Reserve Currencies: Can Multiplicity Work?[*]

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Abstract

The paper analyzes the potential rise of new reserve currencies in the context of the economic and political determinants of an international currency. Two models analyse the role of soft political power, switching cost to a new currency and transaction costs in the rise of a new currency. Quantitative indices are developed to measure these factors, which are then empirically tested and found to be statistically significant in determining the rise of international currency. The study further explores the grteater use of Renminbi in East Asia and the trade integration in this region.

Keywords: Reserve currencies, network benefits, transaction costs, bargaining power, Renminbi

JEL codes: F33, F55, O53

1 Introduction

Historic evidences tell us that the currency of a large global economy plays an important international role. However, the two neither occur simultaneously nor always follow each other. The dollar took twenty to fifty years (depending on different estimates) to overcome British pound after United States of America (USA) became largest economy in late nineteenth century. Moreover, there have been periods of overlap when multiple currencies have been accepted as international currencies.

International currencies play multiple roles. However, store of value (as reserve currency) is the only aspect we have reliable data for. This also closely correlates with other roles of the currency in international transactions so we focus on the analysis of reserve currencies only.

Various economic and political economy determinants have been suggested to judge if a currency can rise to the status of international currency. Many of these, particularly the political economy determinants, are qualitative in nature. This paper develops indices to quantify some of these qualitative determinants, and then uses them in econometric analysis.

The demand for reserve accumulation by the reserve hungry emerging market economies (EMs) will continue as they grow faster than reserve-supplying advanced economies (AEs) for technological and demographic reasons. So, the rise of multiple international currency system is inevitable. In the foreseeable future, if a dollar panic is to be avoided, the world must confront this fundamental pressure in the global monetary system. A South with relatively faster growth cannot continue to rely on the North[1] to satiate an expanding need for insurance. Any feasible solution must involve more than just the current reserve currencies.

China wants to leverage its status as the largest trading nation to shift preferences in favour of Renminbi (RMB). It is convenient for the trading partners to settle trade in RMB with their largest trading partner. For scale reasons alone, China could make a huge difference by emerging as a supplier of reserves, so RMB's internationalization is a desirable outcome from a global standpoint. Experts agree that the rise of RMB is imminent but it is not going to replace the dominance of dollar in foreseeable future. It is more likely to share the role of a major international currency along with dollar, as the world becomes multi-polar.

Table 1: Five largest economies

2001		2011	
Country	GDP (% of world gdp)	Country	GDP (% of world gdp)
USA	32	USA	21
Japan	13	China	10
Germany	6	Japan	8
UK	5	Germany	5
France/China	4	France	4

Source: *Author's calculations*; Data: World Bank

We develop two analytical models learnings from historical precedents on emergence of international currencies. The results of these models are later tested empirically. The first model studies network effects on the decision to choose a currency in the presence of multiple currencies. The second model studies the impact of direct and indirect transaction cost on the choice of the currency in a two currency world. We further investigate whether RMB can play the role of a regional or global currency reserve. Formal tests and analysis of Asian regional integration and China's increasing bargaining power help to asses this issue. If East Asian countries switch to direct settlement in RMB their transaction costs will reduce. This reduction in transaction cost might offset the network benefits these economies gain from the indirect dollar trade settlement.

The paper contributes to the analysis of multiple international currencies. The next section discusses selected literature on international currencies. In section 3, we develop two analytical models based on the literature. In section 4, we develop indices for different economic and political determinants. Section 5 has the is empirical analysis and section 6 is on the rise of China. The last section summarises our findings.

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[1]See Figure: A.1

2 Literature review

To identify gaps in research literature from both economics and political economy is reviewed. The majority of research focuses on the economic literature and ignores political determinants of international currencies.

2.1 Economic literature

The status of a national currency is usually enforced by a set of legal restrictions. However, the use of currencies as international medium of exchange is largely determined by the "invisible hand". Recent work shows multiple reserve currencies can coexist because of multiple equilibria in the use of an international currency (Krugman 1984). Matsuyama et al. (1993), in the framework of random matching games for a two-country model of the world economy, also find multiple equilibria. In one equilibrium, the two national currencies circulate only locally; in another, one currency becomes an international currency. There is also an equilibrium in which both currencies are accepted internationally.

The different roles of an international currency confer varied benefits (Cohen 2012). The use of a currency in foreign-exchange trading, trade invoicing, or for official intervention purposes generates some measure of gain at the microeconomic level. Cohen further adds that only the store-of-value role, which by definition implies some level of foreign accumulation, will generate any amount of seigniorage or macroeconomic flexibility for the issuing country.

Table 2: Functions of money

Function of money	Goverment	Private players
Store of value	International reserves	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:*(Cohen 1971)*

Cohen (2012) argues that a currency's role in trade impacts the reserve preferences of the foreign central banks. The currency composition of the central banks' reserves generally reflects the currency choice of the international commercial relationship. The currency denomination of trade plays a vital part in determining which among several investment currencies will emerge as a favoured reserved currency. Widespread use in trade invoicing and settlement lead to a reserve currency role in the global monetary network. Hence trade is an important track for a currency to become reserve currency.

Frankel (2011) summarizes why most empirical studies of international currency choice have usually focused on the currency composition of foreign exchange reserves as the main indicator of the international use of currencies. First, historic annual data for all relevant currencies are available for a long duration; the other international roles that appear in Table

2 are nowhere near as comprehensively quantifiable. Second, reserve currency holdings are most relevant to important questions, such as whether the United States will continue to be able to finance its current account deficit. Third, the various roles of an international currency are heavily interrelated, causally and statistically.

Chinn & Frankel (2007, 2008) identify output and trade, financial markets, confidence in the value of the currency, network externality as critical factors that determine the status of international reserve currency. Lee (2010) uses the following demand function to estimate economic determinants of international currency. Table 3 lists the proxies he uses in estimating the model.

$\text{Logit(currency share)}_{it} = \beta_0 + \beta_1(\text{GDP share})_{it} + \beta_2\text{inflation}_{it} + \beta_3(\text{FX turnover})_{it} + \beta_4(\text{KA openness})_{it} + \beta_5(\text{lag of Logit(currency share)})_{it} + \epsilon_{it}$
where, $\text{logit(currency share)}^2 = \log(\frac{share}{1-share})$

Table 3: List of Proxies for Determinants in Lee (2010)

Independent variable	Proxy
Size of output and trade	GDP
Depth of financial market	Foreign exchange turnover data and Chinn-Ito Index
Confidence in value of currency	Inflation rate
Network externalities	Lag of currency share

Another important factor determining the international currency is the transaction cost of using the currency. The literature identifies three different approaches - 'Economies of scale', 'thick market externalities' and 'search approach' analysing transaction costs in the foreign exchange market. 'Economies of scale' approach and 'thick markets externalities' approach suggest that transaction costs decline with the liquidity of bilateral currency markets. In the first approach, foreign exchange dealers operating in each bilateral currency market face some fixed costs, which give rise to economies of scale (Black 1991, Krugman 1984). According to the second approach, dealers face a double coincidence of wants problem that causes a thick markets externalities and hence transaction cost declines with the total number of dealers operating in each market (Rey 2001).

The third approach works on the principle that the willingness to accept a given means of payment depends on the expectations about the same willingness on the part of the others. This willingness does not depend on the liquidity of particular bilateral currency markets (as in the earlier two approaches), but rather on the liquidity of the currency itself[3]. In the light of this approach, a greater worldwide usage of a currency increases its acceptability, implying a decline of transaction costs, which result from the liquidity of the currency, rather than from the liquidity of bilateral currency markets (De Freitas 1999). Hence, this model captures the relevant network externalities effect we are interested in understanding in this paper. We will use this insight to develop transaction cost index in a later section.

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[2]We explain in the methodology section how to use logit form of the dependent variable.

[3]This approach is introduced by (Chrystal 1984) by extending the earlier work of (Jones 1976).

These studies, however, ignore political economy determinants which are discussed in next subsection. We develop some indices to proxy these determinants and use the indices for further qualitative as well as empirical study.

2.2 Political economy literature

Chey (2012) identifies domestic actors preferences regarding currency internationalization, financial liberalization, the role of the state, and international political power, as some political determinants.

Strange (1971) pioneered the political economy in the study of international currencies. She raised the following two questions: "Under what political, as distinct from economic, circumstances do people start to use - either for all or for only some monetary purposes - a currency which is either issued or controlled by a state other than their own?" and "What political consequences can be expected to follow, for both parties, from this international use of currency?" She further classified international currencies into four categories: "master currencies[4]," "top currencies[5]," "negotiated currencies[6]," and "neutral currencies[7]," highlighting how both economic and political factors shape currencies' international uses (Chey 2012).

A master currency always derives its status from the political relationships between the issuing and the subordinate states. Sterling in the sterling area and the French franc in the franc zone in the past were examples. In contrast, the status of a top currency is determined primarily by economic factors, and it tends to be the currency of the predominant state in the world economy. The dollar in the 1950s was one example. Strange (1971) characterizes a negotiated currency primarily as a currency in decline, that is, one that has lost or is losing its political dominance as a master currency or its economic dominance as a top currency. Examples of negotiated currencies include sterling in the post war period and the dollar in the 1960s. However, Helleiner (2008) points out that a negotiated currency can also be a currency on the rise. The Swiss franc and the deutschmark were example of neutral currency. Importantly, Strange emphasized that some currencies can be of more than one type at the same time. Even if a certain currency is a top currency for some users, for example, it can also be a master, neutral, or negotiated currency for others. This political economy typology of international currencies provides a useful framework for analyzing the effects of political as well as economic factors on international currency status.

Helleiner (2008) identifies a direct and an indirect channel through which politics can impact a currency's international use. Through the direct channel, politics influences its international status directly, without regard to economic determinants. Through the indirect

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[4]A master currency is the currency of a hegemonic or imperial state that coerces its use by other states.

[5]A top currency is one that is most favoured by the world market for various monetary purposes due to its economic superiority.

[6]A negotiated currency meanwhile occurs when the issuing state bargains or negotiates politically with other states for their use of its currency, offering inducements such as military and diplomatic support or economic benefits.

[7]A neutral currency is a currency whose international use stems primarily from the strong, but not necessarily dominant, economic position of its issuing state, which has no interest in promoting its international use.

channel, politics affects the currency's international use by impacting its economic determinants, which were discussed earlier.

Politics matters in particular for master and negotiated currencies, as discussed earlier, while top and neutral currencies derive their international standings mainly from the inherent economic attractiveness. Helleiner (2003) cites example, during the 1900s and 1910s, of US policymakers directly encouraging many countries in the Caribbean and Central America - a region where the United States had great influence - to increase their usage of the dollar, even calling for the creation of a dollar-based monetary union involving all countries in the Americas, for United States economic and political benefits. For a negotiated currency, however, both the issuing state and the foreign states supporting the currency, and their interactions, influence its international use (Helleiner 2008).

However, the major challenge is to identify the factors that play important role in political economy and quantify them for further analysis across different countries over time. For this purpose, we develop some indices of political economy determinants of international currencies.

3   Analytical framework

This section develops two analytical models to understand a multi-currency world. The first model develops the conditions for coexistence of two currencies in the presence of network externality benefits from a currency network. The model helps in determining the currency a country will adopt in the presence of two currencies if the cost of switching to a new currency and the network externality benefits are known. The second model shows the transaction cost of exchanging currencies also plays an important role in the decision of the choice of the currency when multiple international currencies exist.

3.1   Two currency model using network externalities

Lets assume there are N countries. To simplify our model, we assume that countries trade in proportion of their GDPs. We can place these countries from left to right in decreasing order of their GDP. Let the share of GDP of the countries from left to right be $\{n_1, n_2, \ldots, n_{N-1}, n_N\}$[8]. We further normalise the world GDP to 1 which means $n_1 + n_2 + \cdots + n_{N-1} + n_N = 1$. We divide the time into two discrete periods. In time period one, there is only one international currency and in time period two, there are two international currencies.

In time period one, we assume that country '1' (largest in the world) is the only supplier of the international currency. This assumption is supported by existing literature on the determinants of international currency. Let 'a_1' be the expected intrinsic value of a currency[9] and b_1 is the network externality benefit one gets from joining the network of currency '1'. Total

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[8]'1' is the largest country and 'N' is the smallest country.

[9]The value that one gets by holding the money or the value one gets from the goods and services that the money can be exchanged for. This also captures the volatility in the foreign exchange market.

benefit for any country i from joining the network of currency '1' is $a_1 + (1 - n_i)b_1$[10]. We made a modification from the standard practice of using number of countries in a network, that gives same weight to each country irrespective of the size. We use the size of the countries to account for the asymmetry in the network benefits other country gets from being part of the network. This is justified on the basis of large number of transactions by the residents of a large country or the liquidity of the currency of the large countries in the international market[11]. We notice that as the size of the country (n_i) decreases, network benefit to that country increases[12]. This means small countries are more likely to join the network of a big country to get the network benefit.

We can calculate social welfare to all the countries when they are part of the same network as $\sum_1^N [a_1 + (1 - n_i)b_1]$ i.e. $N(a_1 + b_1) - b_1$. First term, $N(a_1 + b_1)$ is the sum of benefit that each country gets from network of a currency. The second term takes care of the double counting of the network benefit[13].

In time period two, the second biggest country '2' also tries to make its currency an international currency. Here, we assume that a large country wields large bargaining power, which is an important determinant of international currency. This assumption will be empirically tested. Let country K be a marginal country beyond which all countries have small bargaining power and they are more likely to use the new currency 2 if they benefit more from joining its network. Country K can join either of the networks. In a more complex model, each country can use multiple currencies simultaneously. But, for simplification we are restricting each country to use only one currency when multiple currencies coexist.

Let i_1 and i_2 be representative countries of the network of currency '1' and currency '2' respectively. Any country that wants to join the network of currency 2 will incur a switching cost s per GDP unit. Implicitly, we are assuming that a large country needs to spend more resources to join the network of the currency 2. Switching cost to the representative country i_2 to join the network of currency 2 is sn_{i2} where n_{i2} is the GDP of country i_2.

The benefit to country i_2 if it joins the network of currency 2 will be $a_2 + (n_2 + n_k + n_{k+1} + \cdots + n_N - n_{i2})b_2 - sn_{i2}$, where a_2 is intrinsic value of currency 2 and b_2 is the network externality benefit of joining the network of currency 2. We can similarly write the benefit to the country i_1 after the switch of the countries smaller than country K to the currency '2' as $a_1 + (n_1 + n_3 + n_4 + \cdots + n_k - n_{i1})b_1$.

The condition $\forall i_2 \in \{2\} \cup \{K, N\}$ to switch to a new international currency 2 is:

$$a_2 + (n_2 + n_k + n_{k+1} + \cdots + n_N - n_{i2})b_2 - sn_{i2} \geq a_1 + (1 - n_{i2})b_1 \qquad (1)$$

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[10] $= a_1 + [(n_1 + n_2 + \cdots + n_{N-1} + n_N) - n_i]b_1$

[11] We can also justify it assuming that each country has effective workers in proportion to its GDP and each effective workers goes in the international market to sell her produce.

[12] $i.e. a_1 + (1 - n_i)b_1$ increase.

[13] For example, there is only one network benefit in a network of two countries.

Similarly, the condition $\forall\ i_1 \in \{1\} \cup \{3, K\}$ <u>not</u> to switch is:

$$a_1 + (n_1 + n_3 + n_4 + \cdots + n_k - n_{i1})b_1 \geq a_2 + (1 - n_{i1})b_2 - sn_{i1} \tag{2}$$

We can solve these equations for $i_1 = i_2 = k$ and get the value of s and n_k in terms of b_1 and b_2:

$$n_k = 1 - \left(\frac{b_2 - b_1}{b_2}\right)(n_2 + n_{k+1} + n_{k+2} \cdots + n_N) \tag{3}$$

$$s = \left(\frac{a_2 - a_1}{n_k}\right) - \left(\frac{1 - n_k}{n_k}\right)\left[b_2\left(\frac{b_2}{b_2 - b_1}\right) - b_1\right] \tag{4}$$

We notice from equation 3 that the biggest economy that can adopt the new international currency depends only on the network benefits it gets from either of the networks and the total size of the network that adopts the new international currency along with it. Initially, no country adopts a new international currency but when they do, the size of the network of the new international currency suddenly increases. This supports the non-linear relation between the size of the international currency (or foreign reserves) that we observe in the data[14].

Equation 4 gives solution for the switching cost in terms of expected difference in the intrinsic value of the currencies and the network externality benefits from the currency networks. This confirms the finding that the confidence in the currency is an important determinant of the international currency.

The switching cost has a non-linear relation with the benefits b_1 and b_2. We can plot this relation on b_1 and b_2 axis for multiple values of s (Figure 1a). Each curve has same value of s but increases in the direction of the arrow. We notice from the graph that the required network benefit from a new international currency, b_2, increases as the switching cost increases for a given value of network benefit from currency one, b_1. We also notice that the curvature of the curves increases as the value of b_1 increases. This is justified by the inertia in moving to a new international currency in presence of a strong (and large) network of the existing currency.

Figure 1: Qualitative representation of equation 4

(a) Iso-switching cost curves   (b) Impact of intrinsic values
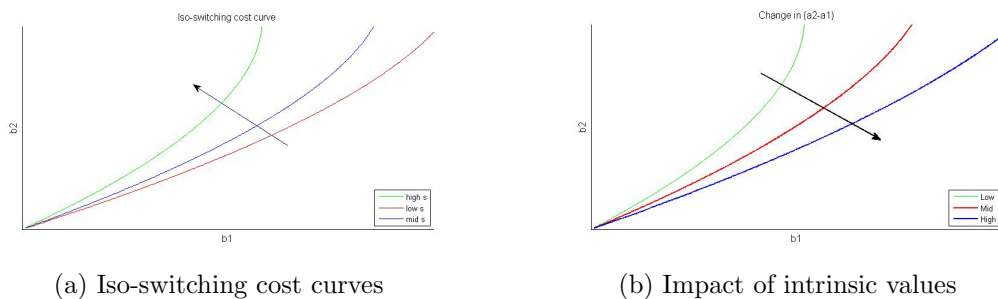
If there is more volatility and risk in the currency that currency will have lower intrinsic value and it is less likely to gain the status of an international currency. If a new international currency has low volatility (i.e. higher intrinsic value, a_2) then the countries can switch to

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[14]This is discussed in the empirical analysis section.

that currency even if the switching cost is high. This is shown in Figure 1b[15]. Iso-switching cost curves moves downward for increasing a_2 while keeping a_1 fixed. For a given value of b_1, countries can switch to a new currency if the intrinsic value of the new currency is sufficiently high irrespective of small network of new currency.

3.2 Transaction cost model with private players

This model replicates the trade pattern of the ASEAN+3 countries with USA and China in 2001 and 2011. In 2001, USA was the largest trading partner of most of these countries but in 2011, China became the largest trading partner. The US dollar was and still it is an international currency, however, there is an option for these countries to use RMB for their trade with China or to completely switch to RMB.

We consider three countries {i,j,k} each with one private agent, $\{A_i, A_j, A_k\}$. Let the value of production in the home currency for country i be y_i. We again divide time into two discrete periods. Country i sells α proportion of its produce to country j and the rest to country k. In time period one, country j is the major trade partner of country i (i.e. $\alpha > \frac{1}{2}$) and the currency of country j is the only international currency. We also normalize all the production and the transportation cost to zero to focus on the cost of transaction alone. In time period one, the transaction cost to the agent A_i is $y_i \delta_{ij}$[16] where δ_{ij} is the cost of exchanging currency j per unit of currency i.

In time period two, the trade pattern changes. Country k becomes the largest trade partner of country i and β proportion of produce of country i is exported to country k (where $\beta > \frac{1}{2}$). Currency of the country j is still an international currency. However, there is an opportunity for country k to push its currency as an international currency. We know that the bargaining power of a country depends on the proportion of the mutual trade between the countries. Our empirical analysis shows the bargaining power is an important determinant of an international currency. As the proportion of trade rises, so does the bargaining power, of country k with the country i. It can push to use its own currency in the settlement of the trade with country i. With this restriction, there are three possible types of transaction cost for the country i to settle its trade in the presence of two international currencies.

$$\begin{cases} \beta y_i(\delta_{ij} + \delta_{jk}) + (1-\beta)y_i\delta_{ij} & \texttt{Uses currency j} \\ \beta y_i\delta_{ik} + (1-\beta)y_i\delta_{ij} & \texttt{Uses both currencies} \\ \beta y_i\delta_{ik} + (1-\beta)y_i(\delta_{ik} + \delta_{kj}) & \texttt{Uses currency k} \end{cases}$$

Now, consider the first case when country i continues to use the currency of country j. In this case, total transaction costs to the agents of country i are $(\delta_{ij} + \beta\delta_{jk})y_i$. This cost is higher than the cost it incurred when currency k was not an international currency and the country i traded mainly with country j. In the absence of any other benefits of using currency j, the country i will incur higher transaction cost under multiple currencies. Moreover, as we found

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[15]All three curves are plotted for same switching cost.

[16]$\alpha y_i\delta_{ij} + (1-\alpha_i)y_i\delta_{ij}$

in the previous model, in the presence of network externality benefits, a country will have inertia in switching to a new international currency.

In the second case, each country i decides to use its currency with each trading partner. We can rewrite the transaction cost as $\delta_{ij}y_i + \beta(\delta_{ik} - \delta_{ij})y_i$. We observe that the first term is the same as in the case of using currency j. However, the second term can be either positive or negative. If the new international currency, k, can develop deep and liquid bilateral foreign exchange market with its trading partners, the transaction cost of the currency conversion can be lower than than using currency j. We observed that China is trying to push for bilateral currency trade with the ASEAN+3 countries. If it succeeds in reducing the transaction cost lower than transaction cost of currency exchange in the dollar market, it can start gaining at least regional currency status.

In the third case, country i decides to use currency k with each trading partner. We can rewrite the transaction cost as $\delta_{ik}y_i + (1 - \beta)\delta_{kj}y_i$. By definition $(1 - \beta)$ is less than one. As β approaches one, this term will approach zero. We discussed in the transaction cost index section that the transaction cost of currency exchange between two international currencies is far less than the transaction cost of currency exchange between a currency and an international currency i.e. δ_{kj} will be far less than δ_{ik}. So, we can ignore the second term and get approximate of transaction cost for the agent A_i while using currency k as $\delta_{ik}y_i$[17]. These results can be summarised as below:

When a new international currency becomes available from a country with large bargaining power, the best option for smaller countries is to either switch to the new currency or use both the currencies simultaneously.

The results of these two analytical models will be tested and used in empirical analysis.

4   Methodology and data

This section quantifies some of the economic and political economic factors discussed and develops indices that are used in estimating the demand function for an international currency. It discusses the indices and the methodology used in the empirical analysis.

4.1   Bargaining power index (pairwise)

(Chey 2012) argues that one of the major sources of a state's soft power may be other states' economic dependence on it, since this may transform their perceptions of their own interests in ways that bring them into line with its interests. For analysing this issue, one of the central problems is how to measure and portray changes in international political power. A large trading partner can use coercive means to force a small state to use its currency in mutual trade.

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[17]Similar approximation can be applied in the case of currency j but the transaction cost cannot be lower than $\delta_{ij}y_i$.

We use trade between a pair of countries to measure the impact of soft political power. Let two countries, 'l' and 's', be engaged in bilateral trade. To analyse soft power, we assume that 'l' is a large country in comparison to country 's'. The proportion of trade of country 'l' with country 's' will be a small fraction of the total trade of country 'l'. However, it will be other way around for the country 's'. In such a scenario, country 's' will be more vulnerable to coercive pressure from country 'l' as 's' depends on 'l' heavily for its trade. Larger the fraction of s's trade is with 'l' more it will be dominated by 'l'. The impact of trade intensity for country 'l' will be reverse. We call this quantitative measure of soft political power the Bargaining Power Index (BPI), and define the bargaining power of 'l' over 's' in the following way:

$$\text{BPI}_l^s = 100 * \left(\frac{M_{sl} + E_{sl}}{\sum_{l=1}^{w}(M_{sl} + E_{sl})} - \frac{M_{ls} + E_{ls}}{\sum_{s=1}^{w}(M_{ls} + E_{ls})} \right)$$

where, w is the total number of countries in the world and s,l $\in$ [1,w], M_{sl} is import of 's' from 'l', E_{sl} is export of 's' to 'l', $\sum_{l=1}^{w} M_{sl}$ is total import of 's' and $\sum_{l=1}^{w} E_{sl}$ is total export of 's'. We have multiplied the number by 100 to make it more convenient for comparative analysis.

4.1.1 Criteria for selecting countries/region

As the main focus of this paper is international currencies, we have selected some of the major economics and regions some of whose currencies have also been used as international currencies.

ASEAN is an important group of east Asian economies that we have included in our analysis. These economies are growing at a rate faster than that of rest of the world. These economies are also closely linked with three other major economies in the region (Japan, South Korea and China).

BRICS[18] is a group of EMs that are already an important market for a large number of goods, leading manufacturers of goods, providers of services and source of natural resources. A large proportion of the world population resides in these countries.

European Union, EU, is the largest economic and monetary union. Some of the economies of the region are also part of G8 and are considered separately as well. Euro is playing an important role in the region and international economics. Many central banks store Euro in the reserve pool of their country.

Group of eight[19], G8, represents the most important economies of current time. Many of these have been great imperial powers in the last few centuries and their currencies have played the role of important international currencies of varying importance. USA has been the largest economy for over the last century and the dollar has played the leading role among the international currencies.

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[18]An acronym for Brazil, Russia, India, China and South Africa.

[19]However, we have excluded Canada from the analysis. Though it is one of the largest economies in the world, its currency is of not of major importance.

Australia is one of the largest source of natural resources. Some central banks store Australian dollar to hedge these risks.[20].

China is the largest trading country and second largest economy. Political leaders of China have expressed desire to make their currency an international currency. They have already started some efforts in this direction. Chinese economy is well integrated with the regional economies and it is the leading trading partner for many of them. China has become a gateway for many of the intermediate products that are manufactured in these countries. Free trade agreement and geographical proxy helps in economic integration.

Japan and Korea are two Asian economic giants of twentieth century. Both of these started from low income base and built on industrial growth and export to developed countries. Japanese economy had its peak in the late twentieth century and continues to play a smaller but important role in international economy.

India is the largest democracy and second most populous country. Its population is also among the youngest in the world. An educated and English speaking young population has helped her in becoming a major service provider of the world. For last two decades it has observed high growth, which became volatile, however, after the global financial crises.

Switzerland is a relatively small economy compared to the others. However, its currency plays a role in international economics. It is a neutral economy with little political and military say in international politics.

Some other economies are included to understand the interaction of the leading economies with them. Mexico has a free trade agreement with USA and Canada and it is well integrated with the North American economies. Middle-east is a leading supplier of energy to the world.

4.1.2 Bilateral trade data

Bilateral trade data is taken from IMF's 'Direction of Trade Statistics' (DOTS) for 1992, 2001 and 2011. The dataset starts from 1992 as data for 1991 for some the economies in our sample were not available. We have substituted zeros for still missing data. Some of the economies in our sample are an economic or political region (e.g. EU, ASEAN) so we aggregated data for all the countries in that region. We calculated BPI index for each economy (Table A.4) using the formula defined earlier in this section.

4.1.3 Observations

China has consistently gained bargaining power over its trading partners during the observed period. Its reversal with Japan is interesting. In 1992, the BPI of Japan on China was 10 so China was dominated by Japan. But, after two decades in 2011, China (BPI=12) had more

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[20]IMF had a separate identification of Australian dollar in its COFER data report. News report at `http://rt.com/business/imf-reserve-currencies-909/`

bargaining power over Japan. Bargaining power of China increased over United States as well.

China has the highest BPI against Australia (20) in 2011, since Australia is heavily dependent on natural resource export, a large proportion of which goes to China. However, the proportion is small for the Chinese economy. This gives advantage to China and it can exercise bargaining power over Australia.

Switzerland's neutral role in the international economy, is reflected in the low BPI index of Switzerland over all our sample economies. There is no significant change in the index over the last two decades.

Germany has significantly high BPI over Switzerland, France and the United Kingdom. However, it has low BPI over ASEAN, Australia and USA. It had high BPI over CIS countries two decades ago but BPI reduced significantly since then. This shows the changing trade patterns of central Asia and regional integration of these economies with China.

India has low bargaining power with most of its partner countries. This is a reflection of its relatively closed economy. Indian trade is a small fraction of the large trading countries.

USA has been a major economic power for the last century. However, its BPI index is decreasing over most of the world economies over the last two decades. In fact, it is so low that it may have lost the status of the leading economic power and have become a negotiated economy. However, it is not correct to judge the status of an economy on just one parameter.

4.1.4   Limitations

Multilateral agencies collect data from the national agencies of different countries. Different agencies have different reporting standards and the data reported by two agencies hardly matches. One of the reasons for this difference is the use of 'Free on Board' (FOB) and 'Cost, Insurance and Freight' (CIF) for reporting the data. Other known problems are differences in reporting the destination and the source of products by the agencies of the exporter and the importer countries. For example, when there is political tension between two countries, many goods are still traded between them but through third country ports. However, the differences because of different reporting practices are a small fraction of total value and, so, can be ignored. For such reasons, the small differences between the values of bargaining power index can be attributed to the error in reporting mechanism of trade data.

4.2   Bargaining power index (for a country)

We need BPI for the six major economies over the period of our analysis (1987-2011) to estimate the model. It is different from calculating the index for a country pair. To calculate BPI for a pair, we need bilateral trade data for two countries to calculate pairwise BPI. Here, we need to find index for a country with all its trading partners. But, each country trades with over hundred other countries. It is difficult to calculate BPI for a country with all these trading partners. We assume that it is important to have high bargaining power against the

biggest trading partners. If a country can exert bargaining pressure on the large trading partners, it should be able to exert pressure on smaller partners with relative ease.

We sorted bilateral trade data for each of the six countries with all other countries of the world and found ten biggest trading partners for each country. We did this for each year over the period 1987-2011. Generally, ten biggest partners constitute over 60% of trade for each of these economies. With the help of this data for these trading partners for each year, we calculated pair-wise BPI for each economy for each year. To come to the bargaining power index for a country for a given year, we assume that the total bargaining power for an economy for a given year is a linear combination of its pairwise bargaining power against its ten biggest trading partners.

4.3   Transaction cost index

We use the Jones-Chrystal model discussed earlier to develop a Transaction Cost Index (TCI) that can be used to compare transaction costs of different vehicle currencies. Consider a decentralized world economy composed of N countries. Time is divided into discrete intervals called 'periods' and in each period a large number of dealers enter the foreign exchange market to make some transactions[21]. Any dealer looking to exchange 'currency i' for 'currency j' needs to make phone calls to other dealers to find a dealer who will be interested to exchange 'currency j' for 'currency i'[22]. The process of finding a corresponding dealer is random but the dealer knows the actual proportion of currencies trade. Let p = {p$_1$, p$_2$, p$_3$, .. p$_N$} represents this proportion in vector form. We can normalize these proportions so that their sum is one and then use them as the probability of finding a desired dealer. Then, the conditional probability of finding a desired dealer in a random search is $p_i p_j$ where p_i, $p_j \in$ p. The expected (direct) transaction cost is $\frac{1}{p_i p_j}$. If the dealers decide to go through a 'vehicle currency k' then the (indirect) transaction cost will be $\frac{1}{p_i p_k} + \frac{1}{p_k p_j}$. The dealer will choose direct transaction if $\frac{1}{p_i p_j} \leq \frac{1}{p_i p_k} + \frac{1}{p_k p_j}$ which can be simplified to get the condition $p_k \leq p_i + p_j$. So, the cost of transaction for direct trade will be lower than the cost of indirect trade when the probability of finding a dealer with vehicle currency is lower than the joint probability of finding dealers in two currencies.

We calculated TCI using data from triennial foreign exchange market survey of BIS (2010). The results are given in tables A.5 and A.6. Data is available only for a few countries so we have taken some of the countries for which BPI was calculated. The tables show indirect TCI using dollar as a vehicle currency is much lower than the direct TCI for any currency combination in 2010. This supports indirect transactions between currency pairs. It also supports network externality benefits from use of a dominant currency.

In table A.7, we have calculated TCI for the currencies pair from 2001 to 2010. The TCI index is falling over the years for most of the currencies as the liquidity of the currencies other than US dollar is increasing marginally. However, the RMB observes largest fall in TCI index

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[21]Number of dealers is constant in any period.

[22]There can be other sophisticated methods like internet auction/bidding to search for a corresponding dealer but for simplicity, and without loss of generality, we will stick to 'telephone calls' method.

with all the currencies over the decade that reflects the increasing liquidity of the currency in the international foreign exchange market.

4.3.1 Limitations

TCI index is developed to find the liquidity of a currency in the market. It is assumed that each dealer has the same amount of a currency but some dealers will have more amount of a currency than the others. This makes the currency market asymmetric and calculating probability the way we have done will be erroneous. Even so, it is a useful approximation to understand network externalities. As the data is available only at triennial intervals, it is not possible to use this index in the empirical analysis.

4.4 Economic power index (EPI)

We use a modified version of the IMF quota formula[23] to design an Economic Power Index (EPI). We drop economic variability from the formula because foreign exchange volatility is of less importance in comparison to the other variables in the equation. It is also difficult to get an annual value that effectively represents the volatility unlike for other variables. We redistribute the weight of other variables and the new weights of gdp, openness and reserves are 0.59, 0.35 and 0.06 respectively. So,

$$EPI = 0.59*gdp + 0.35*openness + 0.06*reserves$$

Since the variables are of different scale, we will use them as a percentage of the total— gdp is the percentage of the world GDP, openness is the percentage of the maximum possible value of the Chinn-Ito Index for openness and reserves is the percentage of total reserves in the currency of that country.

GDP on market exchange rates and PPP exchange rates do not give an accurate picture of the economic power of a country. Each economy has both tradable and non-tradable goods. For the tradable goods one should use market exchange rates and for non-tradable goods one must use PPP exchange rates. For this purpose, GDP is measured as a blend of GDP based on market exchange rates (weight of 60 percent) and on PPP exchange rates (40 percent).

Table 4 shows the EPI index for the international currency supplier countries and for China. We observe that the EPI is either stagnant or decreasing for the developed countries. In contrast, EPI for China has increased significantly. We can say that this is the most conservative estimate for the economic power of China in respect to the other countries as we have used Chinn-Ito Index for openness. This takes care of only *de jure* financial openness of a country. If we use other measures (e.g. trade-to-gdp, share of trade in global trade, capital flow etc.) that are continuously increasing for China, then EPI index for China will rise faster over the same period. So China's relative economic power is increasing.

The variables used in constructing the EPI index are similar to the variables used in the estimation of the empirical model so this index is not used in the empirical analysis to avoid

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[23]Current IMF quota formula. source: `http://www.imf.org/external/np/exr/facts/quotas.htm`

Table 4: Economic power index

	1991	2001	2005	2011
USA	53	55	54	52
UK	38	38	38	38
Japan	42	41	40	40
Switzerland	36	35	35	35
EU	52	51	50	49
China	2	9	10	12

Source: *Author's calculations.*

the problem of collinearity.

We use a modified model of Lee (2010) to estimate economic and political determinants of a reserve currency. The indices developed will serve as a proxy for political determinants. In our model the proxies he used, given in Table 3, are modified as in Table 5.

Table 5: List of Proxies for Determinants

Independent variable	Proxy
Size of output and trade	GDP, BPI
Depth of financial market	Foreign exchange turnover data and Chinn-Ito Index, private capital flow
Confidence in value of currency	Inflation rate, exchange rate volatility
Network externalities	Lag of currency share

Figure 2: GDP vs share of currency (linear and logit)
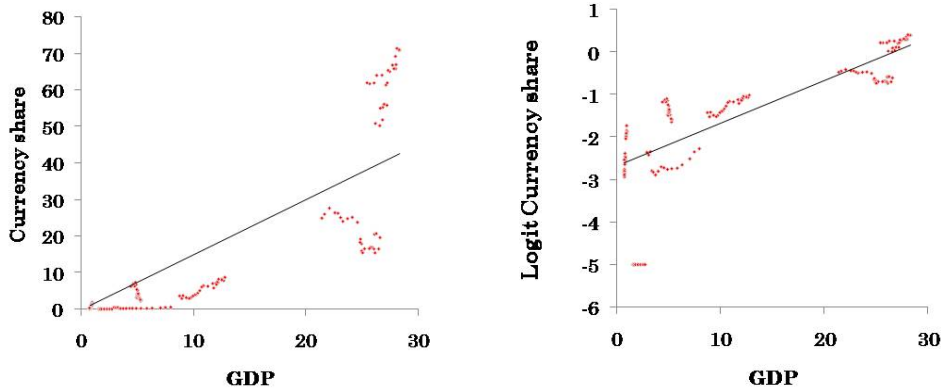
(a) GDP vs share of currency (linear) (b) GDP vs share of currency (logit)

Source: *Author's calculations*

Plotting currency share with the economic determinants (Figure 2a) shows no linear relationship between the variables. The currency share is very low for low values of GDP (as a share of the world GDP). After a threshold it increases and suddenly becomes very high. The literature (Lee 2010) suggests use of logit to capture the non-linear relationship between the variables. In the Figure 2b, we have plotted logit of currency share against GDP and find that the two variables now exhibit a linear relation. So, the model specification uses the logit transformation of currency share.

5   Empirical analysis

5.1   Data description and sources

GDP

Real and PPP GDP are taken from the World Banks's World Development Indicators. Further, we calculated the GDP share of each country from the data and the GDP share has been used in the estimation of the model.

Currency composition

This is taken from IMF's Currency Composition of Official Foreign Exchange Reserve (COFER) database. This gives data for each currency under two components - allocated reserves and unallocated reserves[24]. We used allocated reserve data.

Inflation

Inflation (Consumer Price Index) are taken from IMF's International Financial Statistics database.

Exchange rate and exchange rate volatility

Annual and daily SDR exchange rate data are taken from IMF's International Financial Statistics database. Exchange rate volatility is calculated as the standard deviation of the log first difference of daily exchange rate.

KA openness

De jure financial openness is measured by the Chinn-Ito index. Time series data for the index is maintained at their website `http://web.pdx.edu/~ito/Chinn-Ito_website.htm`

Private capital flow

Private capital flow data has been taken from IMF's International Financial Statistics. We further calculated private capital flow as a percentage of real GDP of corresponding economies. These ratios are used in the estimation of the models.

5.2   Estimation of the model

Using Dickey-Fuller and Perron tests, the bpi index was found to have strong serial correlation. The second lag of bpi was stationary and the model gave the lowest value for BIC. The Hausman test supported the fixed effect model over the random effect model.

GDP and bpi have very strong correlation (0.95). We have not used GDP in any form or any known direct proxy to calculate the bpi index for the the countries over the period. However, high correlation between these two variables suggests that with a large GDP country gains more bargaining power over its trading partners and vice versa. The use of a currency by trading partners further increase the use of the currency through network effect. This also suggest that we can use bpi instead of GDP as an independent variable in our model. There

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[24]IMF defines them as the unallocated reserves the difference between the total reserves data reported to IFS (for the world table on Foreign Exchange) and to COFER, for each of the country groupings mentioned above. It consists of two components:

- The total reserves of nonreporting countries, i.e., the countries within each grouping, which do not report currency composition data to COFER, and any discrepancy between data on total reserves as reported to COFER and to IFS.

- The allocated reserves equals the reporters' data on total reserves as reported to COFER.

Table 6: Results of panel data regression

Explanatory variables	Model I		Model II		Model III	
	Coefficients	Pr (>t)	Coefficients	Pr (>t)	Coefficients	Pr (>t)
Lag of Logit of currency share	0.773	0.00	0.706	0.00	0.768	0.00
GDP	0.041	0.04				
Lag of BPI			0.003	0.07	0.003	0.08
Inflation	-0.003	0.66				
KA open	0.135	0.05	0.639	0.00		
Exchange rate volatility	-7.374	0.11	-8.852	0.04	-10.684	0.02
Private capital flow					0.007	0.21
Intercept	-0.985	0.01	-1.651	0.00	-0.439	0.01
Prob > F	0.00		0.000		0.000	

Source: *Author's calculations.*

are some advantages of using bpi over GDP. Though GDP represents a country's economic share in the world market, however, it is difficult to understand how this can affect other countries decision to hold a currency as reserve currency. Whereas bargaining power as we discussed in earlier section explains the interaction among different countries.

The data panel consists of 25 annual observations for six country groups (United States of America, Eurozone (Germany), Japan, China, United Kingdom, and Switzerland) from 1987 to 2011. Since, we are using data for Germany when Euro was not there so some data points are missing in the panel data. Data is not available for all the years for Germany or Euro zone and this makes our data a unbalanced panel.

We estimated three models (Table 6). Model I is the basic model that is discussed in most of the literature. Under this model, lag of logit of currency share, GDP and KA openness are significant and positive as suggested by the literature. Inflation and exchange rate volatility are negative as they should be but they are not significant. In model II and model III, we have used lag of BPI index as a proxy for the economic power of the economy. This comes out to be positive and statistically significant at 10% in both model II and III. This supports our hypothesis that the BPI index can help in explaining the composition of currency reserve.

Model II and model III suggest that the exchange rate volatility is statistically significant at 5% and negative. The result is supported by the literature that says the share of a currency increases as confidence in that economy increases. Exchange rate volatility adversely affects the confidence in the economy that is denoted by negative sign of the estimates. We used private capital flow as a proxy for market openness in model III. This turned out to be insignificant. We also tried some other parameters (e.g. fdi, stocks traded on exchange etc.) as suggested in IMF (2012). However, all these were insignificant.

6 Application to rise of the Renminbi

China was sixth largest economy in 2001, but it became the second largest economy in a decade (Table 1). It has also consolidated its position as major trading partner in Asia while USA and Japan are losing their share in this region (Table 7).

Table 7: Share of Trade with Japan, USA and China

	Japan		USA		China	
	2001	2011	2001	2011	2001	2011
Cambodia	1	3	31	14	4	14
China	17	9	16	12		
India	4	2	12	7	3	10
Indonedia	20	14	13	7	5	13
Japan			25	12	12	21
South Korea	15	10	18	9	11	20
Malaysia	16	12	18	9	5	13
Mongolia	6	3	17	3	30	59
Myanmar	5	5	9	0	12	31
Phillipines	18	14	24	13	3	11
Singapore	11	6	16	8	5	10
Sri Lanka	5	4	21	8	2	7
Thailand	19	15	16		5	13
Vietnam	15	11	5	11	10	18

Source: *Author's calculations*; Data: IMF's DOTS

The government of China is making phased efforts to make RMB an international currency. The government is providing limited liquidity to international partners and investors and then allowing them to reinvest or hold the RMB. Initially China allowed very few pre-approved private players to settle trade in RMB but now all Chinese private players are allowed to settle their trade in RMB. However, it is largely importers who are settling their trade in RMB. In this process, private players of other countries are accumulating RMB. China has allowed banks in Hong Kong to open accounts in RMB. So, the private players from other countries can deposit their RMB earning in the banks in Hong Kong. The banks in Hong Kong can issue debt and bonds in RMB to provide further liquidity in the market. Foreign firms can also issue bonds in RMB in Hong Kong and invest the proceeds in Mainland China. The process is explained in Figure 3.

Subacchi & Driffill (2010) argue China is pursuing managed internationalization along two interrelated tracks - trade track and financial track. The first track focuses on cultivating use of the RMB in foreign trade. At the official level, currency swap agreements with foreign central banks have been initiated facilitating use of the RMB as a means of payment. At the private level, regulations have been gradually eased to permit more trade transactions to be invoiced and settled in RMB, bypassing traditional invoicing currencies like the dollar. Latter track focuses on use of the RMB in international finance. Emphasis has been placed on the development of active markets for Yuan deposits and Yuan-denominated bonds, mainly

Figure 3: Liquidity of Renminbi in international market
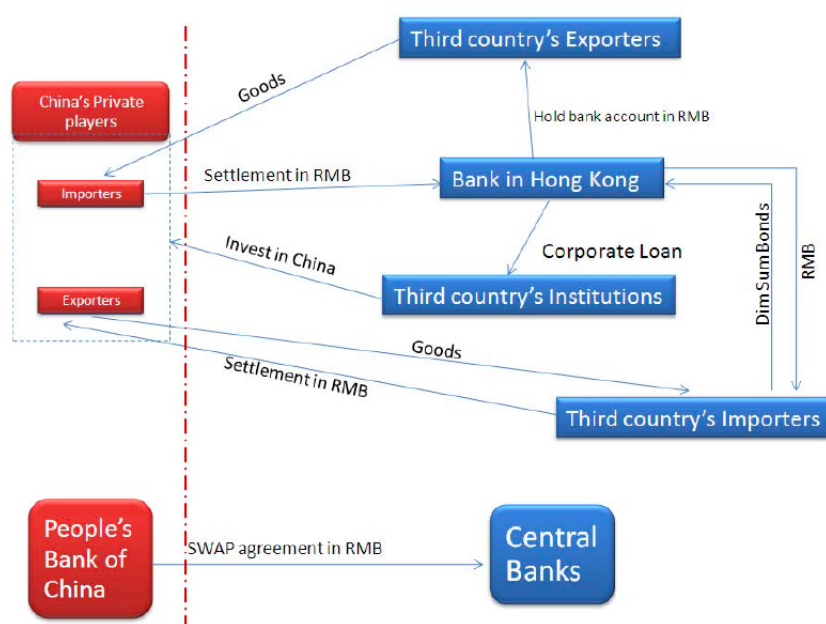
Source: *Author's depiction*

"offshore" in the autonomous region of Hong Kong[25]. The amount of RMB in saving accounts in Hong Kong is continuously increasing (Figure 4). Along both tracks, initiatives have been implemented patiently in finely calibrated phases. The communist party is no stranger to the idea of Long March.

In the next few sections, we discuss the progress that China has made to promote its trade and use of the RMB.

6.1 Cross border settlement in Renminbi

Investors and enterprises were allowed to hold RMB denominated bank accounts in Hong Kong since 2004, however, the amount remain very low till 2009 (Figure 4). The Chinese government allowed trade settlement in RMB for selected enterprises in a few provinces in July 2009 as a pilot scheme[26]. Geographical coverage was further expanded in June 2010. In December 2010, the number of eligible enterprises was increased from 365 to 67,359. Eventually, the scheme was expanded to cover all export and import settlement in RMB in March 2012.

The cross border settlement in RMB (See figure 5) and direct investment in RMB is increasing since 2009. Total settlement in RMB crossed 3 trillion Yuan in 2012 that is more than 10% of Chinese total trade.

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[25]Panda bonds and Dim Sum bonds.
[26]Details of policy initiatives are given in Table A.2.

Figure 4: RMB deposit in Hong Kong's Banks
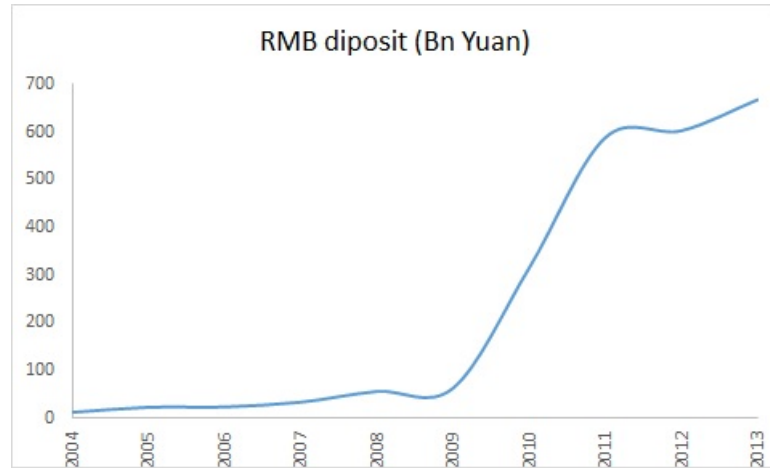
Source: *Author's calculations*; Data: HKMA's monthly press release
Note: Data is taken for end of the year. For 2013, data is for March.

Figure 5: Cross border settlement in RMB (bn yuan)
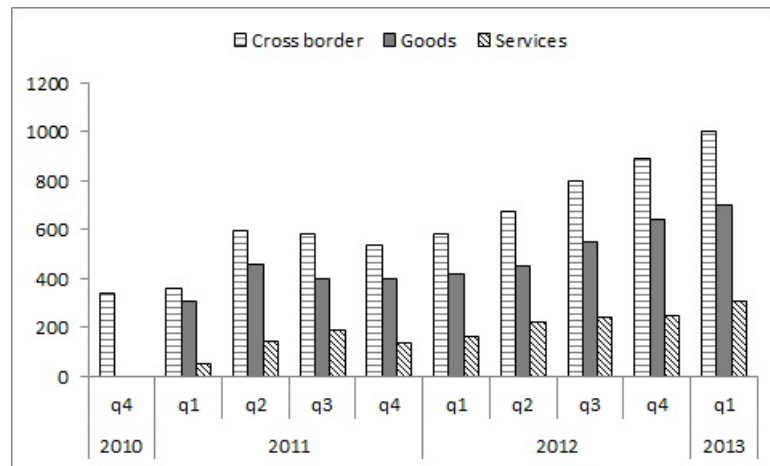
Source: *Author's calculations;* Data: Quarterly reports of People's Bank of China

6.2   Swap agreements with central banks and Chiang Mai Initiative

Government of China has signed (and renewed the expired) currency swap agreement with several central banks since the financial crisis (Table: A.1) to provide financial stability and liquidity in the international market. Total amount involved in the currency swap agreements is over 1.5 trillion yuan. In June 2012, HKMA unveiled a program for banks to tap into its swap line with the People's Bank of China (PBoC) if they are in need of RMB liquidity. Though none of the swap lines has been used, but it indicates the willingness of other countries to acccept RMB as currency for trade. There are a few countries that have not signed currency swap agreement with China but they have shown interest in trading in RMB.

In August, 2012, the central banks of Nigeria and Tanzania added RMB to their reserves. They bought bonds worth RMB 500 million from the China Development Bank. Though the amount is small but it can set precedent for more share in the large reserves of bank

of Nigeria[27] (estimated \$36.4 in foreign exchange). On June 23, 2011, the PBoC signed a new bilateral local currency settlement agreement with the Central Bank of the Russian Federation.This will cover not only border trade but also general trade and economic entities from both countries will be able to conduct settlements and payments for trade of goods and services with a currency of their choice, either a freely convertible currency, RMB or the Ruble[28]. The PBoC and the Banque centrale du Luxembourg signed a Memorandum of Understanding on Sept. 28, 2010 to further promote bilateral exchange and cooperation[29].

China is also major contributor to the Chiang Mai Initiative (CMI), a regional lender of large resort for stressed economies. China intends to play a central role in multi-lateralization of CMI. However, this has not been used effectively due to some structural shortcomings (Sussangkarn 2012).

6.3 Direct trading of Renminbi

People's Bank of China and Bank of Japan allowed direct trading of JPY/RMB at Tokyo stock exchange and Shanghai stock exchange in June 2012. Currently, the volume of currency trading is low but if it increases in line with the bilateral trade then the two countries are expected to save a significant amount of direct trading. China and Australia are also making efforts to reduce currency conversion cost for their economic entities. China and Australia signed agreement to start direct trading between their currencies (RMB/\$A)[30]. Banks in some provinces of China are allowed to trade RMB directly with a few other currencies (See Table A.3). China is promoting its currency as an international currency and has gained success on some parameters.

6.4 East Asian integration and China

Advanced economies are expected to either be stagnant or grow at a marginal rate of 1-3% in next decade[31]. Demography of Asia suggests that growth will come from this region. Growth opportunities are one of the reasons economies of this region were less affected by the global financial crisis and recession in the western hemisphere.

All the economies in Asia (Russia excluded) are highly integrated with each other. USA is not a leading trade partner for most of the economies. USA is second lead partner of China and Japan. However, in case of Japan, volume of trade with China is double the size of trade with USA (See table 8).

However, there is hardly any financial integration in the region. The invoicing currency of trade between these countries is still the US Dollar. Though, some countries have shown

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[27] http://blogs.ft.com/beyond-brics/2012/08/22/africa-new-frontier-for-the-renminbi/

[28] Source: HKMA press release.

[29] Source: HKMA press release.

[30] Source: Press release of People's Bank of China on 9th April, 2013. http://www.pbc.gov.cn/publish/english/955/2013/20130409183325524305206/20130409183325524305206_.html

[31] IMF, World Economic Outlook, April 2013. Available at http://www.imf.org/external/pubs/ft/weo/2013/01/pdf/text.pdf

willingness to use RMB for trade settlement and the volume of settlement in RMB is increasing exponentially. [32]

Japan and Australia have already started direct trading of RMB with their respective currencies. To avoid the delay in settlement using dollar and the transaction cost, more Asian countries might make the switch. Our analytical transaction cost model shows private agents choose to adopt the currency of their largest trade partner if the transaction cost reduces. These Asian countries are in position to invoice in a regional currency or peg their currencies to a regional currency.

Table 8: Regional integration

Country	Partner country[1]		Asia/Total (%)[2]
	1st	2nd	
Brunei	Japan (30)	South Korea (14)	83
Cambodia	China (18)	Thailand/Vietnam (16)	67
China	EU (16)	USA (12)	41
India	EU (14)	China (13)	30
Indonesia	Japan (14)	China (14)	67
Japan	China (24)	USA (12)	48
South Korea	China (23)	EU/Japan (10)	49
Malaysia	China (17)	Singapore (13)	62
Mongolia	China (59)	EU (6)	86
Myanmar	China (31)	Thailand (28)	92
Phillipines	China (16)	Japan (14)	60
Singapore	China (17)	Malaysia/EU (11)	58
Sri Lanka	EU (19)	India (16)	47
Thailand	China (16)	Japan (15)	57
Vietnam	China (20)	EU (12)	60

Source: *Author's calculations*; Data: IMF's DOTS
[1]Data is taken for 2011. Partner country is a country/economic region.

China is getting some success in giving RMB a more prominent role in Asian trade settlement. But as analysis of the determinants of an international currency shows capital market restrictions in China will also have to be relaxed.

7 Conclusion

Two simple analytical models help analyze conditions for the emergence of multiple international currencies. Bargaining power is one reason the currency of a large economy is used internationally. Large switching cost to a new currency also explains the inertia in switching to new international currency. We develop indices to quantify some of the qualitative determinants of international currencies. The bargaining power index provides insight into bilateral relationships. Empirical estimation validates the models since bargaining power,

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[32]Financial statistics report of PBoC says "In November 2012, RMB settlement in cross-border trade in goods, cross-border trade in services and other current accounts, outbound FDI and inbound FDI amounted to 224.4 billion, 79.4 billion, 2.1 billion and 23.2 billion yuan respectively.(`http://www.pbc.gov.cn/publish/english/955/2012/20121219100045372816786/20121219100045372816786_.html`).

switching costs and capital account openness (which lowers transaction cost) all have positive coefficients. Exchange rate volatility, which decreases confidence in a currency has a negative coefficient.

The models and estimation are used to analyze the increased use of the RMB as an international currency, particularly in the Asian region. Intraregional trade is increasing in East Asia and most of the countries trade over 50% within the region. China is either the leading or second leading partner for these countries. So its (pairwise) bargaining power is increasing with all trading partners and especially over its trading partners in Asia. The economic power index also suggests that China has gained significant economic power.

However, to increase the attractiveness of the RMB, China has to adopt more transparent rule bound policies and allow freer capital movements and markets. Since the US now has serious competition, it must take steps to defend its 'exhorbitant priveledge'. It must not only sustain its bargaining power by increasing growth, it must also reduce its twin deficits in order to reduce dollar volatility. Such competition will improve global stability since it will restrain the excesses of either party.

There is scope to further extend the analytical frameworks. First, we can consider the case where each country decides independently whether to join a new currency or not, rather than all countries with bargaining power less than a critical value moving together. Second, current account imbalances can be introduced as another factor affecting bilateral trade patterns. Third, transaction cost can be made function of liquidity of the currency in international financial markets.

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A Appendix

A.1 Renminbi bilateral central bank swap agreements

List of all the bilateral currency swap agreements that People's Bankf of China has signed with other central banks.

Table A.1: Renminbi bilateral central bank swap agreements

Country/region	Date	Amount (Billion RMB)
Bank of Indonesia	23.03.2009	100
Central Bank of Argentina	02.04.2009	70
National Bank of the Republic of Belarus	11.03.2009	20
Central Bank of Iceland	09.06.2010	3.5
New Zealand Reserve Bank	18.04.2011	25
National Bank of Kazakhstan	13.06.2011	7
Bank of Korea	26.10.2011	360
Hong Kong Monetary Authority	22.11.2011	400
Bank of Thailand	22.12.2012	70
State Bank of Pakistan	23.12.2011	10
Central Bank of the UAE	27.01.2012	35
Bank Negara Malaysia	08.02.2012	180
Central Bank of the Republic of Turkey	21.02.2012	10
Central Bank of Mongolia	20.03.2012	10
Reserve Bank of Australia	22.03.2012	200
Central Bank of Ukraine	26.06.2012	15
Monetory Authority of Singapore	07.03.2013	300
Banco Central do Brasil	01.04.2013	190

Source: *People's bank of China*

Annual GDP growth

This data is collected from World Bank's database.

Figure A.1: Annual GDP gowth
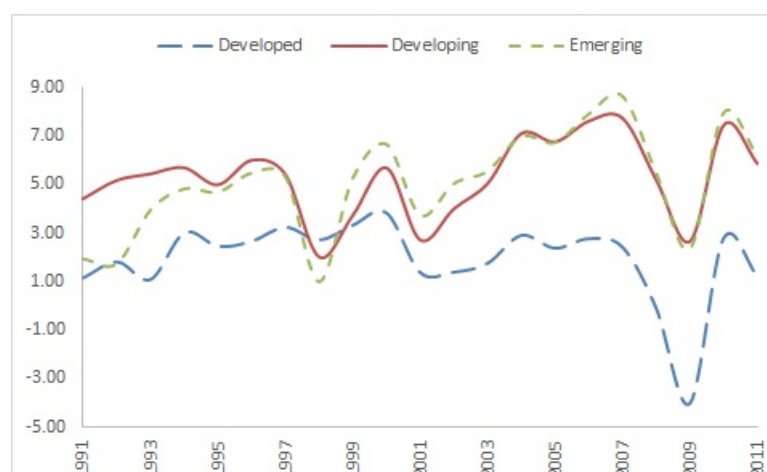
Author's calculations; World Bank data.

Policy initiatives to advance internationalization of renminbi

Table A.2: Trade and finance settlement in Hong Kong

Date	Policy initiative
July 2009	The pilot scheme for RMB trade settlement commenced operation.
September 2009	The first RMB sovereign bond by the Ministry of Finance of China.
February 2010	The Hong Kong Monetary Authority issued a circular to elucidate the supervisory principles and the operational arrangements regarding the cross-border fund flows of RMB and the development of RMB business in Hong Kong.
June 2010	The geographical coverage of the pilot scheme for RMB trade settlement was expanded.
July 2010	The Clearing Agreement for RMB business was amended to facilitate development of RMB asset management and insurance products.
August 2010	Announcement of a pilot scheme for the RMB clearing bank and other eligible institutions outside Mainland China to invest in the interbank bond market in Mainland China.
November 2010	RMB sovereign bonds issued through the Central Moneymarkets Unit.
December 2010	The number of eligible enterprises in Mainland China that can settle merchandise exports in RMB expanded from 365 to 67,359.
January 2011	Enterprises in Mainland China allowed to conduct and settle overseas direct investment in RMB, and banks in Hong Kong can provide RMB funds to facilitate such transactions.
August 2011	The geographical coverage of the pilot scheme for RMB trade settlement was further expanded to the entire Mainland China.
October 2011	Arrangement for foreign enterprises to conduct and settle foreign direct investment into Mainland China in RMB formalised.
December 2011	Foreign investors allowed to invest in Mainland Chinas bond and equity markets through funds issued by qualified fund management and securities companies in Hong Kong under the RMB Qualified Foreign Institutional Investors (RQFII) scheme.
March 2012	The pilot RMB trade settlement scheme was further expanded to all the import and export enterprises.
	A pilot program to allow foreign central banks, Hong Kong and Macau clearing banks and trade settlement banks to invest offshore RMB in the onshore interbank bond market, facilitating the yuan's repatriation mechanism.
April 2012	Quotas for the RQFII investment was increased by RMB 50 billion. The qualified institutions were allowed to use the quota to issue RMB A-share ETF products listed in the HKEX.

Table A.2 – continued from previous page

Date	Policy initiative
June 2012	HKMA unveiled a program for banks to tap into its swap line with the PBoC if they are in need of RMB liquidity. Moreover, HKMA relaxed limit regulation for RMB liquidity for banks.
July 2012	China's authorities pledged to undertake new initiatives to encourage third-parties to conduct RMB trade settlement and investment through Hong Kong. Moreover, new preferential treatment will be applied to the offshore RMB long-term investment in domestic captial market,although the relevant details have not yet been released

Table A.3: Direct currency trading with RMB

Date	Province (China)	Country	Currency	Details
Jun 2011	Yunnan	Laos	Lao Kip (LAK)	Direct exchange between RMB/LAK was provided by the Fudian bank in Kunming, capital of Yunnan province.
Jun 2011	Xinnjiang	Kazakhstan	Kazakhstan Tenge (KZT)	Direct exchange between RMB/KZT was provided by the BOC in Xinjiang province.
Jun 2011	Guangxi	Vietnam	Vietnemese Dong (VND)	The China-ASEAN RMB clearance and settlement center was established by ICBC in Nanning, with a pilot program for direct exchange between RMB/VND.
Jul 2011	Shandong	South Korea	Korea Won (KRW)	Direct exchange between RMB/KRW was provided by selected banks to qualified clients in Qingdao.
Dec 2011	Yunnan	Thailand	Thai Bhat (THB)	Exchange between RMB/THB started to be offered by selected banks from Yunnan province in the interbank market, after the currency swap line was signed earlier between China and Thailand. Direct exchange between the two currencies was also provided.
Jun 2012	China	Japan	Japanese Yen (JPY)	China and Japan announced to begin direct trading of RMB/JPY in Shanghai and Tokyo since June 2012. The JPY will thus become the second major currency (after the USD) to have a direct exchange rate against the yuan in the onshore market of China.

Table A.4: Bargaining power index

Country (l)	ASEAN	Australia	Brazil	China	CIS + Mongolia	European Union	France	Germany	India	Japan	Russia	SADC	South Afica	Switzerland	United Kingdom	United States
						Partner country (s)										
Australia	2	0	1	1	0	1	0	0	2	3	0	1	0	0	1	1
	3	0	0	2	0	0	0	0	2	3	0	2	2	0	1	1
	3	0	1	3	0	0	0	0	2	4	0	1	1	1	1	1
Brazil	0	0	0	1	0	1	0	1	1	1	0	1	0	0	0	1
	0	0	0	2	1	1	1	1	1	1	1	2	2	1	1	2
	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	2
China	3	4	1	0	4	1	1	1	0	5	6	1	0	1	1	3
	5	7	3	0	4	2	2	3	3	12	5	3	3	1	2	7
	13	23	16	0	11	5	4	6	10	21	10	18	14	4	6	14
EU	16	18	30	12	60	67	64	65	31	18	60	44	0	72	59	22
	14	18	28	16	44	65	66	63	22	15	55	35	35	71	53	21
	10	12	21	16	38	64	66	63	14	11	42	23	26	67	51	17
France	2	2	2	1	6	10	0	13	3	2	4	7	0	10	10	3
	1	2	3	2	2	8	0	10	2	2	3	4	3	10	9	3
	1	1	2	1	3	7	0	9	1	1	3	3	2	8	6	2
Germany	4	4	7	4	17	15	18	0	8	5	17	5	0	29	15	5
	3	3	6	5	9	14	17	0	4	4	12	8	11	26	12	5
	2	3	5	5	6	14	18	0	3	3	7	6	8	26	12	4
India	1	1	0	0	1	0	0	0	0	1	2	2	0	0	1	1
	1	1	1	1	1	0	0	0	0	1	1	1	1	0	1	1
	3	3	2	2	1	1	1	1	0	1	1	5	4	1	1	2
Japan	20	22	6	15	3	3	3	4	7	0	4	5	0	4	4	15
	15	16	4	17	2	2	2	3	4	0	3	4	5	3	3	10
	11	14	4	9	2	1	1	1	2	0	3	4	6	3	2	5
Korea	4	4	1	3	1	1	1	1	1	5	1	0	0	1	1	3
	4	6	2	7	1	1	1	1	2	6	1	2	2	1	1	3
	5	6	3	7	2	1	1	1	2	6	3	2	2	1	1	3
Mexico	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	8
	0	0	2	1	0	0	0	1	0	1	0	0	0	0	0	12
	0	1	2	1	0	0	0	1	0	1	0	0	1	0	0	12
Middle East	4	3	7	2	0	3	3	2	17	7	2	3	0	2	3	3
	4	4	3	3	0	2	3	2	8	7	2	5	7	2	2	2
	6	3	4	6	0	2	3	2	24	11	1	5	7	2	3	4
Russia	0	0	0	3	4	0	1	0	2	1	0	0	0	0	0	0

Country (l)	ASEAN	Australia	Brazil	China	CIS + Mongolia	European Union	France	Germany	India	Japan	Russia	SADC	South Afica	Switzerland	United Kingdom	United States
	0	0	1	2	13	2	1	2	1	1	0	0	0	2	1	0
	1	0	1	2	8	3	2	4	1	2	0	0	0	1	1	1
South Africa	0	0	0	0	0	0	0	1	0	1	0	10	0	0	1	0
	0	1	1	0	0	1	0	1	2	1	0	4	0	0	1	0
	1	0	1	1	0	1	0	1	2	1	0	4	0	1	1	0
Switzerland	1	1	1	0	1	3	3	5	1	1	2	1	0	0	2	1
	1	1	1	0	2	3	3	4	4	1	2	1	1	0	2	1
	1	1	1	0	2	3	3	4	4	1	1	2	2	0	4	1
UK	3	5	3	1	4	7	8	7	6	3	4	9	0	6	0	4
	2	5	3	2	3	7	9	8	5	2	3	8	8	6	0	4
	1	3	2	2	2	5	6	6	2	1	2	3	4	4	0	3
USA	17	16	21	10	0	7	7	7	14	26	5	16	0	7	11	0
	16	14	24	16	5	8	8	9	12	25	8	12	10	9	15	0
	8	7	13	12	6	5	4	5	7	12	3	9	8	8	8	0
ASEAN	0	11	2	5	0	2	2	2	7	13	2	0	0	2	3	6
	0	14	2	8	0	2	2	2	8	14	2	0	3	2	3	6
	0	14	4	10	0	2	2	2	10	15	2	0	5	2	3	5

Source: *Author's calculations*; Data: IMF's DOTS.

Note: For each country index is calculated for 1991, 2001 and 2011.

Table A.5: Direct Transaction Cost Index

Country (l)	Currency share	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Canadian dollar	Swedish Krona	New Zealand dollar	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese RMB	Turkish lira	South African Rand	Brazilian real	Taiwan dollar	Malaysian ringgit	Thai Baht	Philippines peso	Indonesian rupiah
		19.5	9.5	6.4	3.8	3.2	2.6	1.1	0.8	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1
US dollar	42.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
Euro	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.6	0.7
Japanese yen	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.8	1.1	1.3	1.4
Pound sterling	6.4	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.7	1.1	1.6	1.8	2.1
Australian dollar	3.8	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.3	0.4	0.4	0.6	0.6	0.6	0.7	0.7	0.8	1.1	1.9	2.7	3.1	3.5
Swiss franc	3.2	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.4	0.4	0.4	0.5	0.7	0.7	0.7	0.9	0.9	0.9	1.3	2.3	3.3	3.7	4.2
Canadian dollar	2.6	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.5	0.5	0.5	0.6	0.8	0.8	0.9	1.0	1.0	1.1	1.6	2.7	3.9	4.5	5.0
Hong Kong dollar	1.2	0.0	0.1	0.1	0.2	0.3	0.3	0.8	1.1	1.1	1.2	1.3	1.8	1.9	2.0	2.3	2.3	2.5	3.5	6.1	8.8	10.1	11.2
Swedish krona	1.1	0.0	0.1	0.1	0.2	0.3	0.3	0.8	1.1	1.2	1.3	1.5	1.9	2.0	2.1	2.5	2.5	2.7	3.8	6.6	9.5	10.8	12.1
New Zealand dollar	0.8	0.1	0.1	0.2	0.3	0.4	0.5	1.1	1.6	1.7	1.8	2.0	2.7	2.8	2.9	3.4	3.5	3.7	5.3	9.1	13.1	14.9	16.6
Korean won	0.8	0.1	0.1	0.2	0.3	0.4	0.5	1.2	1.7	1.7	1.9	2.1	2.8	2.9	3.1	3.6	3.7	3.9	5.5	9.5	13.7	15.7	17.5
Singapore dollar	0.7	0.1	0.1	0.2	0.4	0.4	0.5	1.3	1.8	1.9	2.0	2.3	3.0	3.1	3.3	3.8	3.9	4.1	5.9	10.2	14.7	16.8	18.7
Norwegian krone	0.7	0.1	0.2	0.2	0.4	0.5	0.6	1.4	1.9	2.0	2.1	2.4	3.2	3.4	3.5	4.1	4.2	4.4	6.3	10.9	15.7	18.0	20.0
Mexican peso	0.6	0.1	0.2	0.2	0.4	0.5	0.6	1.5	2.0	2.1	2.3	2.5	3.4	3.5	3.7	4.3	4.4	4.7	6.7	11.5	16.6	18.9	21.1
Indian rupee	0.5	0.1	0.2	0.3	0.6	0.7	0.8	1.9	2.7	2.8	3.0	3.4	4.5	4.7	4.9	5.7	5.8	6.2	8.8	15.2	21.9	25.0	27.9
Russian Rouble	0.5	0.1	0.2	0.3	0.6	0.7	0.8	2.0	2.8	2.9	3.1	3.5	4.7	4.9	5.2	6.0	6.1	6.5	9.3	16.0	23.1	26.3	29.4
Chinese renminbi	0.4	0.1	0.2	0.4	0.6	0.7	0.9	2.1	2.9	3.1	3.3	3.7	4.9	5.2	5.4	6.3	6.4	6.8	9.7	16.8	24.2	27.6	30.7
Polish zloty	0.4	0.1	0.3	0.4	0.7	0.8	0.9	2.3	3.1	3.3	3.5	4.0	5.2	5.5	5.8	6.7	6.9	7.3	10.4	17.9	25.8	29.5	32.8
Turkish new lira	0.4	0.1	0.3	0.4	0.7	0.9	1.0	2.5	3.4	3.6	3.8	4.3	5.7	6.0	6.3	7.4	7.5	8.0	11.4	19.6	28.3	32.3	36.0

Country (l)	Currency share	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Canadian dollar	Swedish Krona	New Zealand dollar	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese renminbi	Turkish lira	South African Rand	Brazilian real	Taiwan dollar	Malaysian ringgit	Thai Baht	Philipines peso	Indonesian rupiah
South African rand	0.4	0.1	0.3	0.4	0.7	0.9	1.0	2.5	3.5	3.7	3.9	4.4	5.8	6.1	6.4	7.5	7.7	8.1	11.6	20.0	28.8	32.8	36.6
Brazilian real	0.3	0.1	0.3	0.5	0.8	0.9	1.1	2.7	3.7	3.9	4.1	4.7	6.2	6.5	6.8	8.0	8.1	8.6	12.2	21.1	30.4	34.7	38.7
Danish krone	0.3	0.2	0.4	0.5	0.9	1.1	1.3	3.2	4.4	4.7	5.0	5.6	7.4	7.8	8.2	9.6	9.8	10.3	14.8	25.5	36.7	41.9	46.6
Taiwan dollar	0.2	0.2	0.4	0.7	1.1	1.3	1.6	3.8	5.3	5.5	5.9	6.7	8.8	9.3	9.7	11.4	11.6	12.2	17.5	30.3	43.5	49.7	55.4
Hungarian forint	0.2	0.2	0.5	0.7	1.2	1.5	1.8	4.2	5.8	6.1	6.5	7.4	9.8	10.3	10.8	12.6	12.8	13.5	19.4	33.5	48.2	55.0	61.3
Malaysian ringgit	0.1	0.4	0.8	1.1	1.9	2.3	2.7	6.6	9.1	9.5	10.2	11.5	15.2	16.0	16.8	19.6	20.0	21.1	30.3	52.2	75.2	85.8	95.6
Thai baht	0.1	0.5	1.1	1.6	2.7	3.3	3.9	9.5	13.1	13.7	14.7	16.6	21.9	23.1	24.2	28.3	28.8	30.4	43.5	75.2	108.3	123.5	137.6
Czech koruna	0.1	0.5	1.1	1.6	2.8	3.3	4.0	9.5	13.1	13.8	14.7	16.6	22.0	23.1	24.2	28.4	28.9	30.5	43.7	75.4	108.5	123.8	138.0
Philipine peso	0.1	0.6	1.3	1.8	3.1	3.7	4.5	10.8	14.9	15.7	16.8	18.9	25.0	26.3	27.6	32.3	32.8	34.7	49.7	85.8	123.5	140.9	157.0
Chilean peso	0.1	0.6	1.3	1.9	3.2	3.8	4.6	11.2	15.4	16.2	17.3	19.5	25.8	27.1	28.4	33.2	33.8	35.8	51.2	88.4	127.2	145.1	161.7
Indonesian rupiah	0.1	0.7	1.4	2.1	3.5	4.2	5.0	12.1	16.6	17.5	18.7	21.1	27.9	29.4	30.7	36.0	36.6	38.7	55.4	95.6	137.6	157.0	175.0
Israeli new shekel	0.1	0.7	1.4	2.1	3.5	4.2	5.1	12.2	16.8	17.6	18.8	21.2	28.1	29.6	31.0	36.2	36.9	39.0	55.8	96.4	138.7	158.2	176.3
Colombian peso	0.0	1.0	2.1	3.1	5.3	6.3	7.6	18.3	25.2	26.5	28.3	32.0	42.3	44.5	46.6	54.5	55.5	58.7	84.0	145.0	208.7	238.1	265.4
Saudi Riyal	0.0	1.7	3.5	5.2	8.8	10.5	12.7	30.6	42.1	44.2	47.3	53.4	70.7	74.3	77.8	91.0	92.6	97.9	140.2	242.0	348.4	397.5	443.0

Table A.6: Indirect Transaction Cost Index

Country (1)	Currency share	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Canadian dollar	Swedish Krona	New Zealand dollar	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese Renminbi	Turkish lira	South African Rand	Brazilian real	Taiwan dollar	Malaysian ringgit	Thai Baht	Philippines peso	Indonesian rupiah
		19.5	9.5	6.4	3.8	3.2	2.6	1.1	0.8	0.8	0.7	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1
US dollar	42.4																						
Euro	19.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Japanese yen	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pound sterling	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Australian dollar	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swiss franc	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canadian dollar	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hong Kong dollar	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swedish krona	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Zealand dollar	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Korean won	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Singapore dollar	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Norwegian krone	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mexican peso	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Indian rupee	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Russian Rouble	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chinese renminbi	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Polish zloty	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Country (1)	Currency share	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Canadian dollar	Swedish Krona	New Zealand dollar	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese Renminbi	Turkish lira	South African Rand	Brazilian real	Taiwan dollar	Malaysian ringgit	Thai Baht	Philipines peso	Indonesian rupiah
Turkish new lira	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
South African rand	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Brazilian real	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Danish krone	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Taiwan dollar	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Hungarian forint	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Malaysian ringgit	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Thai baht	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Czech koruna	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Philipine peso	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Chilean peso	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Indonesian rupiah	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Israeli new shekel	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Colombian peso	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Saudi Riyal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2

Table A.7: Direct Transaction Cost Index (2001-2010)

		Partner currency (s)																		
Country (l)	Year	US dollar	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese Renminbi	South African Rand	Brazilian real	Malaysian ringgit	Thai Baht	Philipines peso	Indonesian rupiah	Saudi riyal
US dollar	2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.8
	2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.4	0.2	0.4	0.4	0.8
	2004	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.5	0.1	0.2	0.9	0.2	1.1	0.4	1.3
	2001	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.1	5.8	0.0	0.1	0.6	0.3	1.1	1.0	0.7
Euro	2010	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.5	0.6	0.7	1.7
	2007	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.3	0.8	0.6	1.0	1.0	1.9
	2004	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.2	1.1	0.1	0.4	2.1	0.5	2.7	1.0	3.0
	2001	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.5	0.3	13.7	0.1	0.2	1.4	0.7	2.6	2.3	1.6
JPY	2010	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.8	1.1	1.3	1.4	3.5
	2007	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.3	0.3	0.5	0.3	0.6	1.7	1.2	2.2	2.1	4.1
	2004	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.6	0.3	2.0	0.3	0.7	3.7	1.0	4.8	1.8	5.4
	2001	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.7	0.5	22.1	0.2	0.4	2.3	1.1	4.2	3.7	2.5
GBP	2010	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5	1.1	1.6	1.8	2.1	5.2
	2007	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.4	0.4	0.6	0.3	0.7	2.0	1.4	2.5	2.4	4.7
	2004	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.2	0.7	0.4	2.5	0.3	0.9	4.7	1.2	6.1	2.3	6.8
	2001	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.3	0.4	1.3	0.9	39.8	0.3	0.6	4.1	2.0	7.5	6.7	4.5
AUD	2010	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.4	0.6	0.6	0.6	0.7	0.8	1.9	2.7	3.1	3.5	8.8
	2007	0.0	0.0	0.0	0.0	0.1	0.1	0.5	0.5	0.5	0.9	0.8	1.3	0.7	1.5	4.5	3.1	5.7	5.5	10.6
	2004	0.0	0.0	0.0	0.0	0.1	0.1	0.6	0.7	0.6	2.1	1.1	6.8	0.9	2.5	12.9	3.3	16.6	6.2	18.6
	2001	0.0	0.0	0.0	0.1	0.2	0.2	1.2	0.9	1.1	4.0	2.7	120.2	1.0	1.9	12.4	6.1	22.7	20.3	13.6

Partner currency (s)

Country (l)	Year	US dollar	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese Renminbi	South African Rand	Brazilian real	Malaysian ringgit	Thai Baht	Philipines peso	Indonesian rupiah	Saudi riyal
Swiss franc	2010	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.4	0.5	0.7	0.7	0.7	0.9	0.9	2.3	3.3	3.7	4.2	10.5
	2007	0.0	0.0	0.0	0.0	0.1	0.1	0.5	0.5	0.4	0.8	0.8	1.3	0.6	1.5	4.4	3.0	5.6	5.3	10.3
	2004	0.0	0.0	0.0	0.0	0.1	0.1	0.6	0.7	0.6	2.0	1.1	6.8	0.9	2.5	12.8	3.3	16.6	6.2	18.6
	2001	0.0	0.0	0.0	0.1	0.2	0.1	0.8	0.6	0.8	2.9	1.9	86.9	0.7	1.4	9.0	4.4	16.4	14.7	9.9
Korean won	2010	0.0	0.1	0.1	0.2	0.3	0.4	1.7	1.9	2.1	2.8	2.9	3.1	3.7	3.9	9.5	13.7	15.7	17.5	44.2
	2007	0.0	0.1	0.2	0.2	0.5	0.5	3.0	3.0	2.6	4.9	4.6	7.7	3.8	8.8	26.0	17.7	32.8	31.4	61.0
	2004	0.0	0.1	0.2	0.2	0.6	0.6	3.1	3.9	3.2	10.8	5.6	36.0	4.8	13.2	67.9	17.5	87.6	32.6	98.4
	2001	0.1	0.1	0.2	0.4	1.2	0.8	6.2	4.7	6.0	21.7	14.4	646.6	5.3	10.5	66.8	32.9	122.2	109.3	73.4
SGD	2010	0.0	0.1	0.1	0.2	0.4	0.4	1.9	2.0	2.3	3.0	3.1	3.3	3.9	4.1	10.2	14.7	16.8	18.7	47.3
	2007	0.0	0.1	0.2	0.2	0.5	0.5	3.0	2.9	2.6	4.8	4.6	7.6	3.8	8.7	25.7	17.5	32.5	31.1	60.4
	2004	0.1	0.1	0.2	0.3	0.7	0.7	3.9	4.9	4.0	13.6	7.0	45.4	6.1	16.6	85.5	22.1	110.4	41.0	124.0
	2001	0.0	0.1	0.2	0.3	0.9	0.6	4.7	3.6	4.6	16.5	11.0	493.0	4.0	8.0	50.9	25.1	93.1	83.3	56.0
MXN	2010	0.0	0.1	0.2	0.2	0.4	0.5	2.1	2.3	2.5	3.4	3.5	3.7	4.4	4.7	11.5	16.6	18.9	21.1	53.4
	2007	0.0	0.1	0.2	0.2	0.5	0.4	2.6	2.6	2.3	4.3	4.1	6.8	3.3	7.7	22.9	15.6	28.9	27.7	53.8
	2004	0.0	0.1	0.2	0.2	0.6	0.6	3.2	4.0	3.3	11.2	5.7	37.1	5.0	13.6	70.0	18.1	90.4	33.6	101.5
	2001	0.1	0.1	0.2	0.4	1.1	0.8	6.0	4.6	5.8	21.1	14.0	628.1	5.1	10.2	64.9	32.0	118.7	106.1	71.3
Indian rupee	2010	0.0	0.1	0.2	0.3	0.6	0.7	2.8	3.0	3.4	4.5	4.7	4.9	5.8	6.2	15.2	21.9	25.0	27.9	70.7
	2007	0.1	0.2	0.3	0.4	0.9	0.8	4.9	4.8	4.3	7.9	7.5	12.5	6.2	14.3	42.2	28.8	53.3	51.0	99.1
	2004	0.1	0.3	0.6	0.7	2.1	2.0	10.8	13.6	11.2	38.2	19.6	126.9	17.1	46.5	239.2	61.7	309.0	114.7	346.9
	2001	0.2	0.5	0.7	1.3	4.0	2.9	21.7	16.5	21.1	76.1	50.5	2266.9	18.5	36.7	234.3	115.4	428.3	383.0	257.4
RUB	2010	0.1	0.1	0.2	0.3	0.6	0.7	2.9	3.1	3.5	4.7	4.9	5.2	6.1	6.5	16.0	23.1	26.3	29.4	74.3

Country (l)	Year	US dollar	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese Renminbi	South African Rand	Brazilian real	Malaysian ringgit	Thai Baht	Philipines peso	Indonesian rupiah	Saudi riyal
	2007	0.1	0.1	0.3	0.4	0.8	0.8	4.6	4.6	4.1	7.5	7.1	11.8	5.9	13.5	40.1	27.3	50.6	48.4	94.0
	2004	0.1	0.2	0.3	0.4	1.1	1.1	5.6	7.0	5.7	19.6	10.0	65.1	8.8	23.8	122.6	31.7	158.4	58.8	177.8
	2001	0.1	0.3	0.5	0.9	2.7	1.9	14.4	11.0	14.0	50.5	33.5	1504.4	12.3	24.4	155.5	76.6	284.2	254.2	170.8
CNY	2010	0.1	0.1	0.2	0.4	0.6	0.7	3.1	3.3	3.7	4.9	5.2	5.4	6.4	6.8	16.8	24.2	27.6	30.7	77.8
	2007	0.1	0.2	0.5	0.6	1.3	1.3	7.7	7.6	6.8	12.5	11.8	19.6	9.7	22.5	66.5	45.3	84.0	80.3	156.1
	2004	0.5	1	2.0	3	7	7	36	45	37	127	65	422	57	155	795	205	1027	382	1153
	2001	6	14	22	40	120	87	647	493	628	2267	1504	67531	551	1093	6979	3437	12758	11410	7667
ZAR	2010	0.1	0.1	0.3	0.4	0.7	0.9	3.7	3.9	4	6	6	6	8	8	20	29	33	37	93
	2007	0.1	0.1	0.3	0.3	0.7	0.6	3.8	3.8	3.3	6.2	5.9	9.7	4.8	11.1	32.9	22.5	41.6	39.8	77.3
	2004	0.1	0.1	0.3	0.3	1	1	5	6	5	17	9	57	8	21	107	28	138	51	155
	2001	0.0	0.1	0.2	0.3	1.0	0.7	5.3	4.0	5.1	18.5	12.3	550.8	4.5	8.9	56.9	28.0	104.1	93.1	62.5
BRL	2010	0.1	0.1	0.3	0.5	0.8	0.9	3.9	4.1	4.7	6.2	6.5	6.8	8.1	8.6	21.1	30.4	34.7	38.7	97.9
	2007	0.1	0.3	0.6	0.7	1.5	1.5	8.8	8.7	7.7	14.3	13.5	22.5	11.1	25.8	76.2	51.9	96.2	92.0	178.8
	2004	0.2	0.4	0.7	0.9	2.5	2.5	13.2	16.6	13.6	46.5	23.8	154.5	20.8	56.6	291.2	75.2	376.2	139.7	422.3
	2001	0.1	0.2	0.4	0.6	1.9	1.4	10.5	8.0	10.2	36.7	24.4	1093.1	8.9	17.7	113.0	55.6	206.5	184.7	124.1
MYR	2010	0.2	0.4	0.8	1.1	1.9	2.3	9.5	10.2	11.5	15.2	16.0	16.8	20.0	21.1	52.2	75.2	85.8	95.6	242.0
	2007	0.4	0.8	1.7	2.0	4.5	4.4	26.0	25.7	22.9	42.2	40.1	66.5	32.9	76.2	225.3	153.6	284.5	272.1	528.8
	2004	0.9	2.1	3.7	4.7	12.9	12.8	67.9	85.5	70.0	239.2	122.6	795.3	107.0	291.2	1499.1	386.9	1936.4	719.1	2173.9
	2001	0.6	1.4	2.3	4.1	12.4	9.0	66.8	50.9	64.9	234.3	155.5	6979.1	56.9	113.0	721.3	355.2	1318.5	1179.2	792.4
Thai baht	2010	0.2	0.5	1.1	1.6	2.7	3.3	13.7	14.7	16.6	21.9	23.1	24.2	28.8	30.4	75.2	108.3	123.5	137.6	348.4
	2007	0.2	0.6	1.2	1.4	3.1	3.0	17.7	17.5	15.6	28.8	27.3	45.3	22.5	51.9	153.6	104.7	193.9	185.4	360.4

Country (l)	Year	US dollar	Euro	Japanese Yen	Pound sterling	Australian dollar	Swiss Franc	Korean Won	Singapore dollar	Mexican peso	Indian rupee	Russian rouble	Chinese Renminbi	South African Rand	Brazilian real	Malaysian ringgit	Thai Baht	Philipines peso	Indonesian rupiah	Saudi riyal
	2004	0.2	0.5	1.0	1.2	3.3	3.3	17.5	22.1	18.1	61.7	31.7	205.3	27.6	75.2	386.9	99.9	499.8	185.6	561.1
	2001	0.3	0.7	1.1	2.0	6.1	4.4	32.9	25.1	32.0	115.4	76.6	3436.9	28.0	55.6	355.2	174.9	649.3	580.7	390.2
PHP	2010	0.3	0.6	1.3	1.8	3.1	3.7	15.7	16.8	18.9	25.0	26.3	27.6	32.8	34.7	85.8	123.5	140.9	157.0	397.5
	2007	0.4	1.0	2.2	2.5	5.7	5.6	32.8	32.5	28.9	53.3	50.6	84.0	41.6	96.2	284.5	193.9	359.3	343.6	667.8
	2004	1.1	2.7	4.8	6.1	16.6	16.6	87.6	110.4	90.4	309.0	158.4	1027.3	138.2	376.2	1936.4	499.8	2501.2	928.9	2808.0
	2001	1.1	2.6	4.2	7.5	22.7	16.4	122.2	93.1	118.7	428.3	284.2	12757.8	104.1	206.5	1318.5	649.3	2410.2	2155.6	1448.5
IDR	2010	0.3	0.7	1.4	2.1	3.5	4.2	17.5	18.7	21.1	27.9	29.4	30.7	36.6	38.7	95.6	137.6	157.0	175.0	443.0
	2007	0.4	1.0	2.1	2.4	5.5	5.3	31.4	31.1	27.7	51.0	48.4	80.3	39.8	92.0	272.1	185.4	343.6	328.6	638.6
	2004	0.4	1.0	1.8	2.3	6.2	6.2	32.6	41.0	33.6	114.7	58.8	381.5	51.3	139.7	719.1	185.6	928.9	345.0	1042.9
	2001	1.0	2.3	3.7	6.7	20.3	14.7	109.3	83.3	106.1	383.0	254.2	11410.0	93.1	184.7	1179.2	580.7	2155.6	1927.8	1295.4
Saudi Riyal	2010	0.8	1.7	3.5	5.2	8.8	10.5	44.2	47.3	53.4	70.7	74.3	77.8	92.6	97.9	242.0	348.4	397.5	443.0	1121.5
	2007	0.8	1.9	4.1	4.7	10.6	10.3	61.0	60.4	53.8	99.1	94.0	156.1	77.3	178.8	528.8	360.4	667.8	638.6	1241.2
	2004	1.3	3.0	5.4	6.8	18.6	18.6	98.4	124.0	101.5	346.9	177.8	1153.3	155.2	422.3	2173.9	561.1	2808.0	1042.9	3152.4
	2001	0.7	1.6	2.5	4.5	13.6	9.9	73.4	56.0	71.3	257.4	170.8	7667.2	62.5	124.1	792.4	390.2	1448.5	1295.4	870.5

Note JPY:Japanese Yen, GBP:Pound sterling,AUD:Australian dollar, SGD:Singapore dollar, MXN:Mexican peso, RUB:Russian Rouble, CNY:Chinese renminbi, ZAR:South African rand, BRL:Brazilian real, MYR:Malaysian ringgit, IDR:Indonesian rupiah, PHP:Philipine peso