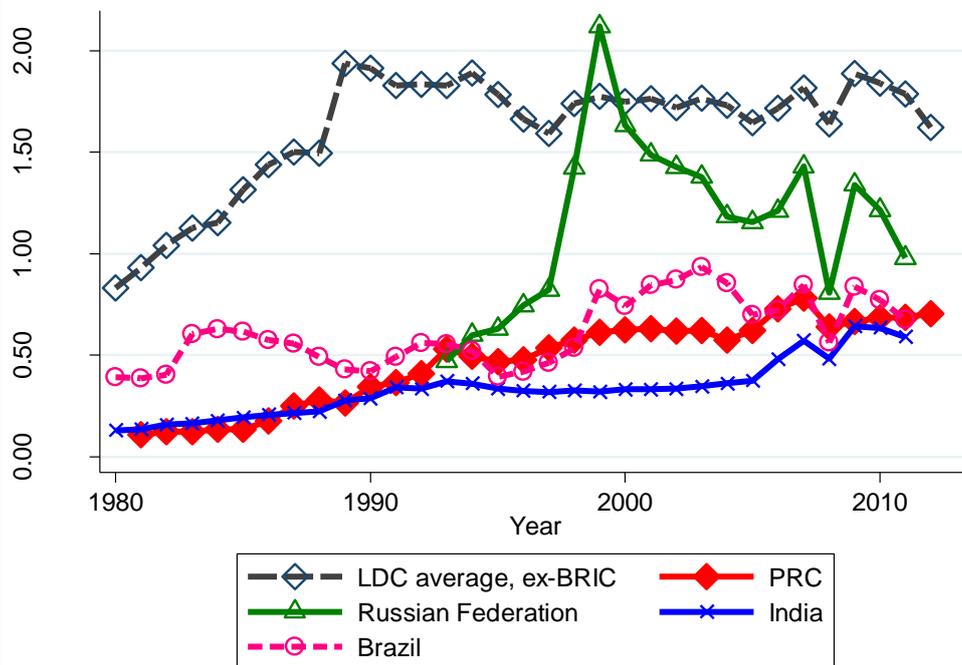
BRIC = Brazil, Russian Federation, India, and the People's Republic of China; PRC = People's Republic of China.

Source: Authors' calculations.

We repeat the above empirical exercise while including the de facto measure of financial openness instead of the de jure measure (not reported). We get the regression results that the estimate of the de facto measure of financial openness in the US dollar share estimation is significantly positive; that in the euro share estimation is significantly negative; and that in the home currency share estimation is insignificant with its magnitude close to zero. That is, all these results are either inconsistent with or contradictory to theoretical predictions. These results are primarily due to the inclusion of financial center countries such as the UK, Ireland, and Luxembourg in the sample. When we interact the de facto measure of financial openness with the dummy for high values of the measure (such as de facto measure is greater than the value of 3) to control for the financial center countries, we can obtain results more consistent with theoretical predictions. However, the results are quite sensitive to what we use as the threshold for the financial center countries. In sum, we do not think the de facto measure gives us consistent results.

Other Factors

We should suspect other potential determinants of currency choice for export invoicing so that we can minimize missing variable bias.

We first test the effect of legal development. A currency might be used more intensively in trade if it is associated with an economy where legal systems and institutions are sufficiently well developed to guarantee smooth and predictable transactions. Hence, we also expect higher levels of legal or institutional development to lead to more home currency invoicing and less invoicing in the vehicle currency, the US dollar. We use a variable, *LEGAL*, as a measure of general legal/institutional development, which is the first principal component of law and order (*LAO*), bureaucratic quality (*BQ*), and anti-corruption measures (*CORRUPT*).[34] The estimated coefficient on *LEGAL* is found to be insignificantly positive for the US dollar share estimation, significantly negative for the euro share estimation, and insignificantly positive for the home currency share estimation (results not reported). We do not have sufficient evidence to support the hypothesis that legal development matters for the choice of invoicing currency.

Next, we investigate the effect of financial crises. Any financial crisis can put the credibility of the currency of the crisis country into question, thereby discouraging the use of that currency for trade settlements or invoicing. Furthermore, if a financial crisis involves expectations for future depreciation or devaluation, that would further help traders to shy away from the currency.

Hence, we include the dummy for currency, banking, or debt crisis individually in each of the three estimations. We use the crisis dummies from Aizenman and Ito (2013) to identify the three types of the crises.[35] The results indicate that countries that experience a banking crisis tend to increase the share of the US dollar for their export invoicing by 4 percentage points while they also tend to *decrease* the share of the euro by 2.4 percentage points.[36] The effect of the banking crisis on the home currency share or that of other types of crises turns out to be insignificant.

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[34] *LAO*, *BQ*, and *CORRUPT* are extracted from the ICRG database. Higher values of these variables indicate better conditions.

[35] To identify currency crisis, Aizenman and Ito use the exchange market pressure index using the exchange rate against the currency of the base country (i.e., the country a country follows most closely in determining its monetary policy. See Aizenman et al. [2013] for details.) The banking crisis dummy is based on the papers by Laeven and Valencia (2008, 2010, 2012). For the debt crisis dummy, they augment the dataset by Reinhart and Rogoff (2009) with other papers including the World Bank's *Global Development Finance* (2012). See Aizenman and Ito's Appendix for more details.

[36] The estimation results are available from the authors upon request.

We also investigate whether the recent global financial crisis had any impact on the choice of invoicing currencies. When we replace the crisis dummy with a dummy variable for the years after 2008, we find that countries on average increase the share of US dollar invoicing by 5.8 percentage points. However, the crisis does not affect other currency shares, suggesting that the global financial crisis may have led investors and traders to flee to the US dollar.

Overall, a crisis, particularly a banking crisis, contributes to more US dollar invoicing, reflecting the role of the dollar as a safe-haven refuge.

Furthermore, we test whether net investment positions matter for the choice of a currency for export invoicing. The currency of a net creditor country may become more available outside the home country, which may make it easier to invoice in that currency. When we include the variable for net investment positions (as a share of GDP) based on the Lane and Milesi-Ferretti dataset, we find that the estimate is significantly positive for the home currency share estimation, suggesting that countries with better net investment positions tend to be able to invoice their exports in their own currency. However, we must take this result with a grain of salt because of potential endogeneity issues. That is, history has told us that countries with international currencies often find it easier to get finance from international financial markets and turn into debtor countries, as happened to the US and the UK.

Lastly, we test whether exchange rate changes contribute to the choice of invoicing currencies. One contributing factor to the internationalization of the RMB is the one-side expectation of the appreciation trend of the currency. As long as the PRC continues to experience rapid productivity growth compared to advanced economies, which is expected to continue in the foreseeable future, the RMB can continue on the appreciation trend.

If the currency of exporters is on an appreciation trend, nonresidents outside the home country would have more incentive to hold the home country's currency and therefore would agree with invoicing in that currency. Similarly, the appreciation trend of the home currency may help lower the share of the US dollar use.

Hence, we include in the regressions for the shares of the US dollar and the home currency the centered 3-year moving average of the rate of depreciation. The rate of depreciation variable should have a positive coefficient in the US dollar share regression; trend currency appreciation (i.e., negative rates of depreciation) would lead to a decrease in the US dollar share, whereas it should have a negative estimate in the home currency share regression. Currency appreciation trend would lead to an increase in the home currency share.[37]

It turns out that the estimate on the rate of depreciation in the US dollar share estimation is significantly positive, but that the estimate in the home currency share estimation is insignificantly positive.[38] In other words, appreciation of the home currency does lead to a fall in the share of US dollar invoicing in exports, but it may not necessarily mean that exporters would invoice in their home currencies.

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[37] We also control for large rates of depreciation (when the 3-year moving average rate of depreciation is greater than 30%).

[38] Results are available from the authors upon request.

Other Specifications

We also test using different specifications to incorporate the unique traits of the currency share data. First, we incorporate the fact that the dependent variable for the share of a currency use ranges between zero and one. The truncation of the dependent variable suggests that we conduct a robustness check using the tobit estimation method. The nonlinearity of the estimation method may better fit with the nature of changes in the shares of currencies used for trade invoicing which entails persistency or inertia as we have shown.

Second, as another way of dealing with the possible nonlinearity of the currency share data, we transform the dependent variable into the logistic form as Chinn and Frankel (2007, 2008) do. They argue that the share of a currency in central banks' reserves can develop in a nonlinear fashion so that the share of a currency can rise rapidly once it surpasses a "tipping point" or threshold due to externality. To better capture the nonlinearity, Chinn and Frankel transform the share of a currency in central bank reserves as $\log(share/(1-share))$. Although the nature of the development of invoicing currency shares differs from that of the shares of reserve currencies, we conduct a robustness check by transforming our dependent variables in the same way as Chinn and Frankel do.

Third, we suspect that the shares of the dollar, the euro, and the home currency are correlated because the shares must sum to one. In other words, positive disturbances in one currency should be associated with negative disturbances on average across the other currencies, making the error terms of the three estimation models correlated with each other. Because our dataset is far from complete or balanced, such correlation does not have to be the case in a strict sense—in fact, there are some cases where the sign of the estimate remains the same across the three estimations for several variables, which would be inconsistent if we had complete data on the three types of currency shares. Nonetheless, we test the possibility that the error terms across the three estimations are correlated by employing the seemingly unrelated regression (SUR) estimation.

Summarizing the results from these alternative econometric specifications, we find most of the estimates in accord with those obtained using ordinary least squares (OLS), often with greater statistical significance. One exception is exchange rate volatility, which turns out to have estimated coefficients contrary to priors.[39] While the financial development/size variable often had a significantly negative coefficient for the home currency share regression, contradictory to theoretical predictions, the estimate in the US dollar share estimation is significantly negative in all the nonlinear models. This supports the OLS result that a country with deeper and larger financial markets is *less* likely to invoice its exports in the US dollar. The variables whose results are persistently consistent with the OLS estimation results include the variables for the share of exports, commodity exports, and relative income all for the three estimations. Financial openness is also often found to be a significantly positive contributor to the share of home currency invoicing, suggesting that the positive effect of greater financial openness on the share of home currency in export invoicing is robust.

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[39] Considering that this variable contains outliers, these contradictory results can be due to the outliers.

4. IMPLICATIONS AND PROSPECTS FOR THE PEOPLE'S REPUBLIC OF CHINA

4.1 Goodness of Fit

Figure 12 (a) shows both the predicted and actual shares of the RMB in the PRC's export invoicing. The prediction is based on the estimates (with random effects) reported in Table 2. Overall, the actual use of RMB for settling PRC exports is much smaller than our estimation model suggests, though the recent rapid rise in RMB settlements of exports makes it look like the actual settlement ratios are getting closer to the predictions. Looking at when the PRC started liberalization of RMB invoicing in 2009, our model suggests that about 20% of the PRC's exports *should* be invoiced in RMB although the actual use of the RMB was essentially non-existent. As for 2011, while our model predicts the share of RMB use in PRC's exports to be 21%, the actual share is still a meager 6.2%. Cui et al. (2009) argue that based on the correlation between the pricing-to-market (PTM) coefficients found their panel analysis and the actual share of home currency invoicing in exports, the PRC has the potential of invoicing 20%–30% of its exports in its home currency, an estimate which is similar to our predictions.

Figure 12: Predicted versus Actual Currency Shares

(a) Renminbi in People's Republic of China Exports
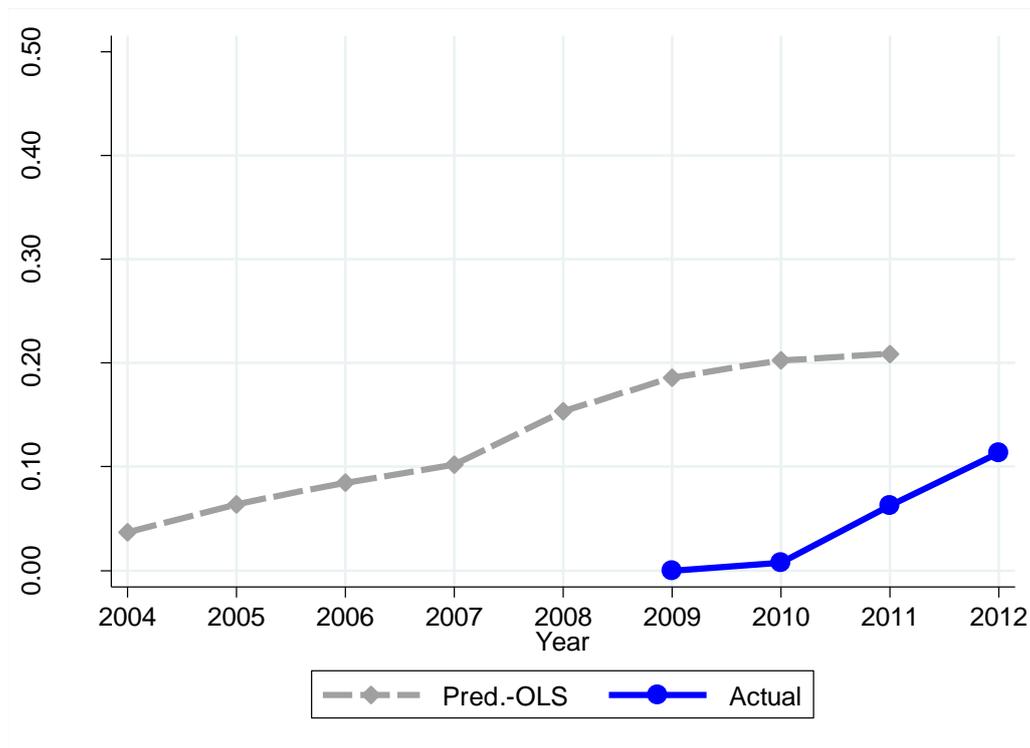
(b) Japanese Yen in Japan's Exports
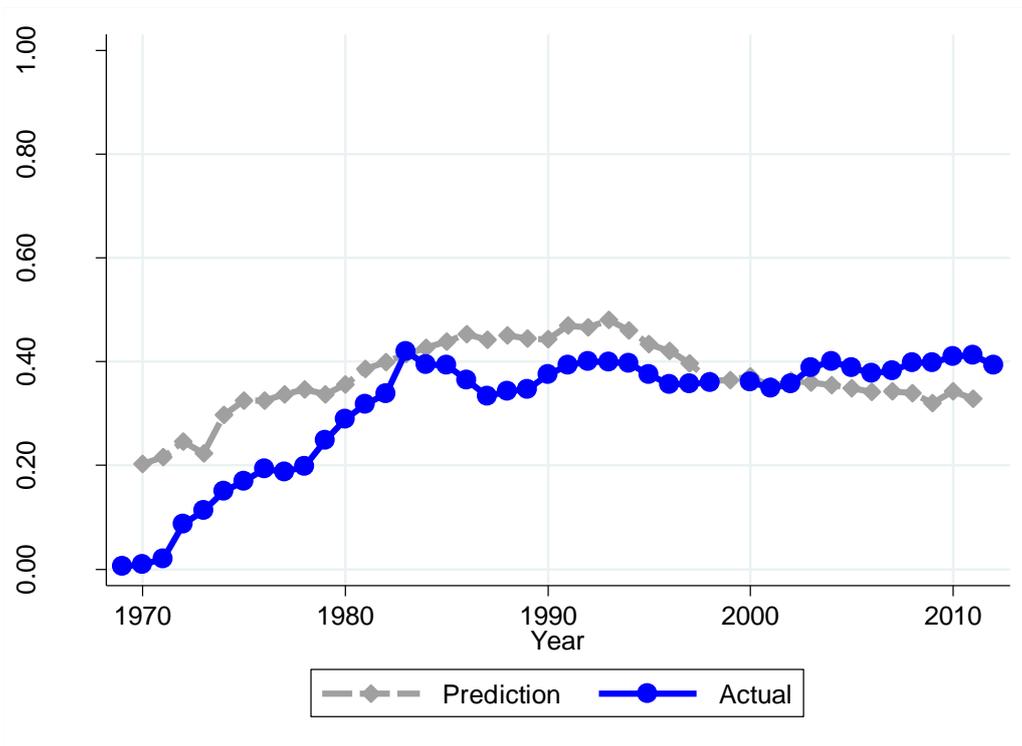
(c) US Dollars in Japan's Exports
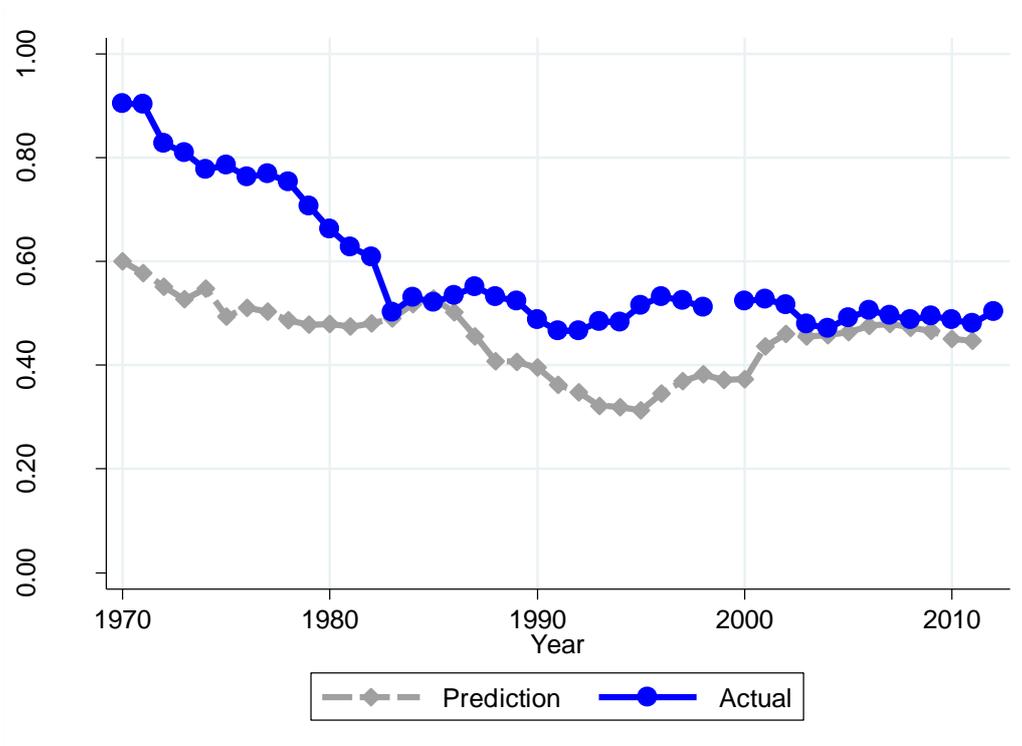
(d) Euro Share in Eurozone's Exports
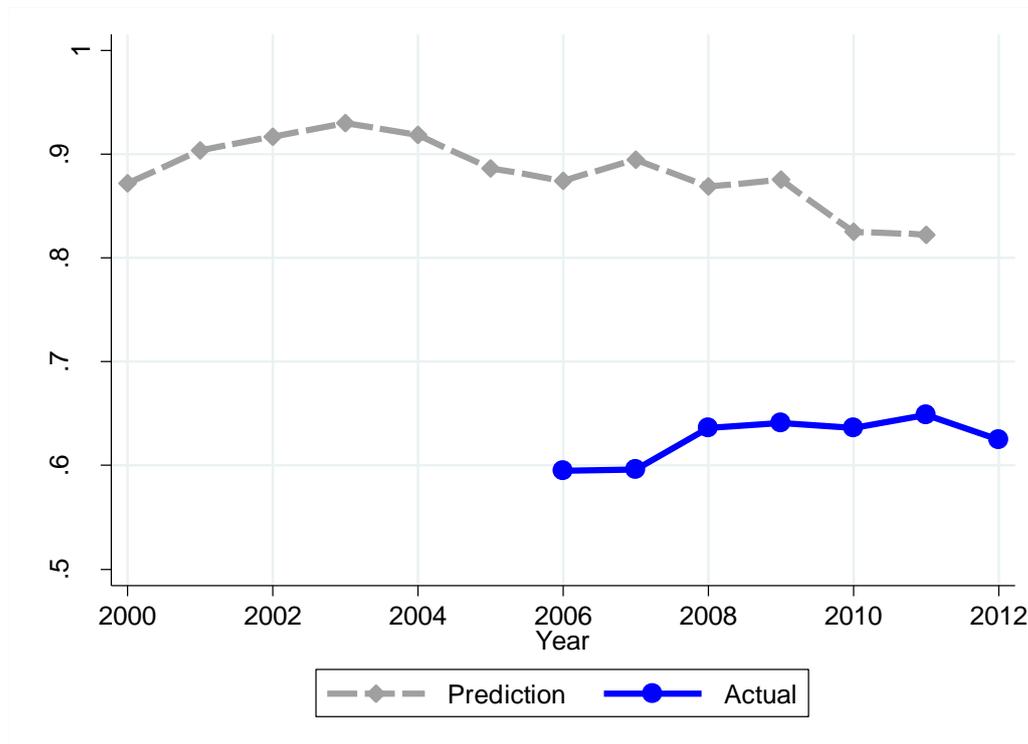
Source: Authors' calculations.

While there is a possibility that the estimates in our model suffer from omitted variable bias, comparison with other countries' experiences tell us that there is more to it than just omitted variable bias. Figure 12 (b) illustrates the predicted and actual shares of the yen among the currencies used for export invoicing, and Figure 12 (c) shows the predicted and actual shares of US dollar use in Japan's exports. It appears that the actual level of yen export invoicing finally reached the level of the model prediction in 1983, more than 10 years after yen invoicing started taking place, but followed by the actual share again hovering at lower levels than the model prediction. In the dollar invoicing, we can observe the opposite (Figure 12 [c]); the actual use of the dollar is persistently higher than the model prediction. The fact that yen invoicing did not become as prevalent as predicted while dollar invoicing prevailed much more than predicted indicates that "inertia" does affect the choice of currency for trade invoicing.

Figures 12 (b) and 12 (c) suggest that the underperformance of RMB invoicing can be attributed to the RMB's recent entry as an invoicing currency and the persistency or the "inertia" of the use of other currencies, particularly that of the US dollar, as the vehicle currency for trade invoicing.[40] Once a currency becomes a dominant invoicing or settlement currency, it tends to continue to be dominant.[41]

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[40] Cui et al. (2009) also mention the persistency of invoicing practice in other non-RMB currencies.

[41] When we repeat the same exercise for the Korean won, Indonesia rupee, and Thai baht, the currencies for which we have longer time series of invoicing currency shares, we observe similar patterns. That is, the actual use of the dollar tends to be persistently higher than the model predicts and declines only slowly, or the actual use of the home currency tends to be lower than the model suggests even when the share of the home currency starts rising, with the gap between the two slowing narrowing.

Figure 12 (d) shows the share of the euro, a newly introduced and internationalized currency, used for the eurozone's exports.[42] The model again predicts much higher levels of euro invoicing, but the actual use of the euro has been gradually rising, narrowing the gap.

4.2 Prospects of Renminbi Export Invoicing

So, where is the RMB heading in the near future? To answer this question, we implement out-of-sample prediction for 2015 and 2018, using the estimates we obtained in the baseline regression (Table 2).

For the out-of-sample predictions, we need to make assumptions about the explanatory variables. We summarize the assumptions we make for the forecasting exercise in Appendix 2. Some of the assumptions are based on the IMF's forecasts reported in the *World Economic Outlook* (as of April 2013). Some other variables are assumed to be the same as the average of the relevant variables in the last 5 years of the sample period (i.e., 2007–2011).

We also conduct some scenario analysis to see how the RMB share in export invoicing can be affected by hypothetical paths of financial liberalization. The baseline assumption for the Chinn–Ito index of financial openness (*KAOPEN*) is that, for 2015, the PRC will increase the level of financial openness to 0.35, a level higher than the current level of 0.16, but not as high as the level of financial openness of Brazil, Colombia, and Indonesia (which all score 0.41 as of 2011). For 2018, we assume the level of the PRC's financial openness continues to rise up to 0.50, more financially open than Turkey (0.45 as of 2011). We also think about both optimistic and pessimistic scenarios and make predictions for these scenarios as points of reference. Under the pessimistic scenario, the level of financial openness for the PRC does not change in 2015; it is the same as the 2011 level (i.e., 0.16). In 2018, we assume it rises to 0.25, a level still lower than in the baseline scenario for 2015. Under the optimistic scenario, KAOPEN rises rapidly to 0.60 in 2015 and to 0.95 in 2018, a comparable level to high-income countries.

Figure 13 illustrates our predictions for 2008–2011, 2015, and 2018. Based on the baseline prediction, the share of RMB invoicing for the PRC's exports would rise up to 22.8% in 2015 and 29.4% in 2018. Despite the significant coefficient on *KAOPEN*, the different scenarios on financial liberalization do not appear to make much difference. Even in the optimistic scenario, the share of RMB invoicing rises only up to 31.4% in 2018, which is not much different from the baseline scenario.[43]

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[42] For this prediction, we also include the data for the eurozone in the regression exercise as one entity (in addition to individual eurozone countries) while the estimation exercise reported in Table 2 does not include the euro.

[43] However, we have shown that the financial openness variable is one of the robust variables to other (nonlinear) estimation models. Hence, financial openness is still one important contributor to the share of home currency use for export invoicing.

Figure 13: Forecasting of the Renminbi Share in the People's Republic of China's Exports
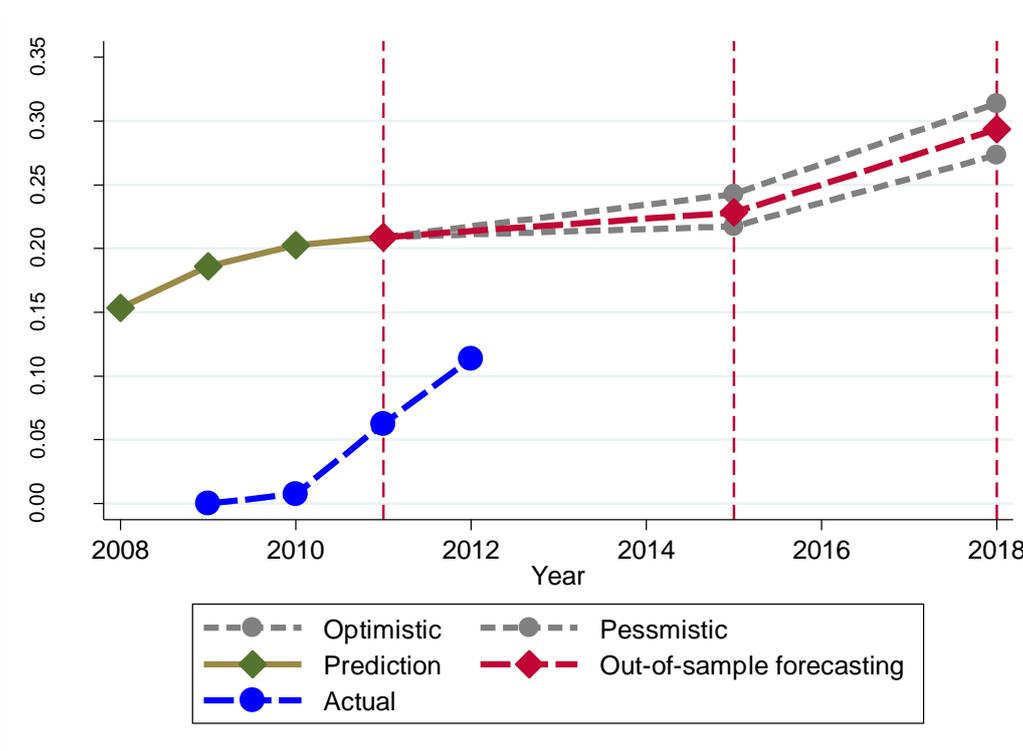
Considering that the gap between the predicted and actual paths for the share of RMB export invoicing can be due to the inertia of invoicing currencies, we can expect the gap to narrow over the years to come. Hence, our predictions probably show the upper end of the actual path of RMB internationalization in terms of export invoicing.

As for the foreseeable future, the PRC may allow greater exchange rate flexibility, leading to greater volatility. In addition, it is likely the PRC's financial markets will continue to grow faster than what occurred in 2007–2011; or, the country could experience higher than expected inflation. All these factors would tend to decrease RMB use (although the insignificant coefficients suggest little effect). If the PRC experiences an even greater increase in its relative income level or export market share, or both, then the PRC's share of RMB invoicing might also increase. Nonetheless, the convergence to the predicted values should happen as the use of RMB in export invoicing rises and creates scale benefits.

5. CONCLUSIONS

One of the important keys to the RMB becoming an international currency hinges upon how widely and how soon the RMB becomes a major currency for trade invoicing or settlement. Despite the fact that RMB use for trade settlement began only in 2009, its use has risen rapidly since then. Many have argued that the future of the RMB as an invoicing currency is closely tied with the issue of the PRC's commitment to liberalizing capital account transactions. In this paper, we investigated the determinants of currency choice for trade invoicing in a cross-country context while focusing on the impact of capital account liberalization.

Our data of trade invoicing reconfirmed that the US dollar still plays an important role as the vehicle currency. Although the use of the euro as an invoicing currency had been steadily increasing before the euro debt crisis, a rise in the risk involving the currency seems to have contributed to the plateauing or even the decline of the currency's use in recent years. In contrast, both the global financial crisis and the euro sovereign debt crisis seem to have helped the US dollar to increase its use for trade invoicing. Furthermore, in the Asian region, countries have relied heavily on the US dollar as the vehicle currency, reflecting the reliance of the regional supply chain network on the US as the ultimate export destination. The Asian dollar bloc therefore stands as a large challenge to the PRC's ambitions for the RMB to become the regional international currency

Despite the recent liberalization of the use of the RMB for trade transactions, the share of RMB use has been rapidly rising. Interestingly, as opposed to other currencies, for which the share of the use for exports is usually higher than that for imports, the RMB has been more used for import invoicing rather than for export invoicing. This reflects the government's goal to increase the use of RMB overseas and support the government-run efforts of internationalizing the currency. Despite the rapid increase in use for trade invoicing, however, compared to the Japanese yen and the euro—the two previous challengers against the US dollar's dominance—the RMB is still far behind in its use as an invoicing currency.

Our panel data analysis provides results consistent with previous studies. Among the variables of our focus, which are also the variables that have not been tested in the past studies, we find that countries with more developed and larger financial markets tend to invoice *less* in the US dollar. At the same time, countries with more open capital accounts tend to invoice in either the euro or their home currency. Hence, financial development and financial openness are among the keys to challenging the dominance of the dollar in general, and to internationalizing the RMB for the PRC.

Our estimates suggest that in the last few years, the use of the RMB in export invoicing should have been higher, around the low- to mid-20s as a percentage of total exports, rather than the actual share of less than 10% as of 2011. The underperformance of RMB export invoicing can be attributed to inertia. That is, once a currency is used for trade invoicing or settlements, it becomes difficult for traders to switch from one currency to another. In fact, both the yen and the euro had not been used as much as the model predicts especially at their inceptions as international currencies. That inertial tendency is likely to persist.

To provide some outlook on the use of the RMB as a trade invoicing currency, we implemented out-of-sample prediction for 2015 and 2018, using the baseline estimation results. Based on the projections, the share of RMB invoicing for the PRC's exports will rise to 26.5% in 2015 and to 31.5% in 2018. Despite the statistically significant coefficient on *KAOPEN*, drastically different assumptions regarding financial liberalization do not appear to make much difference.

Other factors could affect the future path of the RMB use for export invoicing, including exchange rate volatility, the relative size and depth of the PRC's financial markets, its relative income level, and export market share. Nonetheless, our predictions probably show the upper end of the actual path of RMB export invoicing. The convergence to the predicted levels could accelerate as the increased use of the RMB in export invoicing creates scale benefits.

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APPENDIX

Table A1: Availability of Currency Invoicing Data (50 Countries)

	Country	Country Code	Currency	Availability Exports:	Imports:	Sources
1	Austria	122	US dollar	1973, 1975, 2006, 2010, 2012	2006, 2010, 2012	Scharrer (1981), Eurostat
			Euro	2006, 2008–2012	2006–2012	ECB
			Home	1973, 1975, 2006, 2008–2012	1975, 2006–2012	
2	Belgium	124	US dollar	1971, 1975, 1976, 2002–2004, 2010	1972, 1976, 2002–2004, 2010	Kamps (2006), ECB, Eurostat, Scharrer (1981)
			Euro	2000–2011	2000–2011	
			Home	1971, 1975, 1976, 2000–2011	1972, 1976, 2000–2011	
3	Bulgaria	918	US dollar	1998–2006	1998–2006	Kamps (2006), Hristov and Zaimov (2001), ECB,
			Euro	1998–2011	1998–2011	Bulgarian National Bank Annual Report (2006)
			Home			
4	Croatia	960	US dollar	1998–2004	1998–2004	Kamps (2006)
			Euro	1998–2009	1998–2009	ECB
			Home			
5	Cyprus	423	US dollar	2003, 2004, 2010, 2012	2003, 2004, 2010, 2012	Kamps (2006), ECB, Eurostat
			Euro	2003–2012	2003–2012	
			Home	2007–2012	2007–2012	
6	Czech Republic	935	US dollar	1999–2004	1999–2004	Kamps (2006), ECB
			Euro	1999–2011	1999–2011	
			Home	2001–2003	2001–2003	
7	Denmark	128	US dollar	1971, 1975–1976, 1999–2004, 2010, 2012	1972, 1976, 1999–2004, 2010, 2012	Scharrer (1981), Kamps (2006), ECB, Eurostat
			Euro	1999–2004, 2010, 2012	1999–2004, 2010, 2012	
			Home	1971, 1975–1977, 1999–2004, 2010, 2012	1972, 1976, 1977, 1999–2004, 2010, 2012	

8	Estonia	939	US dollar	2003, 2004, 2010, 2012	2003, 2004, 2010, 2012	Kamps (2006),ECB, Eurostat
			Euro	2001–2012	2001–2012	
			Home	2010–2012	2010–2012	
9	Finland	172	US dollar	1971, 1975, 1976, 2010, 2012	2010, 2012	Scharrer (1981), Eurostat
			Euro	2006, 2010, 2012	2006, 2010, 2012	ECB
			Home	1971, 1975, 1976, 2006, 2010, 2012	2006, 2010, 2012	
10	France	132	US dollar	1972, 1975–1976, 1980, 1992, 1999–2003, 2010, 2012	1980, 1992, 1999–2003, 2010, 2012	Scharrer (1981), Park and Shin (2009), Kamps (2006), ECB, Eurostat, Tavlas and Ozeki (1992)
			Euro	1999–2012	1999–2012	
			Home	1972, 1975–1977, 1980, 1988, 1992, 1999–2012	1977, 1980, 1988, 1992, 1999–2012	
11	Germany	134	US dollar	1972, 1975, 1976, 1980–88, 1992, 2002–2004, 2009, 2010, 2012	1972, 1976, 1980–88, 1992, 2002–2004, 2006, 2010	Scharrer (1981), Park and Shin (2009), Kamps (2006), ECB, Eurostat, Tavlas (1993), Tavlas and Ozeki (1992)
			Euro	2002–2007, 2009–2012	2002–2007	
			Home	1972, 1975, 1976, 1977, 1980, 1987, 1992, 2002–2007, 2009–2012	1972, 1976, 1977, 1980, 1988, 1992, 2002–2007	
12	Greece	174	US dollar	2001–2004, 2012	2001–2004, 2010, 2012	Kamps (2006), Eurostat, ECB
			Euro	2001–2012	2001–2011	
			Home	2001–2012	2001–2011	
13	Hungary	944	US dollar	1992–2004, 2010, 2012	1992–2004, 2010, 2012	Kamps (2006), Eurostat, ECB
			Euro	1992–2004, 2008–2009, 2010, 2012	1992–2004, 2008–2009, 2010, 2012	
			Home	1999–2004, 2010, 2012	1999–2004, 2010, 2012	
14	Iceland	176	US dollar	2010	2010	Eurostat
			Euro	2010	2010	
			Home	2010	2010	
15	Ireland	178	US dollar	2006, 2010	2006, 2010	Eurostat
			Euro	2006–2011	2006–2011	ECB?
			Home	2006–2011	2006–2011	

16	Italy	136	US dollar	1971, 1975–1976, 2010, 2012	1972, 1976, 2010, 2012	Scharrer (1981), Kamps (2006), ECB, Eurostat, Tavlas and
			Euro	2001–2010, 2012	2001–2010, 2012	Ozeki (1992)
			Home	1971, 1975–1977, 1980, 1987, 2001–2010, 2012	1972, 1976–1977, 1980, 1987, 2001–2010, 2012	
17	Latvia	941	US dollar	2000–2004, 2010, 2012	2000–2004, 2010, 2012	Kamps (2006), ECB, Eurostat
			Euro	2000–2012	2000–2012	
			Home	2010, 2012	2010, 2012	
18	Lithuania	946	US dollar	1999–2005, 2010, 2012	1996–2005, 2010, 2012	Kamps (2006), ECB, Eurostat
			Euro	1999–2012	1996–2012	
			Home	1999–2005, 2010, 2012	1996–2005, 2010, 2012	
19	Luxembourg	137	US dollar	2002–2004, 2010, 2012	2002–2004, 2010, 2012	Kamps (2006), ECB, Eurostat
			Euro	2000–2012	2000–2012	
			Home	2000–2012	2000–2012	
20	Macedonia, FYR	962	US dollar	1998–2004	1998–2004	Kamps (2006)
			Euro	1998–2009	1998–2009	ECB
			Home			
21	Malta	181	US dollar	2012	2010, 2012	ECB
			Euro	2000–2003, 2012	2000–2003, 2010, 2012	
			Home	2000–2003, 2012	2000–2003, 2010, 2012	
22	Netherlands	138	US dollar	1971, 1975, 1976, 1998–2002, 2010, 2012	1998–2002, 2010, 2012	Scharrer (1981), Kamps (2006), Eurostat
			Euro	1998–2002, 2006, 2010, 2012	1998–2002, 2006, 2010, 2012	
			Home	1971, 1975–1977, 1998–2002, 2006, 2010, 2012	1977, 1998–2002, 2006, 2010, 2012	
23	Norway	142	US dollar	2010	2010	Eurostat
			Euro	2010	2010	
			Home	2010	2010	
24	Poland	964	US dollar	1994–2004	1994–2004	Kamps (2006), ECB
			Euro	1994–2009	1994–2009	
			Home	1998–2004	1998–2004	

25	Portugal	182	US dollar	2002–2004, 2010	2002–2004, 2010	Kamps (2006), Eurostat, ECB (2012)
			Euro	2000–2011	2000–2011	
			Home	2000–2011	2000–2011	
26	Romania	968	US dollar	1999–2005	1999–2005	Kamps (2006), ECB (2012)
			Euro	1999–2011	1999–2011	
			Home			
27	Slovak Republic	936	US dollar	1999–2003, 2010	2010	Kamps (2006), ECB, Eurostat
			Euro	1999–2011	2002–2011	
			Home	2008–2011	2008–2011	
28	Slovenia	961	US dollar	2000, 2001, 2003, 2004, 2010, 2012	2000, 2001, 2003, 2004, 2010, 2012	Kamps (2006), ECB, Eurostat
			Euro	2000–2012	2000–2012	
			Home	2006–2012	2006–2012	
29	Spain	184	US dollar	1998–2004, 2010, 2012	1998–2004, 2010, 2012	Kamps (2006), ECB
			Euro	1998–2012	1998–2012	
			Home	1998–2012	1998–2012	
30	Sweden	144	US dollar	1973, 1993, 2010, 2012	1968, 1973, 1993, 2010, 2012	Scharrer (1981), Friberg (1966)
			Euro	2010–2012	2010–2012	ECB
			Home	1973, 1977, 1993, 2010, 2012	1968, 1973, 1977, 1993, 2010, 2012	
31	Switzerland	146	US dollar	1977		Scharrer (1981)
			Euro			
			Home	1977	1973	
32	Turkey	186	US dollar	2002–2004	2002–2004	Kamps (2006), ECB
			Euro	2001–2009	2001–2009	
			Home	2002–2004	2002–2004	
33	United Kingdom	112	US dollar	1977, 1980, 1992, 1999–2002, 2010–2012	1980, 1992, 1999–2002, 2010–2012	Scharrer (1981), Park and Shin (2009), Kamps (2006), UK, HM Customs and Revenue (trade with non-EU); Eurostat,
			Euro	1999–2002, 2010–2012	1999–2002, 2010–2012	

			Home	1968, 1977, 1980, 1988, 1992, 1999–2002, 2010–2012	1980, 1988, 1992, 1999–2002, 2010–2012	Non-Euro area trade
34	Ukraine	926	US dollar	2001–2004	2002–2004	Kamps (2006)
			Euro	2001–2007	2002–2007	
			Home	2003–2004	2003–2004	
	Asia-Pacific					
35	Australia	193	US dollar	1997–2011	1997–2011	abs.gov.au
			Euro	1997–2011	1997–2011	
			Home	1997–2011	1997–2011	
36	People's Republic of China	924	US dollar			People's Bank of China
			Euro			
			Home	2009–2012	2009–2012	
37	India	534	US dollar	2005, 2008	2005, 2008	Kamps (2006), Rajiv and Prakash (2010)
			Euro	1998, 2005, 2008	1998, 2005, 2008	
			Home			
38	Indonesia	536	US dollar	1991, 1994–2012	1991–2012	Kamps (2006), Bank of Indonesia, Balance of Payments
			Euro	1991, 1994–2012	1991–2012	Statistics; data transformed to represent overall trade (not only
			Home	1991, 1994–1995, 1997–2012	1991–2012	Non-oil trade). http://www.bi.go.id/web/en/Data+Statistik/
39	Japan	158	US dollar	1969–2012	1969–1980, 1986–2012	Yarita (1999), Park and Shin (2009), Masuda (1995), Kamps
			Euro	2000–2012	2000–2012	(2006), Japan's Ministry of Finance
			Home	1969–2012	1969–1980, 1983, 1985–2012	
40	Republic of Korea	542	US dollar	1976–2005	1980–2005	Bank of Korea
			Euro	1990, 1995, 1996, 2000–2005	1990, 1995, 1996, 2000–2005	
			Home			
41	Malaysia	548	US dollar	1995, 1996, 2000	1995, 1996	Kamps (2006)

				Euro	1995, 1996	1995, 1996	
				Home	1995, 1996		
42	Pakistan	564	US dollar	2001–2003	2001–2003	Kamps (2006)
			Euro	2001–2003	2001–2003	
			Home			
43	Thailand	578	US dollar	1993–2012	1993–2012	Bank of Thailand, bilateral data.
			Euro	1993–2012	1993–2012	http://www.bot.or.th/BOThomepage/databank/EconData/Econ
			Home	1993–2012	1993–2012	Data_e.htm
	North America						
44	Canada	156	US dollar	2001		Kamps (2006)
			Euro			
			Home	2001		
45	United States	111	US dollar	1980, 1988, 1992	1980, 1988, 1992, 2003	Park and Shin (2009), Tavlas and Ozeki (1992), Kamps
			Euro		2003	(2006)
			Home	1980, 1988, 1992	1980, 1988, 1992, 2003	
	Middle East and Africa						
46	Algeria	612	US dollar	2003, 2004		Kamps (2006)
			Euro	2003, 2004	2003, 2004	
			Home			
47	Israel	436	US dollar	2000, 2004		Kamps (2006)
			Euro	2000, 2004		
			Home			
48	Morocco	686	US dollar			Kamps (2006)
			Euro		2003	
			Home			
49	South Africa	199	US dollar	2003		Kamps (2006)

			Euro	2003		
			Home	2003		
50	Tunisia	744	US dollar			
			Euro	1995–2001	1995–2001	Kamps (2006)
			Home			

Table A2: Assumptions for Out-of-Sample Predictions

Variable	Assumptions
Share of exports	Based on predictions in WEO
Commodity exports	Same as the average in the 2007–2011 period
Relative income	Based on predictions in WEO
Exchange rate	Same as the average in the 2007–2011 period
Financial development	PCGDP is assumed to be the same as in the 2007–2011 average. The relative size of the market is based on liner extrapolations. We use the product of the two variables.
Inflation difference	Same as the average in the 2007–2011 period
Financial openness	KAOPEN For People's Republic of China: <Middle course> 2015: 0.35; 2018: 0.50 <Pessimistic course> 2015: 0.16; 2018: 0.25 <Optimistic course> 2015: 0.70; 2018: 0.80
Pegged to US dollar	Same as the average in the 2007–2011 period
Pegged to euro	Same as the average in the 2007–2011 period