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MACROECONOMIC DETERMINANTS OF INTERNATIONAL CURRENCIES:

BOND SHARES AFTER THE INTERNATIONALIZATION OF THE RENMINBI

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Resumo

A presente dissertação analisa o contributo das variáveis macroeconómicas na quota-parte das moedas do SDR Basket – CNY, EUR, GBP, JPY e USD – no mercado de obrigações internacionais. Foram extraídos dados para as emissões de obrigações a nível internacional e utilizados dados trimestrais de 2009Q3 a 2015Q4, de modo a captar o período após a internacionalização do Renminbi (CNY) no mercado de obrigações *offshore*. Adicionalmente, com base no país da empresa-mãe, definimos três regiões para cada moeda: (i) América; (ii) Europa e (iii) Ásia, Oceânia e África.

Foi utilizado um sistema baseado num modelo de Seemingly Unrelated Equations (SURE) e rejeitadas as hipóteses de independência dos erros entre equações e da homogeneidade dos parametros. Os resultados mostram que a quota-parte das obrigações internacionais é influenciada pela dimensão da economia, pelas taxas de inflação e pelo *spread* de taxas de juro. Além disso, os resultados sugerem que os determinantes não apresentam um padrão homogéneo. Os coeficientes estimados diferem não só entre moedas mas também entre regiões da mesma moeda. Os nossos resultados indicam que a expansão da economia Chinesa suporta a internacionalização da moeda em todas as regiões e que o USD detém um estatuto distinto que ainda não foi atingido por nenhuma outra moeda.

***Palavras-Chave**: Moedas Internacionais, Obrigações Internacionais, SUR, Determinantes Macroeconómicas da Procura Internacional de Moeda.*

***JEL Codes:** G15, F40, F41*

Abstract

This dissertation analyses the macroeconomic variables that determines the currencies' shares in the international bond market, for the five currencies of the SDR Basket: CNY, EUR, GBP, JPY, and USD. We collect data for bond issuances at an international level and we use quarterly data between 2009Q3 and 2015Q4, in order to cover the period after the internationalization of the Renminbi (CNY) in the offshore bond markets. Additionally, based on the country of the parent company, we define three regions for each currency: (i) America; (ii) Europe and (iii) Asia, Oceania and Africa.

We use a system-based model of Seemingly Unrelated Equations (SURE) and reject the hypotheses of independence of the errors across equations and parameters' equality across equations. The results show that the share of international bonds is influenced by the size of the economy, by inflation rates and by the yield spread. Moreover, they suggest that the determinants do not present a homogenous pattern. The estimated coefficients differ not only between currencies but also between regions under the same currency. Our results indicate that the expansion of the Chinese economy is likely to support the internationalization of the currency across all regions and that the USD has a distinctive role that has not yet been achieved by any other currency.

***Keywords*:** *International Currencies; International Bonds, SUR, Macroeconomic Determinants of International Currencies*

***JEL Codes*:** *G15, F40, F41*

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List of Abbreviations

BIS – Bank of International Settlements

CNY – Chinese Renminbi

ECB – European Central Bank

EUR – Euro

FDI – Foreign Direct Investment

FGLS – Feasible Generalized Least Squares

GBP – British Pound

GDP – Gross Domestic Product

IMF – International Monetary Fund

IMS – International Monetary System

JPY – Japanese Yen

MTN – Medium Term Note

SDR – Special Drawing Rights

SPV – Special Vehicle Purpose

SRCH – Bloomberg's Fixed Income Search Function

SUR – Seemingly Unrelated Regressions

SURE – Seemingly Unrelated Equations

USD – US Dollar

1. Introduction

On November 30th 2015, the International Monetary Fund (IMF)'s Executive Board decided to include the Chinese Renminbi (CNY) in the Special Drawing Rights (SDR) Currency Basket as the fifth currency alongside with the US Dollar (USD), the Eurozone Euro (Euro), the British Pound (GBP) and the Japanese Yen (JPY). This was the major change that occurred on the 2015's five-year revision of the SDR Currency Basket. Effective on October 1st 2016, the inclusion of the Renminbi in the SDR Basket represents the beginning of a new era for the Chinese Currency and for the International Monetary System (IMS). There are two factors that support its inclusion in the Currency Basket. Firstly, the rise of China as one of the world's largest exporters in the five year period that preceded the review. Secondly, the Renminbi is now considered "freely usable" according to the definition stated on the IMF's Articles of Agreement: "A freely usable currency means a member's currency that the Fund determines (i) is, in fact, widely used to make payments for international transactions, and (ii) is widely traded in the principal exchange markets." (Article XXXf, IMF, 2016). Based on the factors determining the currencies weight in the SDR Basket, the CNY will represent, on October 1st 2016, 10.92% of the SDR Currency Basket surpassing the JPY (down from 9.4% in 2010 to 8.33% in 2015) and the GBP (down from 11.3% in 2010 to 8.09% in 2015)[1].

This dissertation aims to analyse the international role of the five currency units of the SDR Basket and to understand what economic and financial factors drive the use of these currencies at the international sphere. We study the period after the introduction of the Renminbi in the offshore bond markets and we make use of data from the international bond market, which include both public and private issues of bonds at the international level. We explore the use of currencies as a store of value and unit of account. We aim to understand if the economic and financial factors that influence the share of international currencies have the same impact over the share of each of the five currencies or, on the other hand, if the impact differ depending on the currency in question. Additionally, we segregate the issuances of each currency by regions, according to the region of the issuer of the bond, to capture if the determinants that

[1] The USD represents 41.73% (41.9% in 2010) and the Euro 30.93 (37.4% in 2010).

influence each of the currencies' shares also differ by geographic regions from which the issuers belong.

We use a system-based model of Seemingly Unrelated Equations (SURE) and reject the hypothesis of independence of the errors across equations. Since contemporaneous correlation exists across the equations of the model we therefore estimate the model using the feasible generalized least squares (FGLS) estimator, thus obtaining more precise point estimates for the parameters.

The results suggest that the determinants of international bonds shares do not present a homogenous pattern. There is heterogeneity between currencies and also between different regions for the same currency. Determinants such as the GDP share of currency's country, the bilateral trade share between the currency's country and the region of the issuer, inflation and yield spread are statistically significant.

We find that one of the measures of the size of the economy, the GDP share of the currency *i*'s country, has a positive impact over the share of international bonds among issuers from the region of the currency *i*. In other words, the share of bonds issued by agents that belong to the region of the currency tend to increase when the share of the GDP of the currency's country increases. Furthermore, the results indicate that the impact of determinants such as the size of the economy or the stability of a currency show a clear dichotomy, with negative GDP share coefficients for the share of bonds issued by agents outside the region of the currency. For the USD, the inflation rates present positive coefficients for the shares issued by American issuers but negative otherwise. We find out that the expansion of the Chinese economy is likely to support the internationalization of the currency across all regions and, finally, we conclude that the USD still is a distinctive reference currency at a global level.

The dissertation is structured as following. In the next section, Section 2, we review the literature on international currencies and international bonds. We start by looking to the three functions of money, then we look at the determinants that influence both international currencies shares and international bond shares, and we conclude this section be revisiting and reviewing the concept of international bonds itself and understanding what justifies the study of bonds to measure international currency strength. In Section 3 we describe the data and methodology applied and we terminate with a descriptive analysis of the data that we collect. In Section 4, we present the

empirical results of our models using the system of SUREs. Section 5 derives the conclusions.

2. Literature Review

In this section, we start by looking to the three functions of money in their private and public uses. In section 2.2., we review the economic and financial determinants that influence the use of one currency at an international level. Additionally, in order to analyse the particular dimension of bonds, we complete the list of determinants influencing international currencies with those that influence the issuance of international bonds (section 2.3). In Section 2.4., we discuss the concept of international bonds, its changes through time and which bond types integrate this category of issuances. Finally, in section 2.5., we connect the literature on international currencies with the research that uses bonds to study the strength of the currencies outside their domestic area, while justifying the use of international bonds.

2.1. The Three Functions of Money

It is well established among economists that money encompasses three fundamental roles: medium of exchange, unit of account, and store of value. Furthermore, these roles were subsequently divided into private and official uses, to emphasize the differences between the use operated by private agents and by official institutions, respectively (Cohen, 1971; Krugman, 1984). An international currency is, therefore, one that plays the traditional aforementioned roles at the international level. With the establishment of international economic relationships as a fundamental cornerstone of modern economic development, the choice of what currency is used in such transactions started to be analysed by economists (Kindleberger, 1967; Swoboda, 1968, 1969; Cohen, 1971; Hakkio, 1973; McKinnon, 1979; Krugman, 1980, 1984; Blinder, 1996; Chinn and Frankel, 2007).

Medium of Exchange

A third currency used to mediate economic transactions between importers and exporters is a *vehicle currency*, functioning as a medium of exchange. In international transactions between two countries with small economies, it can be convenient for both

to settle trade through a *foreign trade vehicle currency*, in order to diminish transaction costs based on the strategic externalities (e.g., a large percentage of international trade with the country of the vehicle currency) or economies of scale (a large community widely using and accepting the vehicle currency) that the vehicle currency might be able to provide (Matsuyama *et al.*, 1993).

Similarly, a currency can be used as a "*forex vehicle currency"* (Hartmann, 1998), which is another important dimension of an international currency. In other words, the forex vehicle currency plays the medium of exchange role by mediating the trade of two other currencies in financial markets – more concretely, in the foreign exchange (forex) market.

At the official level, a vehicle currency would be the currency used by Central Banks to intervene in the foreign exchange markets and influence exchange rates or sustain an official parity. McKinnon (1979) in his seminal work, discusses why it does not exist a system of "symmetrical multiple interventions by each central bank in all convertible currencies", showing that the international system – at an official level – also tends to rely on one currency.

Unit of Account

The medium of exchange function is often linked with the unit of account function (Krugman, 1984). At a private level, a currency functions as an *invoicing currency* whenever it is used to denominate trade or financial transactions. At the official level, countries can peg their domestic currencies to a foreign one in order to reduce exchange rate uncertainty by fixing the exchange rate with that currency.

Store of Value

Finally, the last function of money is to serve as a store of value. A currency that is widely used internationally, often presents a stable value with relatively low volatility, enabling both private and official agents to hold it, without losing wealth through constant corrosives processes of devaluation (Chinn and Frankel, 2008, p. 57; Cohen, 2005). Therefore, functioning as an *investment* or *reserve currency*.

2.2. Determinants of Currencies' International Use

The literature in international currencies defines some economic and financial factors that contribute to the international use of currencies. Since this dissertation focus on the store of value and unit of account roles of a currency, the goal of the section is to present all the determinants identified by the economic literature, giving particular emphasis to the literature focusing on the study of these roles.

Output Size and Trade

In the words of Chinn and Frankel (2007), the currency of a country that possesses a large share world's output, trade and finance has a big natural advantage. In fact, the five currencies of the SDR Currency Basket represent the five largest countries or monetary unions in the world measured by the Gross Domestic Product (GDP). Large economies are more likely to achieve low transaction costs making their currencies more attractive to be used in international trade and cross-border financial transactions (Lim, 2006). Additionally, larger economies present a "high-density network of trading relationships" to foreign agents, making the currencies of these countries more attractive (Chen and Peng, 2010, p. 117). The income share appears as a statistical significant explanatory variable in the works of Chinn and Frankel (2007, 2008), Bobba *et al.* (2007), Eichengreen *et al.* (2014) and Ito and Rodriguez (2015)[2]. All corroborate the idea that a large economy will have a tendency to have a higher share of international reserves denominated in its currency.

Similarly, trade is also considered by the literature as an explanatory variable influencing the international status of a currency. Bobba *et al.* (2007) uses disaggregated data to study the relationship between bilateral trade shares and the share of international bonds issued in different currencies. The results suggest that an increase in the bilateral trade share between the issuer's country and the currency's country leads to an increase of bonds denominated in that currency, particularly for the subsample of developing countries.

Stability of a currency's value

[2] Ito and Rodriguez find the same based on the opposite angle, i.e., they find that a country with a larger output will rely less on Foreign Currency Denominated Debt.

In order to perform a role as an international store of value, economic agents need to have confidence in the value of a currency. Stability is an important factor, so that investors and economic agents do not see the value of their assets erase. Chinn and Frankel (2007) empirical results suggests that exchange rate volatility and relatively high inflation levels influence negatively the share of a currency's international share as a store of value. Similarly, Cohen (2005), studying the international bond market, concludes that the issuance of international bonds tends to be higher for strong currencies. However, in Bobba *et al.* (2007), inflation has a very low positive impact over the share of international bonds and it is statistically significant only for developed countries.

The results obtained by Bobba *et al* (2007) reveal that, although inflation contributes to undermine currency's value, higher inflation levels can benefit the share of bonds issued in that currency, particularly, at an international level. Despite the fact that unstable currencies are associated with higher risk and therefore higher interest rates for issuers, it can still be possible to reduce costs by issuing in a foreign currency that presents high inflation levels. Hence, explaining the positive impact of inflation in debt issuances at an international level.

Financial Markets Development

The development and deepness of financial centres of a country has been recognized as one of the major factors driving the ascendance of one currency's international use (Eichengreen *et al.*,. 2014). With the sophistication of domestic financial markets, the increase in liquidity and the expansion of the available financial instruments, it is likely that international actors will rely on the currencies of countries where financial markets are liquid, broad, and diverse. Also, historically, the two main international currencies of the XXth century, the British Pound and the US Dollar, were backed by the most developed financial centres at the time, London and New York, respectively (Lim 2006). Nevertheless, studying empirically the deepness and development of financial centres it is a difficult task. The most broadly used proxy to capture financial markets development is foreign exchange turnover. Chinn and Frankel (2007, 2008), Frankel (2012), Lee (2014), and Chinn (2014) use the triannual data of foreign exchange turnover from BIS as a proxy, using a log-linear interpolation method between observations. Eichengreen *et al.* (2014), studying foreign public debt issuance in the XXth century, and Eichengreen and Flandreau (2008) use bank assets relative to the

GDP as a proxy for financial depth. Ito and Rodriguez (2015) use gross domestic savings as a ratio to GDP and total private credit creation to examine the development of financial markets. Finally, the stock market capitalization is also considered as an alternative to measure of financial market development in the work of Chinn and Frankel (2008).

Persistence and Network Externalities

Many economists, such as Eichengreen and Mathienson (2000), Lim (2006), and Chinn and Frankel (2007), stress the importance of path-dependency and emphasize that reserve currencies are unlikely to change dramatically. However, this does not mean that a change of the leading international currencies do not occur, but rather that – if it happens – it will occur gradually. There is a deep consensus that "an international currency, like a domestic currency, is more useful when others use it." (Chinn and Frankel, 2007, 2008; Frankel, 2012; Eichengreen *et al.*,. 2014, p. 14), making economies of scope also an important factor regarding the international use of currencies. Despite the evidence that changes in international currency status do not occur rapidly, the fact that one currency can perform different international roles and reinforce itself help to support Chinn and Frankel's belief that international currencies can be considered a *tipping phenomenon* (Chinn and Frankel, 2008), i.e., the derivative of currency's use with respect to its determinants might be greater when one currency overcomes and surpasses the other. Hence, they can accelerate the shift in the international order.

2.3. Factors Influencing Currency Choice in Debt Issuance

Summing up to the aforementioned determinants, we also consider some specific factors that may influence the choice of issuance currency in international debt securities. The issuance of bonds across national borders appeared as a result of the willingness of economic agents to diversify characteristics of the assets issued for financing purposes or held as a financial asset (Benzie, 1992), and the increasing globalization and capital mobility "encourage borrowers to utilise bond markets outside their country of residence" (1992). Under this context, which that contributed to the expansion of cross-border debt issuance, two main factors influence the choice of the

issuance currency: risk management considerations and borrowing costs minimizations (Cohen, 2005).

Interest Rate Differential

One factor that influences currency choice in the issuance of international bonds is the possibility to reduce borrowing costs. The cost of borrowing money through financial markets is the yield that investors demand in the moment of raising debt. Since the yields offered by corporations in a given currency will be affected by the benchmark interest rate in that currency, the proxy used by the literature to measure borrowing costs are differences in benchmark government bond yields. Cohen (2005) uses the 10-year yield differentials and Bobba *et al.* (2007) use one-year interest rate differentials between the dollar and the other currencies. An increase in government bonds' interest rate tend to increases corporate bonds' yields, following the government benchmark curve and maintaining the risk premium. However, it is also true that the government bond interest rate depends on the monetary and fiscal policies adopted by the country and, of course, by their creditworthiness. Therefore, interest rate differential might arise, for instance, in virtue of divergent monetary policies of different central banks.

It must be stressed that in a world with no transaction costs and perfect information both Uncovered Interest Parity (UIP) and the Covered Interest Parity (CIP) would always prevail, since any deviation from those parities would be exploited by economic agents through an arbitrage process. McBraddy and Schill (2007) study this issue empirically and find that agents without hedging motives take advantage of international foreign-currency bonds to exploit advantages and minimize borrowing costs. Additionally, they find that bond issuance tend to occur after periods of appreciation of a given currency and that consequently, on average, the issuance of that bonds precedes a period of devaluation (2007).

Habib and Joy (2008) present the most complete study regarding uncovered and covered interest parity. They use bond-data to verify the existence of deviations from the equilibrium parities and their significance for the issuance of foreign-currency denominated debt. Habib and Joy concerns are not with the total amount issued but rather with the total number of bonds issued in foreign currency. Hence, issues regarding currencies' dominance at an international level are not addressed. Nevertheless, the results obtained by Habib and Joy provide microeconomic empirical

evidence that can support results at the aggregate level. They find that issuers take advantage of uncovered interest parity deviations and conclude that they will prefer to issue in lower yield currencies. However, they also state that "issuance does not respond in a consistent manner to expected depreciation of the issuance currency" (2008), which is contrary to the findings obtained by Mcbraddy and Schill (2007).

Hedging Motives

Firms that possess assets or revenues in a given currency can decide to issue in that given currency in order to hedge the income generated and overcome exchange rate risks. This "natural hedge" allows firms to avoid currency mismatches between assets and liabilities and international bonds denominated in the main currencies are often used by firms from developing countries as a risk management tool. Although evidence that the presence of foreign operations leads firms to issue in foreign currency arise from firm-level studies (Keloharju and Niskanen, 2001; Allayannis *et al.,*. 2002; Kedia and Mozumdar, 2003; Esho *et al.,*. 2007; Clark and Judge, 2009), Cohen (2005) takes into account this evidences and uses investment growth as a proxy to capture the use of international bonds in a given currency to hedge future cash-flows from real assets (2005, p. 59).

2.4. The Concept of International Bonds

The definition of what might be considered an international bond is far from being consensual. The Bank of International Settlements (BIS), the institution that publishes, since the 1980's, statistics on debt capital markets, defines International Debt Securities as "debt securities issued in a market other than the local market of the country where the borrower resides. They capture issues conventionally known as Eurobonds and foreign bonds"[3].

In 2012, the BIS proceeded to a revision of the definition of an international bond in order to harmonize their statistics with the standards existent in the *Handbook on Securities Statistics* (see the latest version from the IMF, the ECB, and the BIS in 2015). The institution faces contemporary conceptual challenges in the definition of what is an

[3] See www.bis.org/statistics/about_securities_stats.htm.

international bond (Wooldridge, 2012). On the basis of these conceptual changes is the evolution of the debt securities markets.

In the 1980's, the international bonds were a measure of a country's level of debt held by foreign investors, i.e., it was a proxy for foreign portfolio investment (Wooldridge, 2012). However, with the integration of financial markets and the liberalization of capital flows, foreign investors can access domestic markets as well as domestic investors can use international markets. Consequently, international bonds as they were defined, cannot, nowadays, accomplish its initial purpose of functioning as a proxy of foreign portfolio investment. Moreover, other metrics and accountability techniques appeared that perform better that role (see, for instance, the Balance of Payments and International Investment Position Statistics from the IMF).

The BIS "no longer refers to the targeted investor base [as before the revision] and instead focuses on the primary market, i.e., the market where securities are issued for the first time" (Wooldridge, 2012). Thus, international bonds are "those issued in a market other than the local market of the country where the borrower resides" (Wooldridge, 2012). BIS's International Debt Securities, therefore, compare two factors: the country where the borrowers reside and the market where the bond was issued. It does not take into account the currency of denomination, i.e., a US company issuing a US Dollar bond can be considered an international bond as long as this bond is issued in a country other than the US.

To better grasp what the BIS takes into account we look closely to the definitions of foreign bonds and Eurobonds. Foreign bonds are bonds denominated in a currency other than the one used in the issuer's country, independently of the market were they are issued. They are also called Foreign-Currency Denominated Bonds[4]. The criterion used is whether the *issuer's country* is the one of the currency of issuance or not, rather than the primary market where the security was issued. Consequently, there are foreign bonds issued on both domestic and non-domestic markets.

Eurobonds are bonds issued offshore, independently of the currency of issuance – in relation to the issuer's country, the currency can be either domestic or non-domestic. A Eurobond is an instrument of debt issued through "a syndicate of issuing banks and

[4] Although some authors use the old and narrower definition of foreign bonds: bonds issued in domestic markets by non-residents, in the same currency of the market were the bond is issued (Choudhry, 2001)

securities houses, and distributed internationally when issued, that is sold in more than one country of issue and subsequently traded by market participants in several international financial centres" (Choudhry, 2001). Hence, in order to distinguish between an Eurobond and a domestic one, we need to look into the *primary market* and understand if the bond is subject to domestic laws, placed and traded through domestic structures of intermediation and settlement (or not). If the *primary market* is non-domestic and the governing laws international, therefore we are in presence of an international bond.

The data from the BIS was used in the work of Benzie (1992) and in both empirical works of Cohen (2005) and Bobba *et al.* (2007). Nevertheless all of them preceded the adoption of the aforementioned BIS's definition for International Bonds. At that time, international bonds were those targeted to foreign investors.

It is important to understand that "as financial markets become more open to foreign issuers and investors, the boundaries between domestic and international securities markets become less clear" (IMF, ECB, and BIS, 2015) and that the BIS methodology – drawn from the *Handbook of International Statistics* – is far from being exact and clear. This methodology is drawn primarily from the External Debt Statistics (Task Force on Finance Statistics, 2013) developed by the IMF and other institutions – including the BIS – which aims to contribute with improvements to "help assess external vulnerabilities at a time when increasing international capital flows are resulting in greater market interdependence" and, therefore, not concerned with the strength of currencies outside their original boundaries. Finally, and more importantly, the way to distinguish an international issue from a domestic one "depends on the question of interest" (Wooldridge, 2012, p. 66).

2.5. Why the International Bond Market?

Empirical research on international currencies is often derived from the aggregated value of official currency reserves held by central banks (Chinn and Frankel, 2007, 2008; Eichengreen and Flandreau, 2008; Chinn, 2014; Eichengreen *et al.*,. 2014), focusing mainly on the international prominence of currencies as a store of value at the official level. On the other hand, international vehicle currencies – particularly, forex vehicle currencies – have been modelled theoretically (Swoboda, 1969; Krugman, 1980;

Black, 1991; Matsuyama *et al.*, 1993; Devereux and Shi, 2013), but there are scarce empirical evidence (Hartmann, 1998; Flandreau and Jobst, 2009, among the few). Regarding the unit of account function, examples of empirical evidence can be found in the works of Calvo and Vegh (1992) and Goldberg and Tille (2008).

Currency considerations derived from the denomination of international bonds can be found in the work of Cohen (2005), Bobba *et al.* (2007), Chitu and Eichengreen (2012) and Ito and Rodriguez (2015). Cohen (2005) tries to understand the determinants of aggregate issuance of international debt securities, using data from the BIS. Bobba *et al.* (2007), investigate the determinants of international currency choice in the context of the creation of the Euro. Chitu and Eichengreen (2012) investigate when the dollar surpassed the pound as the leading international currency using the bond market as a reference. Finally, Ito and Rodriguez (2015) use foreign-currency public debt to investigate the factors that drive the issuance of debt, with an emphasis not on the currencies' international strengthen but rather on the issuance country's idiosyncrasies that justify its reliance on foreign debt at the government level.

Despite economists' preference towards international official reserves as the main instrument to help us explain the relevance of international currencies, there are reasons to believe that other accountabilities should be explored to complement the analyses and results obtained through the study of the amount of central banks' official reserves.

By studying the international bond market, essentially we are studying two roles of a given currency. First, the use of a currency as an investment currency and therefore its capacity to be a leading *store of value*. Secondly, it measures the capacity of a currency to function as *unit of account*, allowing agents (both private and public) to quote debt in that currency. Moreover, as mentioned previously, with higher volume of debt in a given currency, it becomes more likely for a currency to emerge as a forex vehicle currency, contributing to the success of the currency as a *medium of exchange* in financial markets. Therefore, by studying the issuance of international bonds we are able to cover a wider perspective that encompass more than a single role and takes into account the private sphere of financial markets.

Additionally, other arguments unveil the importance of the bond market. Mehl *et al.* (2004) argue that "with increasing capital mobility, central bank reserve holdings and interventions are smaller in volume than private transactions in international financial

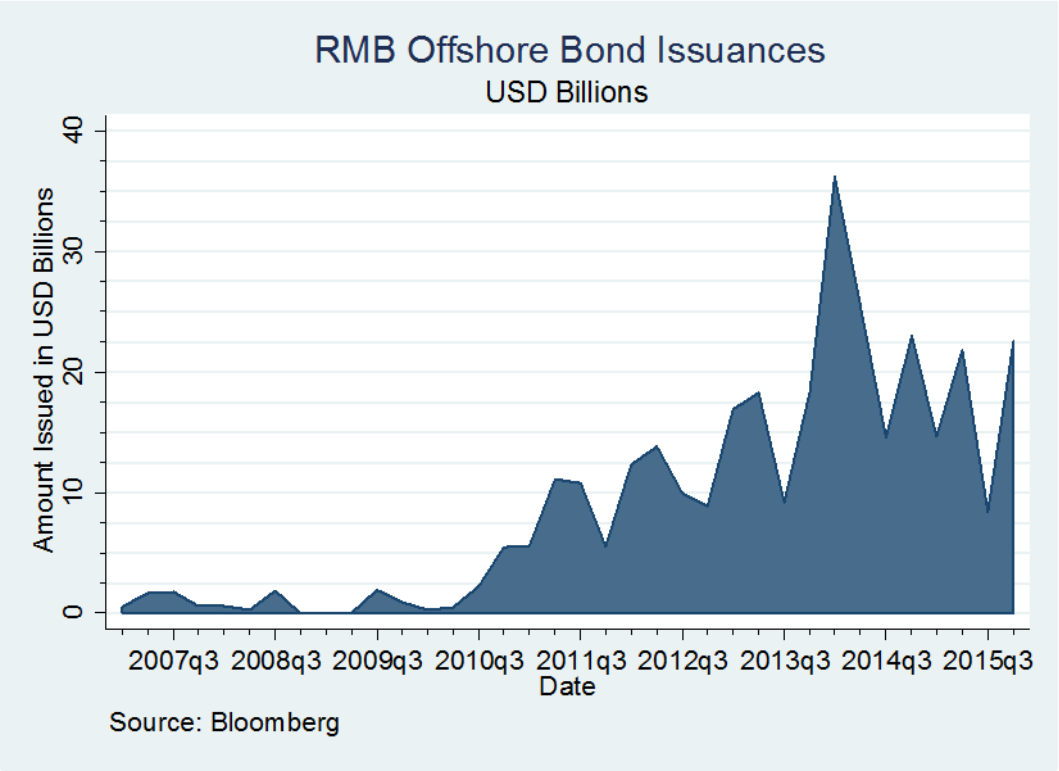
markets and are likely to have less bearing on a currency's international status", adding that bonds play an important role due to the size and volume of the market. Moreover, the majority of the foreign reserves held by central banks are foreign assets, namely bonds, because even though the main goal is to intervene in the exchange markets, central banks want to get some return meanwhile. Hence, they hold very liquid assets that give support to the exchange market interventions. As Ma and Yao (2015) state, "currency markets on their own are the largest financial markets, but currency trades typically involve bond purchases and sales. Thus what we mean by a liquid and actively traded currency is primarily one backed by a big and liquid bond market".

At the end of the XXth century, it was already set the idea that financial transactions were important and its magnitude contributed significantly to the definition of the IMS. Blinder (1996), conceived that, even though historically "the market's choice of an international reserve currency has followed the patterns of trade", in the modern world, financial considerations could became more relevant. Thus, at the end of the XXth century, the vast majority of international transactions stemmed from trade in assets rather than trade in goods (Blinder, 1996). This pattern did not change. It did not change the prominence of financial markets in international exchange nor the importance of international bond markets. The transition to an economy less dependent on banking as a source of finance is occurring slowly not only in developed countries but also in emerging markets, particularly in Latin America (Powell 2014; Turner 2014).

3. **Data and Methodology**

The dissertation covers the period after the internationalization of the CNY. Although the first issuance occurred in 2007, between the last quarter of 2008 and the third quarter of 2009 there was no issuances (see Figure 1). Therefore, our analysis starts in the third quarter of 2009, the date from which the CNY offshore bonds have been issued ever since. We collect data for the five currencies of the SDR for 26 quarters, with the sample ending in the last quarter of 2015. The data was extracted from the Bloomberg Terminal.

Figure 1: RMB Offshore Bond Issuances



Our main goal is to understand if the aforementioned macroeconomic determinants affect differently the currencies of interest and across different regions and, therefore, we estimate a system of equations with a Seemingly Unrelated Equations (SUR) developed in a first moment by Zellner (1962). The model is composed by 15 equations representing the different share of international bonds for each currency/region combination possible (*i*,*j*). The shares vary through time and are modelled as follows:

$$Debt\ Share_{ijt} = a_{ij} + \beta_{1ij} GDP\ Share_{it} + \beta_{2ij} Trade\ Share_{ijt} + \beta_{3ij} Stability_{it} + \beta_{4ij} Market\ Cap_{it} + \beta_{5ij} Spread_{it} + \beta_{6ij} FDI_{it} + u_{ijt}$$

$$i = CNY;\ EUR;\ GBP;\ JPY;\ USD$$
$$j = America; Europe;\ Asia, Ocenia\ and\ Africa$$
$$t = [2009Q3; \dots; 2015Q4]$$

Where Debt Share is the share of international bonds in currency *I* issued by agents in region *j* at time *t*, GDP Share is the share of the GDP of the currency *i*'s country at time t, Trade Share is the average bilateral trade share between the currency *i*'s country and the countries of the region *j* at time *t*, Stability is measured using two different variables

in different regressions: the average inflation rate of the quarter and currencies volatility against the SDR of the currency *i*'s country at time *t*, Market Cap is the market capitalization share of currency *i's* country at time *t* in world's total market capitalization, Spread is the difference between the interest rate of the benchmark government bond of currency *i*'s country and the US government yield with the same maturity, and FDI is the Foreign Direct Investment in each of the currency *i*'s local economy at time t. More details about all these variables are provided bellow.

The SUR model allows the errors to be correlated between different equations in the same period in time, that is, $E(u_{ijt}u_{klt}) \neq 0$. Since our dependent variable is measured in percentages, bounded between zero and one, and since increases in one share imply decreases in at least one of the remaining shares, the estimation method allows us to investigate the correlation and the relationship between the errors of the different shares, something we cannot do by using individual regressions nor with panel data methods. Additionally, since the dependent variable is bounded between zero and one, we apply a logarithmic transformation which allows us to use standard linear regression methods, in line with Chinn and Frankel (2008) and Bobba *et al* (2007). Hence, the new dependent variable is now $log(\frac{Debt\ Share_{ijt}}{1-Debt\ Share_{ijt}})$. We test different specifications of the model, making use of two different measures of the size of the economy and two measures of stability in a currency.

A. Dependent Variable

As mentioned previously, the dependent variable used to study the international role of currencies is the share of international bonds issued in a given currency. The definition we intend to use is closely related with the one used by the BIS. We use Bloomberg as a platform to help us differentiate international bonds from domestic ones. There are few tools we can take advantage of to better discriminate between the two forms of debt. First, we will make use of the Bloomberg Field "*Market Type*" which allows us to understand if the market is *Domestic* (e.g. Domestic, Domestic MTN, US Domestic, etc.) or *International* (e.g. Euro MTN, Euro Non-Dollar, Global, etc.). Secondly, we use the field "*Exchange Code"* to understand if the bond was issued through a *Domestic Exchange* or not, when compared with the country of the currency of issuance. Therefore all bonds with a Market Type *International* and issued through *Non-Domestic Exchanges* are considered as international. Additionally, we include issues from non-

domestic agents which present an "International" Market Type and a domestic Exchange Code, in relation with the currency of issuance. Since the focus of the dissertation is on the currencies, we decided to include this second group of issuances which, although placed in multiple exchanges included domestic ones, are issued by non-residents. The focus is not on the relation between issuer *country vs. market of issuance* but rather between *currency vs. issuer* and *currency vs. market of issuance*.

The amount of international currencies has been collected from Bloomberg using the function SRCH, which allows downloading data about bonds. We have selected all asset classes (government and corporate) and all the securities (outstanding and matured). After that we filtered by "Market Type" and selected the bonds that presented the following market type: *Euro-MTN*, *Euro Non-Dollar*, *Euro-Dollar*, *Global*, *Bulldog*[5], *Samurai*[6], *Shogun*[7], *Yankee*[8] or *US Non-Dollar*. The full list of subfields can be found in Annex 1.

Then, two different filters were applied in order to collect all bonds considered as *international* (*Eurobonds* or *Foreign Bonds*): (1) Bonds in a given currency exchanged through markets other than those of the currency's country issued by all agents[9]; (2) Bonds in a given currency exchanged through the exchanges of the currency's country and issued by non-domestic agents[10]. The full list of domestic exchanges for each currency can be found in Annex 2.

Examples of the first filter are euro-denominated bonds issued through an American exchange by a German entity or a euro-denominated bonds issued through an American exchange by an American firm. Both counting as International Bonds denominated in euros. Examples of the second filter are euro-denominated bonds issued in a European exchange by an American or a Japanese firm, whereas euro-denominated bonds issued by European agents through a European exchange are not considered as international bonds.

After this selection process, which is done individually for each currency presented in the study, we run the command *results* on Bloomberg.

[5] Pound-denominated bond issued in the United Kingdom by non-British institutions
[6] Yen-denominated bond issued in Tokyo by non-Japanese entities.
[7] Foreign-currency bonds issued in Japan by non-Japanese entities.
[8] Dollar-denominated bonds issued in US by non-American entities
[9] Presented in the next section of this dissertation as the bonds issued "out".
[10] Presented in the next section of this dissertation as the bonds issued "in".

Then we use tab *matrix*, available on Bloomberg, to adjust the results to our goals and export them to excel. The tab *matrix* shows us a matrix with the date in the first column, allowing the remaining columns to be defined based on the user's preferences – constrained to the Bloomberg fields available, e.g. exchange code; issuer country, industry, etc. These columns will be important, since it allows us to segregate the amount issued per country.

Each of the cells of the matrix present the amount issued or outstanding in the respective period.

We choose the quarterly time length, we use the *Ultimate Parent Country of Risk* as the Bloomberg field to define each of the columns of our matrix and we measured the amount issued (not the outstanding) converted to USD using the exchange rate of the period. The *Ultimate Parent Country of Risk* field returns the country of the ultimate parent company that issued the bond[11]. We choose the ultimate parent in detriment of the issuer's country since in a considerable number of cases, the issuer is a Special Vehicle Purpose (SPV) created only with a purpose of issuing debt and incorporated in offshore countries. By choosing the ultimate parent company we avoid considering the country of the SPVs in our sample. An example of the structure of the Excel output obtained through the matrix tab can be found in Annex 5

In order to produce a share, we take into account all international bonds issued by issuers from a specific region regardless the currency of issuance:

$$Debt\ Share_{ijt} = \frac{Debt_{ijt}}{\sum_{i=1}^{N} Debt_{ijt}}$$

$$i = CNY;\ EUR;\ GBP;\ JPY;\ USD$$
$$j = America; Europe;\ Asia, Ocenia\ and\ Africa$$
$$t = [2009Q3; \dots; 2015Q4]$$

Where Debt is the amount issued. The full list of currencies that were used can be found in Annex 4.

B. Independent Variables

[11] Throughout the dissertation, when we mention issuer, it is the Ultimate Parent Company of issuance that we are mentioning.

Next, we describe each of the independent variables used in the model. The full list of the variables and its details can be found in Annex 5.

1. GDP Share

In order to measure the size of the economy of the currency's country we constructed the GDP share on the G20 total GDP[12]of each of the five economies under study. The GDP share of each country is the quarterly real GDP value in USD, with 2010 as the base year. All time series with a different base year were transformed using the OECD deflator. All time series denominated in other currencies were transformed into dollars using the average annual exchange rate of the given currency against the dollar in the base year. The full detailed list of the GDP variables used can be found in Annex 6.

2. Bilateral Trade Share

The trade share is also conceived by Chinn and Frankel (2008) as a measure of the size of the economy. Therefore, in line with Bobba *et al.* (2007), we intend to capture a third dimension by introducing a bilateral trade share between the currency's country and the region of the issuer. In Bobba *et al.* (2007) they use country-level data to produce bilateral trade shares. In our case we produce regions instead of country level data, since our quarterly data at a country-level presented a considerable portion of zeros for the CNY. Hence, in order to avoid this issue, we built 3 regions: Europe, America and Asia, Oceania and Africa. The regions represent the total amount of issues from countries that belong to that specific region. The countries that are included in each region can be found in Annex 6 (naturally they differ across currencies).

The data was collected from the bilateral trade historical series database developed by the research center CEPII. We take the average bilateral share of all the countries that composes the respective regions in each currency:

$$Bilateral\ Trade\ Region_t = \frac{\sum_{i=1}^{n} Bilateral\ Trade\ Share\ Country_{it}}{Number\ Countries}$$

Additionally, since the data is annual, we use the value obtained for the last quarter of the year and we interpolate linearly for the remaining quarters. Following Bobba *et al.* (2007), we use lagged trade in order to avoid reverse-causality.

[12] The G20 total GDP sums the Real GDP of all the G20 countries except Saudi Arabia, due to lack of data.

3. Inflation Rate

We use currency *i*'s country seasonally adjusted monthly year-on-year inflation rate data. Then we compute the average inflation value of the quarter using the monthly data[13]. The last observation of the quarter was also tested in detriment of the averaged value. Data for the UK and China were seasonally adjusted using Eviews. Final remark, the inflation rate for the currency *i*'s country do not vary with region.

4. Volatility Against the SDR

We collect data for the volatility against the SDR basket using the IMF International Financial Statistics. We use the monthly exchange rates of each currency against the SDR from which we calculate the standard deviation of the quarter.

5. Market Capitalization

We use market capitalization data produced by Bloomberg to create shares for each of the currency *i*'s country. As a denominator, we use world market capitalization also produced by Bloomberg. To the Eurozone, we compute the sum of the market capitalization of each of the nineteen countries of the Euro Area.

6. Spread

In order to analyse borrowing costs, we use 5-year government bond yields of each of the currencies' country and compute their differences against US Government Bonds. In the case of the USD, the spread between the German Bonds and US Government Bonds is used.

7. FDI

We decided to use a variable that could enable us to test the existence of hedging motives at an aggregate level. We decided to include the foreign direct investment growth in the currency's country. We seasonally adjusted all the data using Eviews.

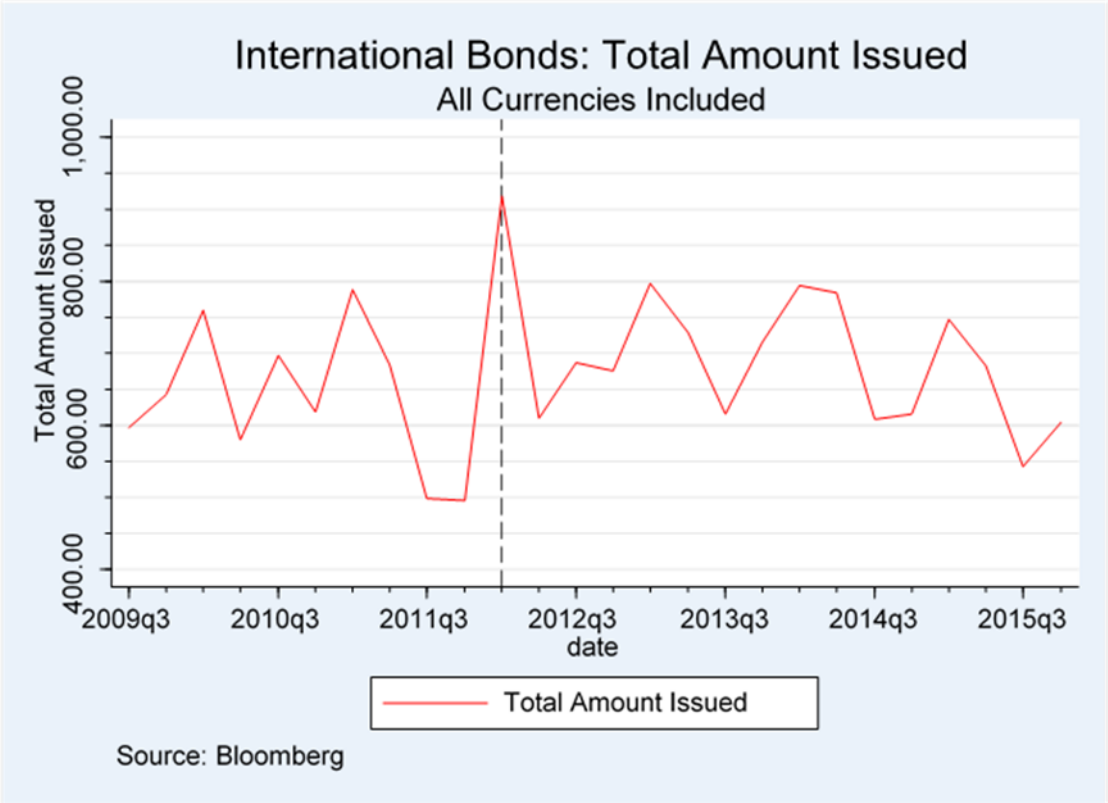
[13] We tested models with both averaged value and using the last observation of the quarter and the results were identical without any significant difference. Since the R-Squared were higher in models with the first, we kept the averaged value.

4. The Evolution of International Bonds after the Internationalization of the Renminbi

In this section we describe the evolution of the share and amount of international bonds for the five currencies of the SDR Basket. The analysis starts with an overall look into the dynamic of the aggregate amount of international bonds issued and, in a second moment, derives a deeper descriptive analysis by segregating the amount issued *per* region.

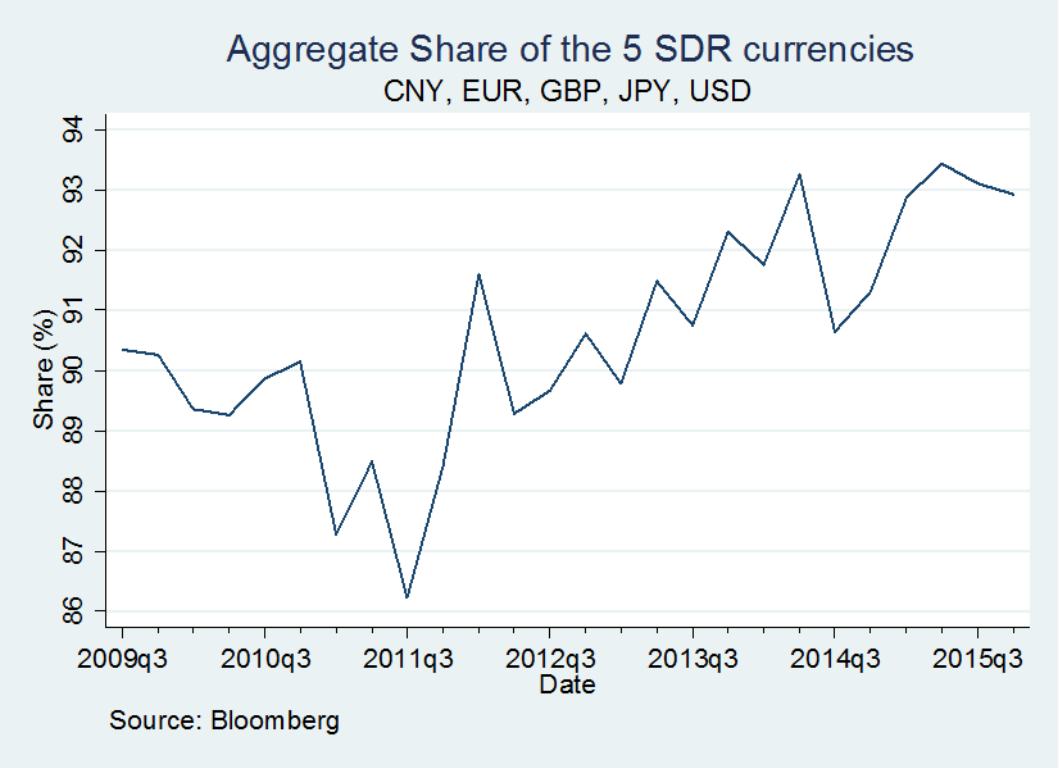
Between the third quarter of 2009 and the last quarter of 2015, the total amount of international bonds issued averaged $672.2675 Billion USD *per* quarter. It reached a maximum of $918.0832 Billion USD in the first quarter of 2012, right after the two quarters with the lowest amount of international securities issued: the third quarter of 2011 and the minimum in the last quarter of 2011 ($495.655 Billion USD) – see Figure 2. Figure 2 aggregates the total amount of international bonds issued for all the currencies available on Bloomberg. The complete list of currencies can be found in Annex 3.

Figure 2: Total Amount of International Bonds



The dominance of the five currencies of the SDR in the international scene is evident. The majority of international bonds are issued in one of the 5 currencies under study. Altogether, between the third quarter of 2009 and the end of 2015, the five currencies of the SDR basket always represented more than 86% of the total of international issuances – see Figure 3 –, reaching a maximum of 93.44% of the amount issued in the second quarter of 2015. On average, during this period, 90.55% of the amount issued was denominated in one of these currencies.

Figure 3: Aggregate Share of the 5 SDR Currencies



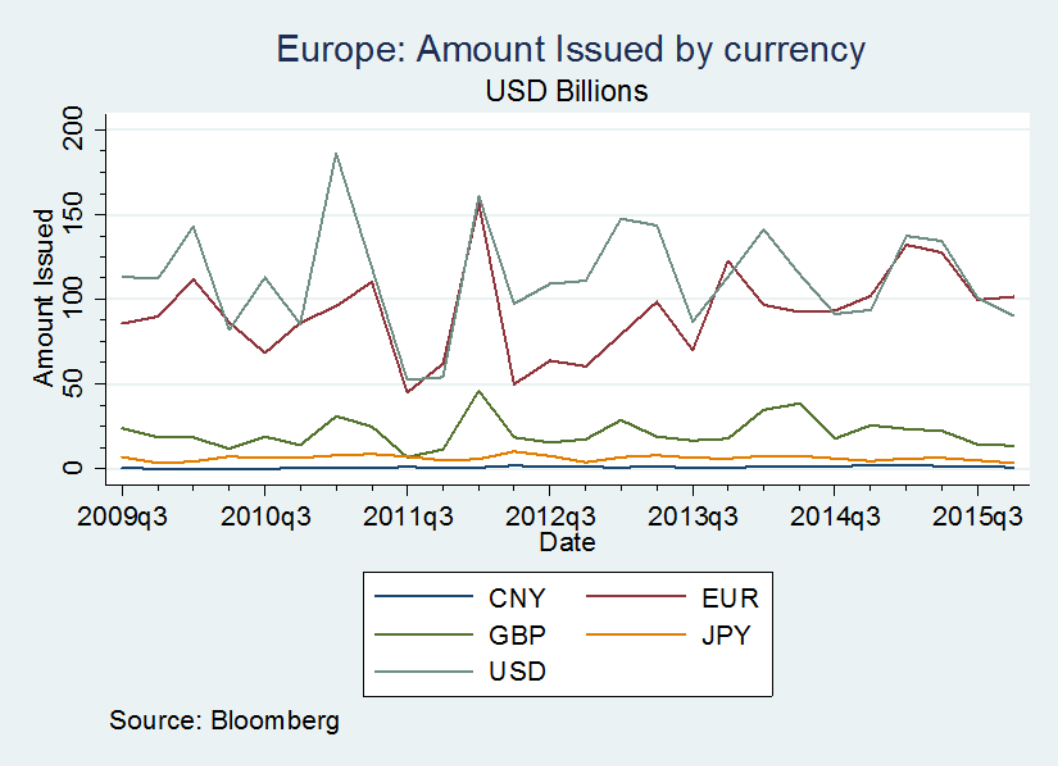
Despite the dominance of the five currencies of the SDR, the extent of their dominance differs depending on the location of the issuer agent. Based on the ultimate parent country of risk, we consider three geographic areas: (i) Europe, (ii) Asia & Oceania & Africa and (iii) America[14].

[14] Including North, Central, and South America

1. *Europe*

Among European agents, the Dollar and the Euro were the two main currencies of issuance. During the period under study, the average amount issued *per* quarter was $112.80 Billion and $91.81 Billion, for the Dollar and Euro, respectively (see figure 4).

Figure 4: Amount Issued by Currency from European Agents



Three interesting data points need to be mentioned. In the first quarter of 2011, with the sovereign crisis undergoing, there was a need for European Agents to search for financing sources in USD. The amount issued increased more than 100 USD Billion from 85.35 USD Billions to 186.289 USD Billions. The increased amount was mainly issued outside the Eurozone (see figure 7, left graph). Similarly, in the first quarter of 2012, during the sovereign crisis, there was a sharp increase in the amount issued by European Agents, although this time both EUR and USD denominated issuances surged – a similar movement occurred in the GBP amount. Finally, despite the upturn in the beginning of 2015, the indirect impact of the QE actions promoted by the ECB over the international bond market seem to have been reduced. In particular, when compared with the two data points mentioned previously.

It is possible to see that the euro and the dollar together always represented more than 80% of the issuances among European agents (see figure 5). Consequently, the issuances in the other three currencies of the SDR Basket are of a reduced number among European agents. Of the three remaining currencies, only the GBP represented more than 10% of the issuance during the period under study (and solely for two consecutive quarters). The pound, the yen, and the Renminbi averaged 8.88%, 2.87%, and 0.38%, respectively (figure 6).

Figure 5: EUR and USD Percentage among European Agents

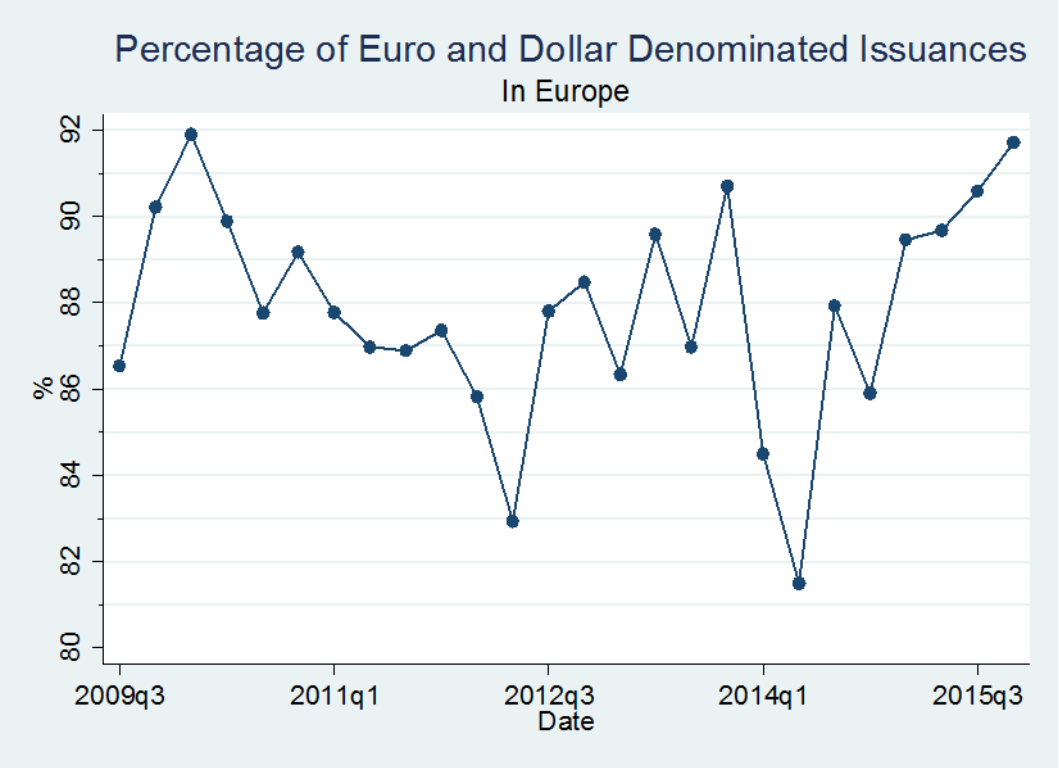
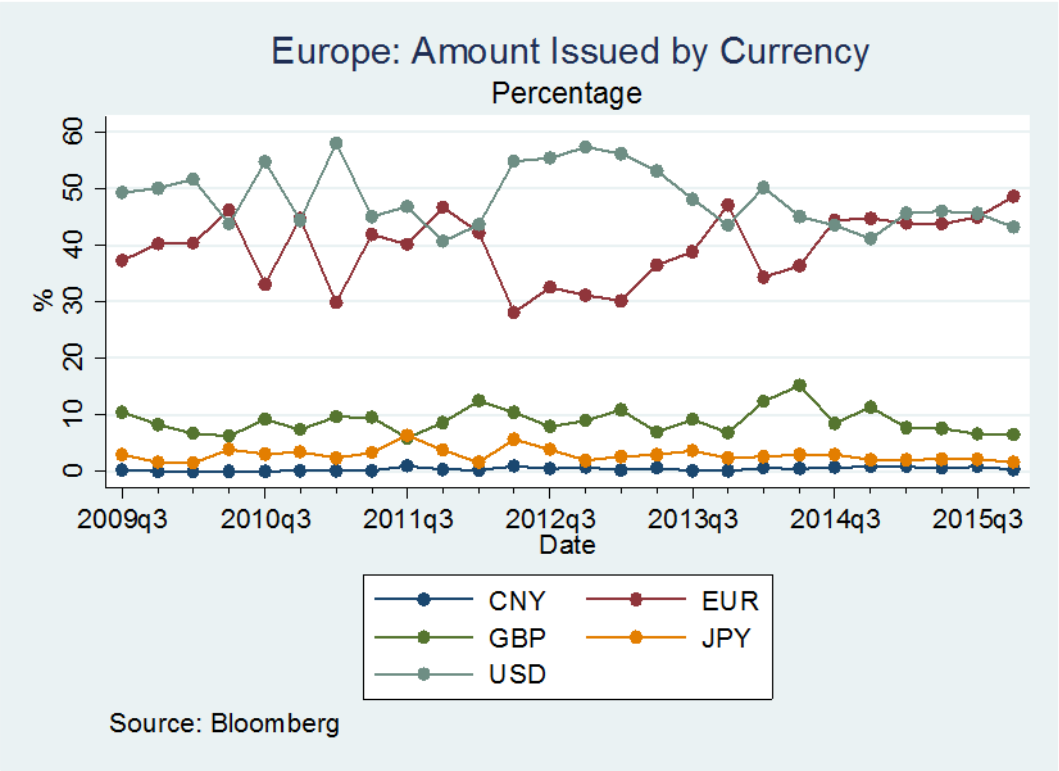
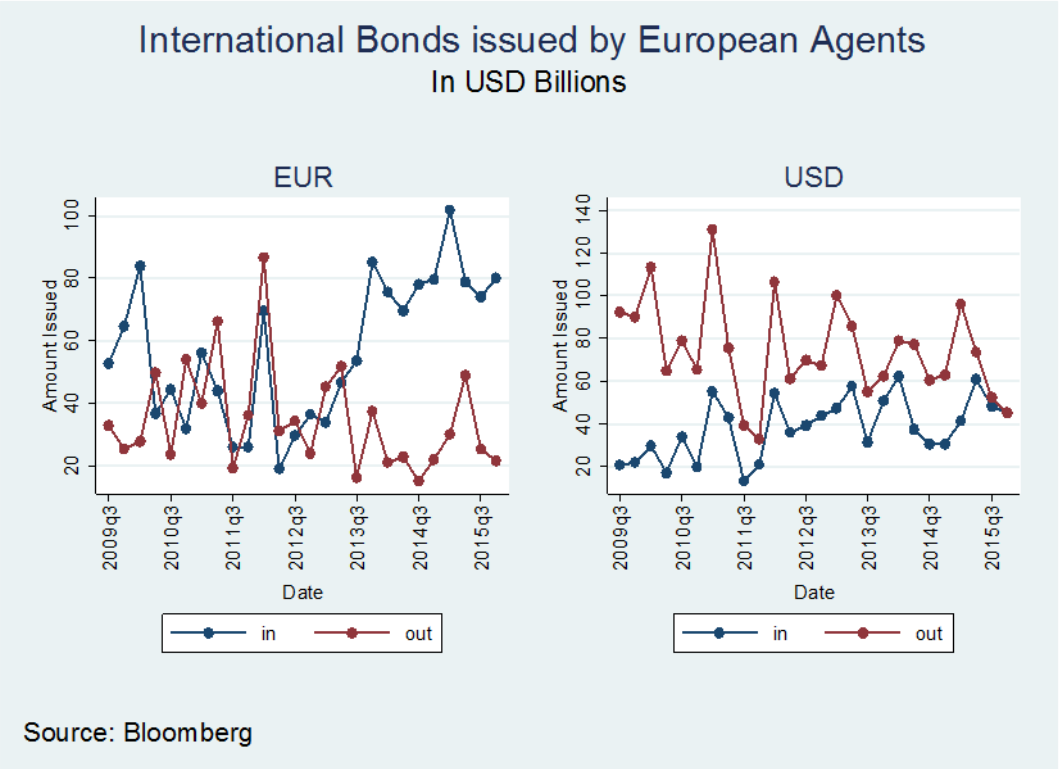


Figure 6: Percentage of the Amount Issued for European Agents



Notably, the dollar overwhelmed the euro, on average, during the period under study. However, the euro denominated bonds show an upward trend since the second quarter of 2012 that helped to close the gap between the euro and the dollar and enable the euro to end 2015 as the first rank currency among European agents. This upward trend was obtained due to the increase in the amount of euro-denominated bonds listed in exchanges inside the euro-zone (see figure 7, left graph). Hence, more than showing the recovery of the euro against the dollar as an international currency among European agents, these international bonds issued by agents from outside the Eurozone also reveal that the Euro-area is being more widely used as an international financial centre.

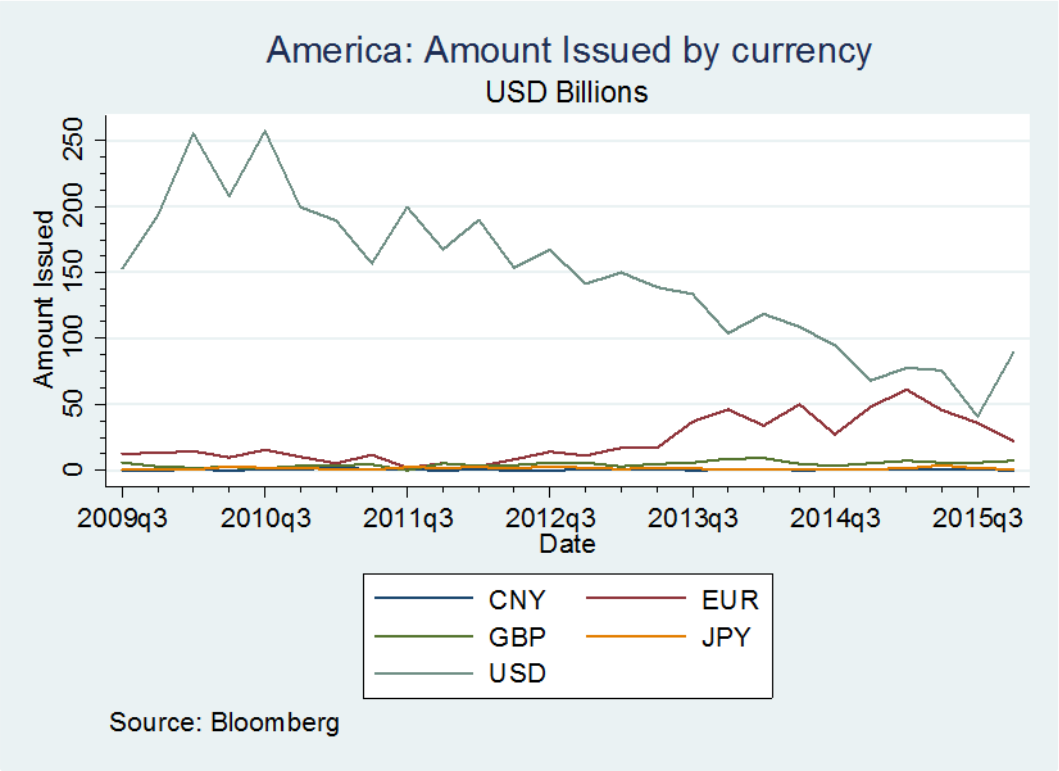
Figure 7: EUR/USD Comparison among European Agents



2. *America*

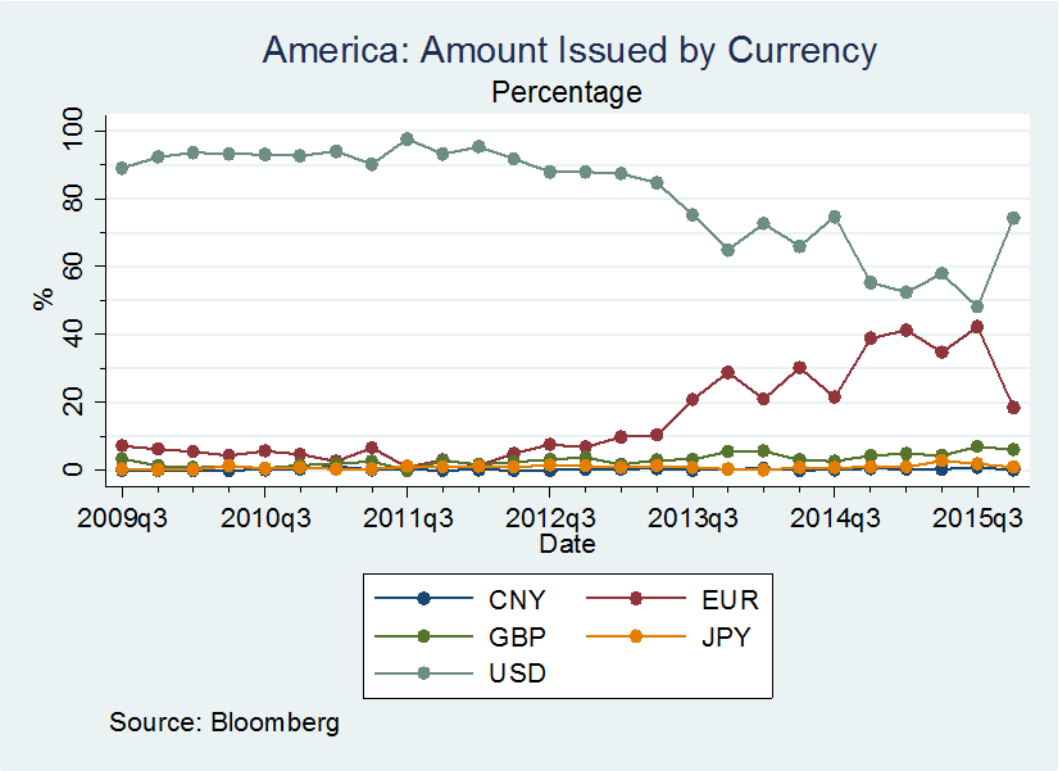
If we look only for international bonds issued by American agents, we can conclude that the dollar remains the main currency despite the constant downward trend that started in 2010 (see figure 8). On average, the agents from countries of the North, Central, and Latin America issued $147.46 Billion of dollar-denominated international bonds. It represented more than 80% of the issuances of international bonds from American agents until the second quarter of 2013, falling sharply afterward and reaching a minimum of 48.12% in the third quarter of 2015.

Figure 8: Amount issued by Agents from America



The decrease in the share of the dollar is justified by the increase in the share of euro-denominated international bonds among American issuers. If we take into account all the period under study, the second most important international currency among American issuers averaged $22.23 Billion *per* quarter in issuances. On the other hand, between the second quarter of 2013 and the last quarter of 2015, the average amount of euro-denominated international bonds was $38.60 Billion whereas the average value of the dollar falls drastically to $95.54 Billion. The euro share of international issuances among American agents reached a maximum of 42.29% in the third quarter of 2015, falling sharply again in the last quarter of 2015 (see figure 9).

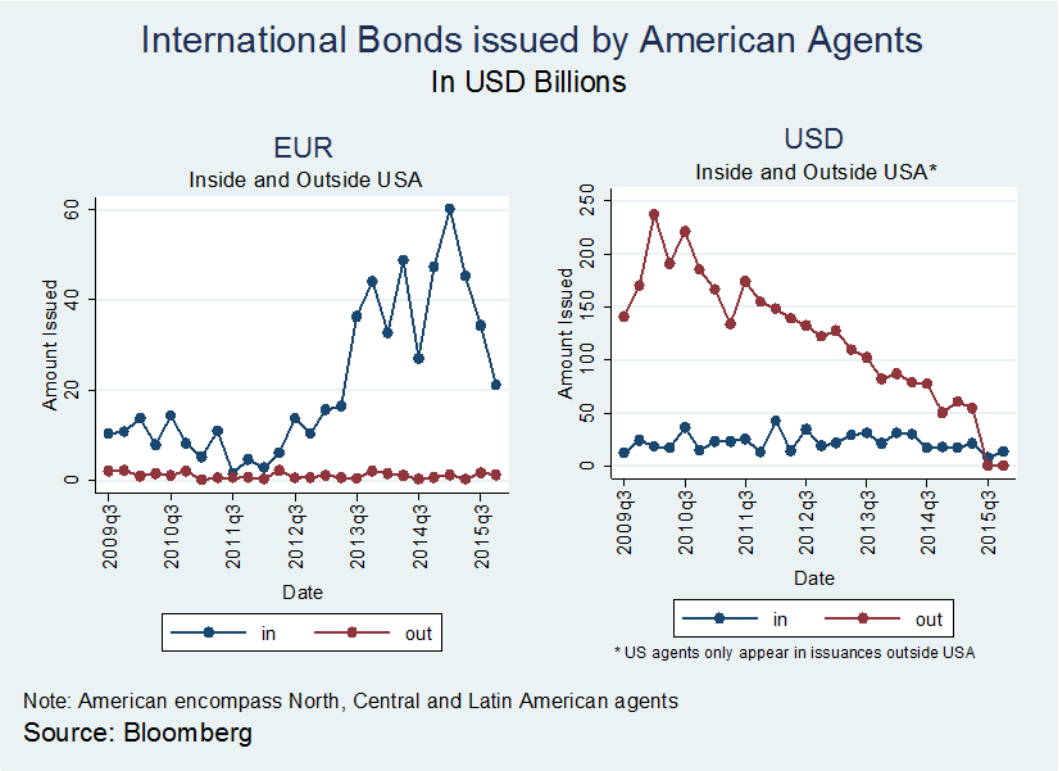
Figure 9: Percentage of the Amount issued by Agents from America



It is also possible to observe that the sharp increase in the issued amount of euro-denominated international bonds by American agents occurred due to an increase in the issuances inside the euro-area, while the issuances in exchanges outside the euro-area maintained a stable pattern (see figure 10, left graph). On the other hand, the decrease in the issuances of dollar-denominated bonds among American agents happened as a result of the continuous decline of the international bonds issued outside the United States of America (see figure 10, graph on the right). Thus, it is possible to conclude that American agents are issuing less dollar-denominated international bonds outside USA and issuing more euro-denominated international bonds through euro-area exchanges.

Among the American agents the other three currencies of the SDR basket represent a tiny share of the total of international bonds issued. On average, between 2009 and 2015, the British pound, the Japanese yen, and the Chinese Renminbi represented together only 4.1% of the issuances.

Figure 10: EUR/USD Comparison among Agents from America



3. *Asia & Oceania & Africa*

The majority of the international debt issued by agents from Asia, Oceania, and Africa is dollar-denominated (see figure 11 and 12). The share of the dollar-denominated international bonds averaged 74.65% of the total issuances by agents from these regions. The average amount of dollar-denominated bonds during this period was $79.59 Billion and, although it registered a slight upward trend between 2009 and 2015, its share decreased. The decrease in the overall shared occurred mainly due to the emergence of Renminbi-denominated international bonds. Although the amount of Renminbi-denominated bonds is still reduced when compared with the dollar, two interesting facts are worth mentioning. First, the Chinese currency was able to be the currency with the second largest share of international bonds issued by agents from Asia, Oceania, and Africa, surpassing the euro in 14 periods out of the 26 (see figure 13). Second, the share of Renminbi-denominated bonds reached 22.97% of the issuances of agents of this region in the first quarter of 2014 and averaged 9.18%, while

the euro-denominated securities represented 9.58% on average between 2009 and 2015, only 0.4% more on average than issues in Renminbi.

Figure 11: Amount issued by Agents from Asia, Oceania and Africa

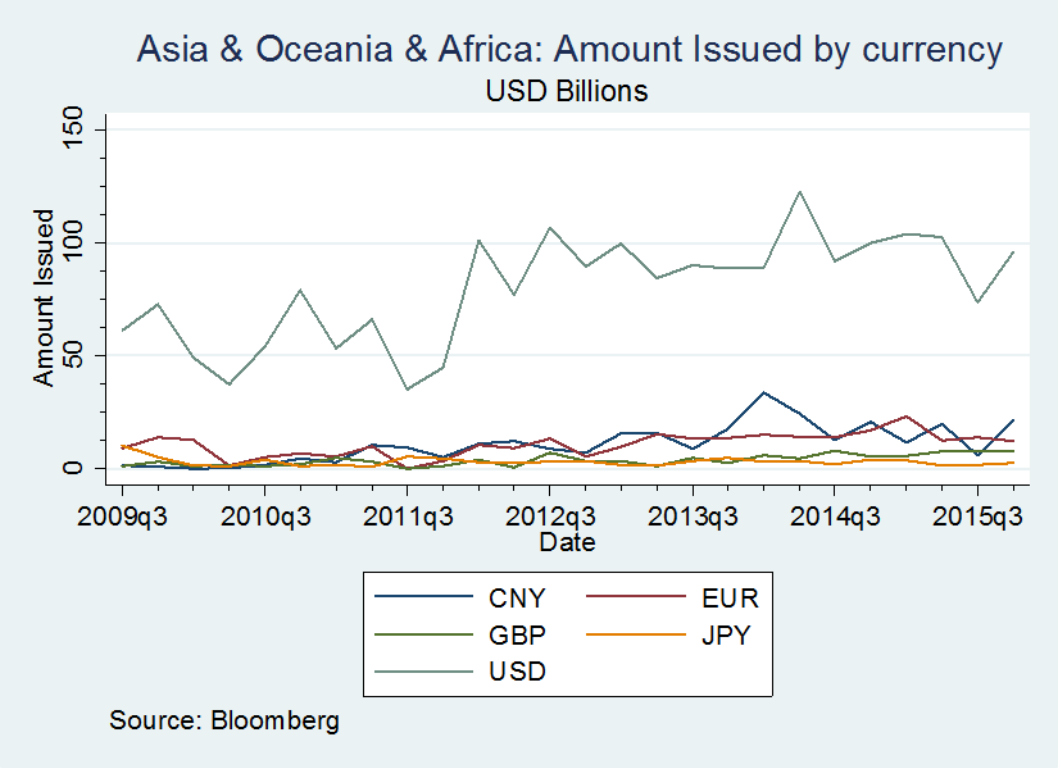


Figure 12: Percentage of the Amount Issued by Agents from Asia, Oceania and Africa

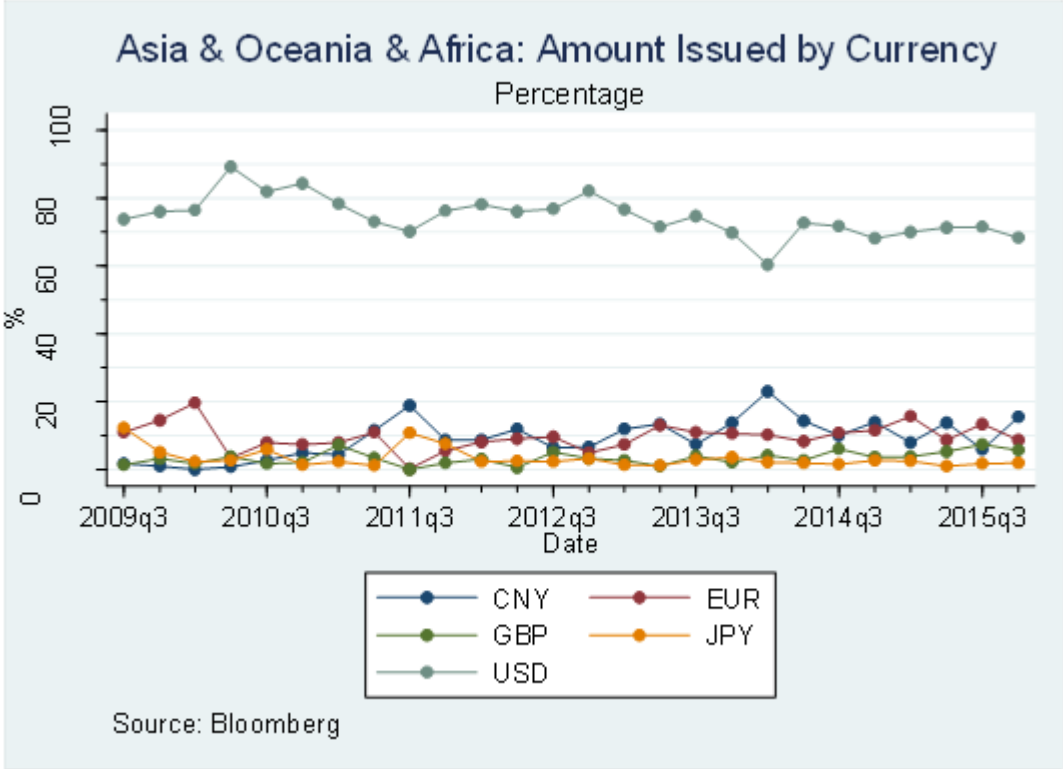
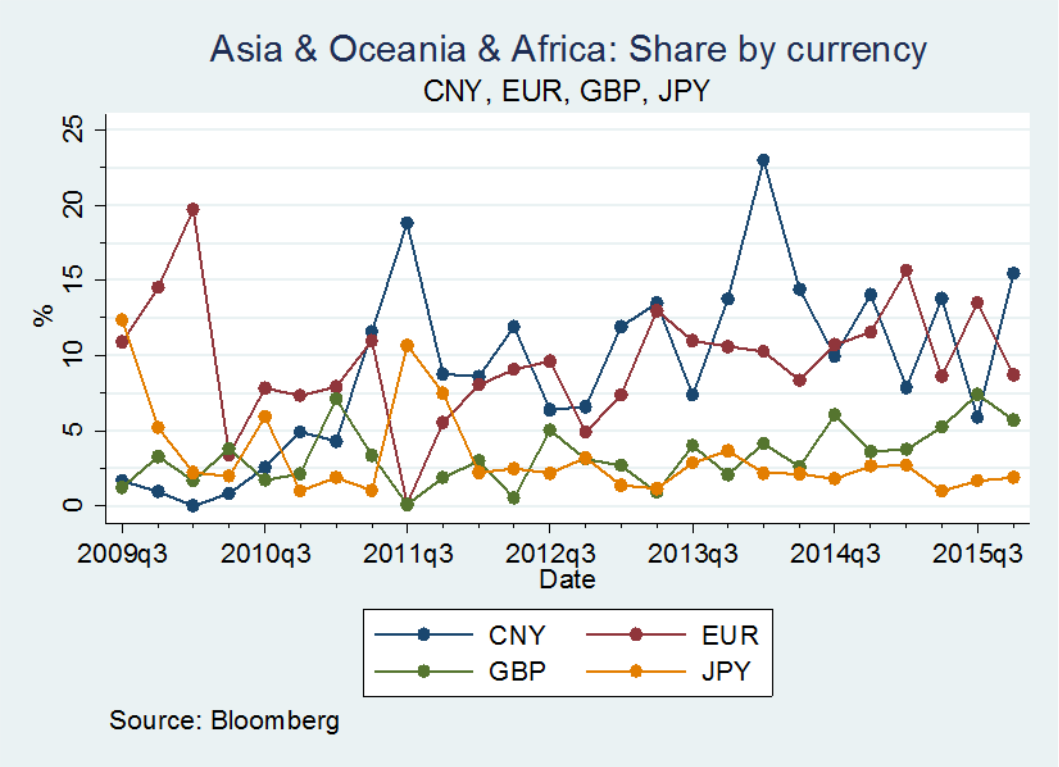


Figure 13: Percentage of the Amount Issued by Agents from Asia, Oceania and Africa, except the USD



5. Empirical Results

In this section we present the results derived from the SUR Model. Although in the first moment, our goal was to produce a unique SUR Model to model the shares of international bonds per currency and across regions, we were forced to take another path and take two specifications. The two measures of the size of the economy, the GDP share and the Bilateral Trade Share, present high levels of correlation for some currencies (see Table 1). In order to avoid problems with multicollinearity, we compute two different specifications, one with the GDP share and the other one with the bilateral trade share as a covariate for all equations but maintaining the two in those equations where the correlation is less than 0.8, in absolute value.

Table 1: Correlation between GDP Share and Bilateral Trade Share

	***i* = CNY**	***i* = EUR**	***i* = GBP**	***i* = JPY**	***i* = USD**
	GDP Share currency *CNY*	GDP Share currency *EUR*	GDP Share currency *GBP*	GDP Share currency *JPY*	GDP Share currency *USD*
Currency *i* Bilateral Trade Share - Europe (t-1)	**0.9691**	**0.8199**	0.4888	0.5535	-0.4725
Currency *i* Bilateral Trade Share - America (t-1)	**0.9483**	**0.9652**	0.6804	0.4728	0.6592
Currency *i* Bilateral Trade Share - Asia, Oceania and Africa (t-1)	**0.9904**	**0.9759**	**0.9040**	0.5886	**0.8561**

Tables 2 and 3 estimation was adjusted for small samples using *STATA* options that report small sample statistics and the estimated covariance of the disturbances.

Table 2 presents the results when considering the GDP share for all equations as a measure of the size of the economy. The Market Capitalization shares and the FDI are not statistically significant and therefore dropped from the estimated model. Furthermore, the specification takes inflation as a variable for stability, since volatility against the SDR appears to be not statistically significant.

Table 2: SUR Model 1 - Share of International Debt with GDP Share

Variables	CNY - America	CNY – Europe	CNY - Asia, Oceania and Africa	EUR - America	EUR - Europe	EUR - Asia, Oceania and Africa	GBP - America	GBP - Europe	GBP - Asia, Oceania and Africa	JPY - America	JPY - Europe	JPY - Asia, Oceania and Africa	USD - America	USD - Europe	USD - Asia, Oceania and Africa
GDP Share	**163.9*** **	**120.1*** **	**65.25*** **	**-119.0*** **	**26.87*** **	-36.91	**-1,250*** **	-123.8	216.0	**-116.9*** **	**51.75** **	**161.2*** **	**105.7*** **	**-18.65***	**64.76*** **
	(42.27)	(19.52)	(8.662)	(18.03)	(8.890)	(33.84)	(373.1)	(110.1)	(345.0)	(27.08)	(20.82)	(27.75)	(26.99)	(10.13)	(16.56)
Bilateral Trade (t-1)							**445.5*** **	**-81.41** **		-241.4	392.7	**-157.8** **	8.713	10.32	
							(154.2)	(34.23)		(158.1)	(275.5)	(75.77)	(31.77)	(24.53)	
Inflation	**0.964*** **	**0.480*** **	**0.266*** **	**-0.981*** **	0.0412	**-0.461** **	**-0.486*** **	**0.0907** **	**-0.250***	**-0.168*** **	**0.139*** **	**0.117***	**0.407*** **	**-0.101*** **	-0.0346
	(0.266)	(0.124)	(0.0535)	(0.0999)	(0.0420)	(0.196)	(0.131)	(0.0406)	(0.143)	(0.0639)	(0.0454)	(0.0633)	(0.0637)	(0.0221)	(0.0494)
Spread	-0.494	**0.924*** **	**0.529*** **	**0.919*** **	**-0.439*** **	**0.705***	0.809	-0.151	-0.107	**0.520*** **	**0.235** **	**0.657*** **	**-0.554*** **	**-0.264*** **	**-0.162***
	(0.579)	(0.263)	(0.105)	(0.246)	(0.114)	(0.365)	(0.565)	(0.218)	(0.791)	(0.177)	(0.115)	(0.207)	(0.153)	(0.0605)	(0.0910)
Dummy Quarter 2											**0.491*** **				
											(0.113)				
Dummy Quarter 3											**0.480*** **	**0.399*** **			
											(0.101)	(0.135)			
Constant	**-28.04*** **	**-23.46*** **	**-11.94*** **	**21.76*** **	**-5.721*** **	5.454	**45.09*** **	4.775	-11.70	**10.79*** **	**-11.07*** **	**-12.40*** **	**-26.04*** **	**4.634***	**-15.05*** **
	(4.923)	(2.285)	(1.031)	(3.498)	(1.706)	(6.404)	(14.78)	(4.120)	(13.86)	(3.327)	(2.299)	(2.841)	(6.887)	(2.759)	(4.211)
Observations	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
R-squared	0.318	0.782	0.815	0.888	0.308	0.169	0.419	0.156	0.242	0.452	0.604	0.454	0.842	0.368	0.511

Standard errors in parentheses
*** p<0.01,
** p<0.05,
* p<0.1
Non-Significant F-Test

Note: Obtained using STATA command sureg <varlist>, small dfk corr

Table 3: SUR Model 2 - Share of International Debt with Bilateral Trade Share

Variables	CNY – America	CNY – Europe	CNY - Asia, Oceania and Africa	EUR - America	EUR – Europe	EUR - Asia, Oceania and Africa	GBP - America	GBP - Europe	GBP - Asia, Oceania and Africa	JPY - America	JPY - Europe	JPY - Asia, Oceania and Africa	USD - America	USD - Europe	USD - Asia, Oceania and Africa
GDP Share							**-1,010*** **	-111.0		**-128.6*** **	**48.28*** **	**122.4*** **	**93.20*** **	-5.515	
							(307.0)	(111.6)		(20.12)	(18.39)	(32.52)	(25.41)	(12.12)	
Bilateral Trade (t-1)	**556.2***	**396.9*** **	**57.26*** **	**-61.94*** **	4.216	31.48	136.3	**-100.6** **	-22.26	**-207.8***	**594.3*** **	-45.09	-1.081	-11.58	**36.49***
	(323.8)	(87.17)	(8.781)	(14.99)	(9.951)	(27.70)	(180.6)	(43.00)	(75.45)	(121.2)	(226.0)	(77.12)	(28.39)	(28.80)	(20.94)
Inflation	**0.618** **	**0.473*** **	**0.245*** **	**-0.600*** **	**-0.0870***	-0.0290	**-0.392*** **	0.0355	**-0.365** **	**-0.169*** **	**0.158*** **	0.0748	**0.262*** **	**-0.0843*** **	-0.0942
	(0.271)	(0.126)	(0.0426)	(0.0815)	(0.0506)	(0.174)	(0.141)	(0.0439)	(0.144)	(0.0481)	(0.0412)	(0.0761)	(0.0578)	(0.0290)	(0.0600)
Spread	0.0110	**0.960*** **	**0.595*** **	**-0.393***	-0.0229	**-0.633** **	-0.0932	0.257	0.723	**0.673*** **	0.0926	0.120	**-0.906*** **	**-0.214*** **	**-0.309*** **
	(0.811)	(0.310)	(0.104)	(0.206)	(0.108)	(0.267)	(0.624)	(0.273)	(0.744)	(0.137)	(0.109)	(0.217)	(0.166)	(0.0750)	(0.107)
Dummy Quarter 2											**0.494*** **				
											(0.0773)				
Dummy Quarter 3											**0.449*** **	**0.460*** **			
											(0.0621)	(0.156)			
Constant	**-24.20*** **	**-16.45*** **	**-9.260*** **	0.867	-1.064	**-4.510*** **	**37.06*** **	4.905	**-2.548*** **	**11.44*** **	**-12.36*** **	**-13.32*** **	**-21.60*** **	1.937	-0.123
	(8.399)	(1.484)	(0.728)	(0.695)	(1.826)	(1.602)	(12.10)	(4.103)	(0.793)	(2.895)	(2.023)	(3.154)	(6.302)	(3.307)	(0.945)
Observations	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
R-squared	0.234	0.670	0.856	0.873	0.197	0.186	0.454	0.198	0.263	0.456	0.524	0.336	0.865	0.210	0.377

Standard errors in parentheses
*** p<0.01,
** p<0.05,
* p<0.1
Non-Significant F-Test

Note: Obtained using STATA command sureg <varlist>, small dfk corr

Table 3 presents the results using the Bilateral Trade Share for all equations as a measure of the size of the economy. Similarly, the variables Market Capitalization, FDI and Volatility against the SDR presented non-significant statistical results.

We also included seasonal time dummies, in order to understand if the shares of the international bonds are influenced by seasonality. Only the JPY presented significant seasonal dummies in which the share of international bonds in Europe and Asia, Oceania and Africa increases in quarters 2 and 3. Additionally, we tested dummies for the first quarter of 2011 and 2012 for issuances from European Agents for all the five currencies under study, since the graphs presented spikes at those dates that justify their existence in the model. However, none of the dummies ended up being statistically significant. Finally, we tested for the existence of a time trend, but the results again were not statistically significant.

The first important result is that we reject the null hypothesis of no contemporaneous cross-equation correlations between errors. For instance, the USD and the EUR, the two main currencies at an international level, present residuals that are negatively correlated, especially among European and American issuers. The share of international bonds in EUR and in USD display a residual correlation of -0.7052 (Model 1) and -0.7879 (Model 2) among American issuers. Similarly, among European issuers, the correlation of the residuals is -0.8678 (Model 1) and -0.862 (Model 2). These results demonstrate and justify the pertinence of using a Seemingly Unrelated Equations model (see Annex 1 for the full matrix of correlation).

Additionally, the results indicate the existence of heterogeneity across coefficients. In both specifications, the estimated impact of the explanatory variables across currency shares differ. Moreover, in some situations, when we analyse different regions for the same currency, we observe that the estimated impact of explanatory variables also differ. The pairwise heterogeneity of the coefficients was tested using a standard F-type test – see annex 7.

We decided to discuss the results by analysing separately the most relevant features of each macroeconomic determinant in the model. The R-squared vary from 0.15 to 0.88 in model 1 and from 0.19 to 0.89 in model 2. The models perform worst, in terms of fit, in the case of the GBP. Moreover, the GBP presents one equation (Asia, Oceania and Africa) that is overall insignificant, in model 2. The R-squared for the CNY share

among issuers Asia, Oceania and Africa; for the EUR among American issuers; and for the USD among American issuers are all above 0.8.

It is not possible to clearly identify which specification performs best since the R-squared values are very similar in both models. Model 1 present relatively higher R-squared in 8 out of 15 equations and model 2 in the remaining 7.

Size of the Economy

As expected, the results suggest that the size of the economy has a positive impact in the region of the currency, for all currencies in which this macroeconomic variable showed to be significant (CNY, EUR, JPY and USD).

Among issuers that belong to the currency's region, the influence of the size of the economy is greater for the JPY (161.2) and the USD (105.7). Both the EUR share of international bonds and the CNY share of international bonds also increase among agents from Europe and from Asia, Oceania and Africa, respectively, when the correspondent economy grows, but the coefficients are smaller (26.87 for the EUR and 65.25 for the CNY). The GBP is the only currency that presents a non-significant value – in this case, for issuances by European agents - meaning that the share of international bonds denominated in GBP among European Agents do not react to an expansion of the British Economy.

However, the same homogeneity does not occur when we consider other regions rather than the region where the country of the currency belongs to. The impacts of the size of the economy are positive for CNY in both America and Europe regions – with the highest estimate values–, for the USD among Asia, Oceania and Africa agents, and for the JPY among European agents.

The EUR and the USD, for instance, present interesting results in this respect. When the share of the economy of the Eurozone increases, the share of international bonds denominated in EUR among American issuers tend to be smaller and, similarly, the same happens for the USD, although in this case the estimate is only significant at a 10% level. According to the estimates, the magnitude of the results are also striking. The negative impact on the share of EUR among American issuers is ten times higher than the negative impact on the share of USD among European agents. Similarly, the GBP share among American issuers decrease every time the British economy expand, in

fact, the currency that presents the most negative coefficient. Since the GDP share do not contribute positively in none of the regions, one of the conclusions we can obtain is that the expansion of the British economy do not favour the internationalization of its currency. Curiously, the Japanese GDP share impacts negatively among American issuers but positively among European agents. The results are robust in both models 1 and 2.

Finally, and contrary to all the other currencies, the CNY is the only currency which increases its' share in all regions when the Chinese GDP share increases. The impacts are higher among American issuers, followed by European issuers and finally in the local region Asia, Oceania and Africa. These results suggest that the CNY has the potential and capacity to become a relevant currency not only in its local region but rather globally. It is also interesting to understand that the impact of the Bilateral Trade Share – presented in model 2 – is always positive and it is larger than the impact of the GDP share among American and European agents.

Inflation

With regard to the inflation rate, we obtained different results to those obtained by Bobba et al (2007). In our model, inflation has a negative effect on the share of international bonds denominated in EUR and USD in regions other than those of the currency of issuance. Additionally, the inflation's coefficient for USD issuances among American issuers is positive in both models 1 and 2, and we verify the same positive sign in model 2 for the EUR share among European agents. If we look at the particularities of the USD and EUR, as the main global reference currencies, we can understand why inflation undermines the share of international bonds among international actors. Both EUR and the USD are used as safe-heavens and present stable inflation rates in their local economies and, therefore, rarely used by issuers as an instrument to reduce costs of borrowing based on continuous erosion of value through inflation. Hence, a sudden increase in inflation is not sufficient to change expectations among issuers that the long-term level of inflation will increase permanently. Rather, it can be seen as a measure of risk and, as a consequence, the role of a safe-haven currency get affected, which consequently reduces the issuances among international actors.

On the other hand, the impact of Chinese inflation on CNY share of international bonds is positive across all regions. In this case, it is possible to admit that agents expect inflation to be continually high and, therefore, try to take advantage and reduce borrowing costs through this mean.

For the remaining two currencies, the GBP and the JPY, the impacts are heterogeneous between the different regions. In the case of the GBP, the impact of higher levels of inflation rate is positive among European issuers – local region of the currency – but negative for the other two regions. The JPY presents a positive coefficient for Europe and negative for America. Additionally, in Asia, Oceania and Africa the results are not robust across both specifications, presenting a significant value in Model 1 but not in Model 2.

Spread

The results obtained for the proxy that capture borrowing costs are also statistically significant. Moreover, they corroborate the idea that the USD is the main reference currency at an international level. It is the only currency that does not present positive responses in the shares of international currencies to an increase in the spread between the government bond yields – in this case, the different between the US government bonds and the German government bonds.

Assuming no change in the risk spread associated with international bonds, the spread between international bonds will also widen due to the increase in the spread of the benchmark bonds. Hence, this can have one of two consequences: an increase in the demand of international bonds of the currency with the relative higher interest rate or a decrease in the supply of international bonds of that same currency. If the first occurs, then the share of bonds denominated in that currency tend to be higher; with a decrease in the supply, however, the share of bond tend to be lower.

In the case of the USD, since the spread has a negative impact over the share of international bonds denominated in dollars, we can conclude that, when the interest rate is relatively higher, the downward movement in the supply curve offset any possible upward movement in the demand curve. Thus, that investors do not "search for yield" in USD denominated bonds but rather look for stability, regardless of the issuer's region. The opposite seems to occur with the remaining currencies, with the exception of the EUR among European agents, a region where the EUR is also a reference currency.

For the CNY, the effects of a higher spread have a positive impact over the share of international bonds issued by agents from Europe and from Asia, Oceania and Africa. The results are robust and hold in both models. Contrarily, the results from the JPY seems to not hold in the second specification. Despite presenting positive statistical significant coefficients for all the regions in model 1, in model 2 only the JPY share among American issuers seems to respond to changes in the spread between yields of the benchmark bonds.

Distinctively from the other currencies, the GBP present no significant values in any of the regions. Therefore, the results suggest that this macroeconomic variable do not have impact in the share of GBP denominated bonds at an international level.

6. Conclusions

The CNY is now considered a "free usable" currency by the IMF. How much this currency will be used outside its borders it is still an uncertainty. According with the data that we collect, the CNY was able, after few years of its inception in the international markets, to be the second most used currency – after the USD – between issuers from Asia, Oceania and Africa. The offshore bonds denominated in CNY appeared in 2007 and, since then, the IMS seems to be in a continuous process of adaptation to the internationalization of the Renminbi. As a proof of it, the CNY is now part of the SDR Basket with the third higher weight after the USD and the EUR.

In line with these changes, our goal was to understand how the macroeconomic determinants influence the different shares of international bonds. When looking to the determinants that influence the strength of one currency at an international level, the literature analyse the currencies altogether, and not distinguish between currencies.

We decided to chase this view and, in this dissertation, we model the shares of international currencies using Seemingly Unrelated Regression Models, between 2009Q3 and 2015Q4. The data is composed by international debt shares of each of the five currencies of the SDR Basket, which are subsequently divided into three regions (America; Europe and Asia, Oceania and Africa), based on the country of the parent company of issuance.

We find strong evidence supporting the hypothesis of distinct coefficients across equations and of correlated errors, thus supporting our modelling technique based on Seemingly Unrelated Equations.

We find out that the share of international bonds is influenced by the size of the economy, by inflation rates and by the yield spread. The size of the economy has a positive impact over the share of a given currency among the issuers that belong to the region of the currency. In particular, we conclude that the share of the USD, EUR, CNY and JPY among issuers from America, Europe and Asia, Oceania and Africa, respectively, increases when their national economy expand. However, of all currencies under study, only the CNY presents a positive coefficient for the size of the economy irrespectively of the region of the issuer. For the CNY we also establish that the impact of the bilateral trade share over the share of international bonds is higher than the impact produced by an increase in the share of the Chinese GDP. For the EUR and USD, the findings suggest that when the Eurozone or American GDP share increases, the share of international bonds denominated in EUR or USD decrease among American and European issuers, respectively.

We also find out that for the case of inflation, there are heterogeneous results. For the EUR and the USD, inflation has a negative impact over the share of international bonds when we consider regions other than the one of the currency of issuance – Europe and America, respectively. The findings suggest that both the EUR and the USD are reference currencies, since international issuers do not tend to issue more in order to take advantage of higher inflation rates. Contrarily to this, the CNY share of international bonds increase with inflation, irrespectively of the region under study.

Finally, the spread of government bond yields suggest that the USD has a distinctive role that has not yet been achieved by any other currency. The USD is the only currency which is not used by investors as a "search of yield" currency in any of the regions under study. On the other hand, the share of the EUR, the second most important currency worldwide, responds positively to an increase in the spread in regions other than Europe, however, the results seem to not be robust in our model. Finally, both the CNY and the JPY respond positively to a wider spread between the local government bond and the government of the reference currency.

Despite these interesting findings, our models present some visible limitations. Firstly, the models do not incorporate the lagged dependent variable as an explanatory factor. A lagged variable would be able to capture the persistency that exists in the share of international currencies and already mentioned in the literature. As a result, our models present, in some cases, low R-Squared values that we believe could be increased if we took into account this specification. However, in some cases, even with this handicap, our models present a R-Squared of above 0.8 for (i) the USD Share among American issuers; (ii) for the EUR share among European issuers; (iii) for the CNY among issuers from Asia, Oceania and Africa. Thus, we also offset the idea that shares of international currencies do not react to macroeconomic fundamentals.

Therefore, in our perspective, further research could be produced by applying dynamic models that allowed coefficients to vary between currencies. The hypothesis that the coefficients of the macroeconomic explanatory variables are equal for all currencies and regions seems to be too strong.

Moreover, some important determinants defined by the literature such as the market development or hedging motives need to be explored further with better proxies. Additionally, another research path could take into account the exchange venues where these bonds are traded and analyse the shares based on the exchanges rather than on the country of the issuer. Although many bonds end up being traded Over-the-Counter, we believe that further research on this could bring also interesting results.

References

Aizenman, J. 2015. The internationalization of the RMB, capital market openness, and financial reforms in China. ***NBER Working Paper***.

Allayannis, G., Brown, G. & Klapper L. 2003. Capital Structure and Financial Risk: Evidence from Foreign Debt Use in East Asia. ***Journal of Finance,* 58 (6).**

Benzie, R. 1992. The Development of the International Bond Market. ***BIS Working Papers***

Black, S. 1991. Transactions costs and vehicle currencies. ***Journal of International Money and Finance***, 10(4) : 512–526.

Blinder, A. 1996. The role of the dollar as an international currency. ***Eastern Economic Journal***, 22 (2) : 127.

Bobba, M., Corte, G. & Powell, A. 2007. On the Determinants of International Currency Choice: Will the Euro Dominate the World? ***Inter-American Development Bank Working Paper***.

Calvo, G., Vegh, C. 1992. Currency Substitution in Developing Countries: An Introduction. ***Munich RePEc Archive***.

Chen, H. & Peng, W. 2009. The Potential of the Renminbi as an International Currency. ***BIS Working Papers***

Chinn, M. & Frankel, J. 2007. Wil the Euro Eventually Surpass the Dollar as Leading International Reserve Currency? Clarida RH, editor. ***G7 Current Account Imbalances***. 284–323. The University of Chicago Press.

Chinn, M. & Frankel J. 2008. Why the Euro Will Rival the Dollar. **International Finance**, 11(1):49–73.

Chinn, M. 2014. Emerging Market Economies and the Next Reserve Currencies. ***Open Economics Review***, 26 : 155–174.

Chitu, L., Eichengreen, B. & Mehl, A. 2012. When Did the Dollar Overtake Sterling As the Leading International Currency? Evidence From the Bond Markets. ***ECB Working Papers***

Clark, E. & Judge, A. 2009. Foreign Currency Derivatives versus Foreign Currency Debt and the Hedging Premium. ***European Financial Management Review***, 15 (3) : 606–642.

Cohen, B. 1971. ***The Future of Sterling as an International Currency***. Mcmillan Publisher.

Cohen, B. 2005. Currency choice in international bond issuance. ***BIS Quarterly Review***, 53–66.

Devereux, M. & Shi, S. 2013. Vehicle currency. ***International Economics Review***, 54 (1) : 97–133.

Eichengreen, B., Chi, L. & Mehl, A. 2014. Stability or Upheaval? The Currency Composition of International Reserves in the Long Run. ***ECB Working Papers***

Eichengreen, B. & Flandreau, M. 2008. The rise and fall of the dollar, or when did the dollar replace sterling as the leading reserve currency? ***European Review of Economic History***, 13 : 377–411.

Eichengreen, B. & Mathieson, D. 2000. The currency composition of international reserves: Retrospect and Prospect. ***IMF Working Paper***.

Esho, N., Sharpe, I. & Webster, K. 2007. Hedging and choice of currency denomination in international syndicated loan markets. ***Pacific-Basin Finance Journal***, 15 (2) : 195–212.

Flandreau, M. & Jobst, C. 2009. The Empirics of International Currencies: Network Externalities, History and Persistence. ***The Economic Journal***.

Frankel, J. 2012. Internationalization of the RMB and Historical Precedents. ***Journal Economic Integration***. 27 (3) : 329–365.

Goldberg, L. & Tille, C. 2008. Vehicle currency use in international trade. ***Journal International Economics***, 76 (2) : 177–192.

Habib, M. & Joy, M. 2008. Foreign-Currency Bonds: Currency Choice and the Role of Uncovered and Covered Interest Parity. ***ECB Working Papers***.

Hakkio, C. 1973. The Dollar's International Role. ***Contemporary Policy Issues***, 11 : 62–75.

Hartmann, P. 1998 ***Currency competition and foreign exchange markets. The dollar, the yen, and the Euro***. Cambridge University Press.

IMF, European Central Bank, Bank of International Settlements. 2015. ***Handbook on Securities Statistics***.

IMF. 2016. **Articles of Aggreement**. Washington, DC

Ito, H. & Rodriguez, C. 2015. Do We Like the Greenback or Something Else? An Analysis on the Determinants of Reliance on Foreign-Currency Denominated Debt. ***Working Paper***.

Kedia, S. & Mozumdar, A. 2003. Foreign Currency--Denominated Debt: An Empirical Examination. ***The Journal of Business***, 76 (4) : 521–546.

Keloharju, M. & Niskanen, M. 2001. Why Do Firms Raise Foreign Currency Denominated Debt? Evidence from Finland. ***European Financial Management***, 7 (4) :481–496.

Kindleberger, C. 1967. Essays in International International Finance: The Politics of International Money and World Language. ***Essays on International Finance***, (61).

Krugman, P. 1980. Vehicle Currencies and the Structure of International Exchange. ***Journal of Money, Credit Banking***, 12 (3)

Krugman, P. The International Role of the Dollar: Theory and Prospect. ***National Bureau of Economic Researh***. 1984 ; I : 261–278.

Lee, J. 2014. Will the renminbi emerge as an international reserve currency? ***Asian Development Bank***. 37(1):42–62.

Lim, E. 2006. The Euro's Challenge to the Dollar: Different Views from Economists and Evidence from COFER (Currency Composition of Foreign Exchange Reserves) and Other Data. ***IMF Working Papers***.

Ma, G. & Yao, W. 2015. Can The Chinese Bond Market Facilitate A Globalizing Renminbi Renminbi? ***BOFIT Discussion Papers***.

Matsuyama, K., Kiyotaki, N., Matsui, A. 1993. Toward a theory of international currency. ***Review of Economic Studies***, 60: 283–307.

Mcbrady, M., Schill, M. 2007. Foreign currency-denominated borrowing in the absence of operating incentives. ***Journal financial economics***. 2007;86(1):145–77.

McKinnon, R. 1979. ***Money in International Exchange***. Oxford University Press.

Mehl, A., Geis, A. & Wredenborg, S. 2004. International Role of the Euro Evidence from bonds issued by non-euro area residents. ***ECB Working Papers***.

Powell, A. 2014. ***Global Recovery and Monetary Normalization Escaping a Chronicle Foretold?*** Latin America and Caribbean Macroeconomic Report

Swoboda, A. 1968. The euro-dollar market: An interpretation. ***Essays on International Finance***, 64.

Swoboda, A. 1969. ***Vehicle currencies in the foreign exchange market: the case of the dollar***. New York: Praeger.

Task Force on Finance Statistics. 2013. ***External Debt Statistics: Guide for Compilers and Users.*** *Washington DC.*

Turner, P. 2014. The global long-term interest rate, financial risks and policy choices in EMEs. ***BIS Working Papers***.

Wooldridge, P. 2012. Enhancements to the BIS debt securities statistics. ***BIS Quarterly***

Review 63–76.

Zellner, A. 1962. An efficient method of estimating seemingly unrelated regressions and test for aggregation bias. **Journal of the American Statistical Association**. 57(298): 348-368.

A. Annexes

Annex 1: Correlation Matrix of Residuals

Table 4: Model 1 – Correlation Matrix of Residuals (cont.)

Correlation Matrix	CNY - America	CNY – Europe	CNY - Asia, Oceania and Africa	EUR - America	EUR - Europe	EUR - Asia, Oceania and Africa	GBP - America	GBP - Europe	GBP - Asia, Oceania and Africa
CNY - America	1								
CNY – Europe	-0.1385	1							
CNY - Asia, Oceania and Africa	0.0866	0.0365	1						
EUR - America	-0.1341	0.0926	-0.2107	1					
EUR - Europe	-0.2527	-0.2611	-0.2383	0.02	1				
EUR - Asia, Oceania and Africa	0.1615	-0.0502	0.0387	0.4848	-0.1724	1			
GBP - America	-0.0913	-0.0436	-0.0797	0.5915	0.0757	0.7935	1		
GBP - Europe	0.0695	0.0513	0.2669	0.2163	-0.578	0.4277	0.2823	1	
GBP - Asia, Oceania and Africa	-0.0006	-0.0695	-0.3591	0.4151	0.035	0.5687	0.7766	0.2904	1
JPY - America	-0.14	0.5401	-0.2584	-0.0624	0.2731	-0.2575	-0.1719	-0.2699	-0.0382
JPY - Europe	-0.2658	0.1448	0.1614	-0.0608	0.1531	-0.3571	-0.0794	-0.3784	-0.1418
JPY - Asia, Oceania and Africa	-0.3188	-0.2094	0.1251	-0.4134	0.1657	-0.4467	-0.2638	-0.1212	-0.3445
USD - America	0.1496	0.3185	0.2218	-0.7052	-0.1759	-0.306	-0.4895	-0.2232	-0.2993

	CNY - America	CNY – Europe	CNY - Asia, Oceania and Africa	EUR - America	EUR - Europe	EUR - Asia, Oceania and Africa	GBP - America	GBP - Europe	GBP - Asia, Oceania and Africa
USD - Europe	0.3289	0.113	0.1732	-0.147	-0.8678	0.0641	-0.2348	0.3431	-0.1099
USD - As(ia, Oceania and Africa	-0.2359	0.4222	-0.4742	0.2485	0.0215	-0.0329	0.1214	-0.0053	0.2995

(cont.) Table 4: Model 1 – Correlation Matrix of Residuals

Correlation Matrix	JPY - America	JPY - Europe	JPY - Asia, Oceania and Africa	USD - America	USD - Europe	USD - Asia, Oceania and Africa
JPY – America	1					
JPY – Europe	-0.0442	1				
JPY - Asia, Oceania and Africa	-0.1613	0.15	1			
USD - America	0.3965	0.1168	-0.0284	1		
USD - Europe	-0.3555	-0.2052	-0.019	0.2295	1	
USD - Asia, Oceania and Africa	0.5723	-0.0924	-0.3481	0.1754	-0.0892	1

Breusch-Pagan test of independence: chi2(105) = 232.770, Pr = 0.0000

Note: Obtained using STATA command sureg <varlist>, small dfk ***corr***

Table 5: Model 2 – Correlation Matrix of Residuals (cont.)

Correlation Matrix	CNY - America	CNY – Europe	CNY - Asia, Oceania and Africa	EUR - America	EUR - Europe	EUR - Asia, Oceania and Africa	GBP - America	GBP - Europe	GBP - Asia, Oceania and Africa
CNY - America	1								
CNY – Europe	-0.0547	1							
CNY - Asia, Oceania and Africa	-0.0157	-0.0633	1						
EUR - America	-0.0825	-0.0009	-0.1269	1					
EUR - Europe	-0.181	-0.0922	-0.2145	-0.0803	1				
EUR - Asia, Oceania and Africa	0.1207	-0.2801	-0.1733	0.5069	-0.2259	1			
GBP - America	-0.0813	-0.2416	-0.3564	0.5468	0.0566	0.7906	1		
GBP - Europe	-0.016	-0.0695	0.0923	0.1866	-0.5498	0.413	0.292	1	
GBP - Asia, Oceania and Africa	0.0503	-0.0951	-0.5149	0.3552	0.0485	0.5584	0.7794	0.2709	1
JPY - America	-0.1626	0.604	-0.3486	-0.1956	0.4005	-0.5389	-0.3267	-0.3145	-0.1691
JPY - Europe	-0.2406	0.2484	0.1493	-0.025	0.1702	-0.4161	-0.1482	-0.3147	-0.1968
JPY - Asia, Oceania and Africa	-0.3044	-0.0934	0.0581	-0.259	0.0717	-0.45	-0.3357	-0.0939	-0.4183
USD - America	0.1932	0.2963	0.0118	-0.7879	-0.1753	-0.3471	-0.4399	-0.042	-0.1686
USD - Europe	0.2761	0.2131	0.0645	-0.0173	-0.862	0.1394	-0.1268	0.4129	0.0381
USD - Asia, Oceania and Africa	-0.2846	0.4742	-0.5323	0.0624	0.0792	-0.0228	0.1456	0.105	0.287

(cont.) Table 5: Model 2 – Correlation Matrix of Residuals

Correlation Matrix	JPY - America	JPY – Europe	JPY - Asia, Oceania and Africa	USD - America	USD - Europe	USD - Asia, Oceania and Africa
JPY – America	1					
JPY – Europe	0.0596	1				
JPY - Asia, Oceania and Africa	0.0975	0.2645	1			
USD - America	0.2735	0.1035	0.0531	1		
USD - Europe	-0.3269	-0.1525	-0.0143	0.34	1	
USD - Asia, Oceania and Africa	0.5577	-0.1603	-0.2363	0.2102	0.0528	1

Breusch-Pagan test of independence: chi2(105) = 246.585, Pr = 0.0000

Note: Obtained using STATA command sureg <varlist>, small dfk ***corr***

Annex 2: Market Types from Bloomberg

Table 6: Market Types on Bloomberg

Market Type	
Included	Euro-MTN
	Euro Non-Dollar
	Euro-Dollar
	Global
	Samurai
	Shogun
	Yankee
	US Non-Dollar
Excluded	Australian
	Canadian
	Domestic
	Domestic MTN
	Private Placement
	Restructured Debt
	UK Guilt Stock
	US Domestic
	US Govt
	Warrant

Annex 3: Exchanges on Bloomberg for each of the Currencies

Table 7: List of Domestic Exchanges per Currency

Domestic Exchanges	Market Type
CNY	Shangai Stock Exchange
	Shengzhen Stock Exchange
EUR	Luxemburg
	Frankfurt
	Dusseldorf
	Vienna
	Dublin
	Amsterdam
	Paris
	Madrid
	Brussels
	Milan
	NOMX Helsinki
	Berlin
	Hamburg
	Hannover
	Munich
	Stuttgart
	Lisbon
	Athens
	Valencia
	Bilbao
	AIAF
	Lyon
	Strasbourg
	Marseille
	Nancy
	Nantes
	Barcelona
	Cent Anotacione
	All German SE
	Malta
	Nouveau Marche
	Euronext-Paris
	Euronext-Amsterdam

	Euronext-Brussels
	TLX
	EuroMTF
	Euwax Stuttgart
	Antwerp
	SEDEX-Milan
	Malta
	Euro TLX
	Xetra
	SCDACH-Frankfurt
	SIBE
	NYSE BondMatch
	Malta
	Mercato Telemati
	Extra MOT Pro
GBP	London
	London Intl
	MTS Amsterdam
	MTS S.p.A
	MTS Belgium
	MTS Portugal
	MTS France
	MTS Ireland
	MTS Greece
	Chi-X
	Tradeweb Europe
	Tradeweb LLC
	LSE-Retail
JPY	Tokyo
	Tokyo 2
	Osaka
	Osaka 2
	Nagoya
	Fukuoka
	Sapporo
USD	New York
	NYSE MKT LLC
	Yellow Sheets
	Nasdaq

NYSE Arca
Trace
CBOE
Nasdaq OMX PHLX
Chicago
Cincinnati
Nasdaq/NCM
Nasdaq/NGM
Nasdaq/NGS
Third Mkt Corp
BATS

Annex 4: Currencies Used in the Total Amount of International Bonds

Table 8: List of Currencies

Currency	Name
AED	United Arab Emirates dirham
ARS	Argentine Peso
AUD	Australian Dollar
BRL	Brazilian Real
CAD	Canadian Dollar
CHF	Swiss Franc
CLP	Chilean Peso
CNY	Chinese Renminbi
COP	Colombian Peso
CZK	Czech Koruna
DKK	Danish Krone
EGP	Egyptian Pound
EUR	Euro
GBP	Pound Sterling
HKD	Hong Kong Dollar
HUF	Forint
ILS	New Israeli Shekel
IDR	Indonesian Rupiah
INR	Indian Rupee
JPY	Japanese yen
KRW	South Korean Won
KZT	Kazakhstani Tenge
MXN	Mexican Peso
NGN	Naira
NOK	Norwegian Krone
NZD	New Zealand Dollar
PEN	Peruvian Nuevo Sol
PLN	Polish Zloty
RON	Romanian New Leu
RUB	Russian Ruble
SEK	Swedish Krona
SGD	Singapore Dollar
TRY	Turkish Lira
TWD	Taiwan Dollar
USD	US Dollar
VEB	Venezuelan bolívar
VND	Vietnamese đồng
ZAR	South African Rand

Annex 5: Example of the Matrix Output from Bloomberg

Table 9: USD Issuances per Ultimate Parent Country

Issue Date	Total	US	GB	DE	FR	CH	CN	AU	NL	BR
2015 Quarter 4	239,098,455,070.00	66,690,155,510.00	1,611,380,710.00	14,757,061,500.00	7,639,887,000.00	1,713,040,000.00	40,641,450,000.00	2,656,000,000.00	6,441,093,000.00	583,508,000.00
2015 Quarter 3	188,322,677,500.00	24,004,027,300.00	1,506,731,700.00	20,556,642,000.00	8,905,406,000.00	2,542,530,000.00	33,889,697,000.00	1,662,630,000.00	4,154,300,000.00	1,777,136,700.00
2015 Quarter 2	261,471,102,490.00	42,092,204,150.00	10,101,698,560.00	23,733,565,000.00	5,674,394,200.00	3,991,661,000.00	48,036,310,000.00	828,546,000.00	8,951,799,000.00	3,084,195,000.00
2015 Quarter 1	297,422,953,133.00	38,115,039,000.00	9,477,681,400.00	21,830,319,000.00	13,342,000,000.00	7,679,211,000.00	40,604,489,000.00	3,703,400,000.00	9,964,500,000.00	1,752,618,483.00
2014 Quarter 4	232,991,337,500.00	39,198,501,390.00	3,552,115,610.00	22,358,905,000.00	3,248,003,000.00	1,686,655,000.00	46,395,781,000.00	1,673,000,000.00	3,971,369,000.00	2,514,862,000.00
2014 Quarter 3	266,955,603,176.00	56,495,191,900.00	12,442,138,146.00	8,259,571,200.00	5,612,620,000.00	4,618,181,000.00	38,124,296,000.00	1,142,200,000.00	8,121,768,000.00	9,908,932,000.00
2014 Quarter 2	349,017,882,420.00	56,026,315,000.00	11,152,458,000.00	25,181,435,000.00	3,663,198,800.00	6,362,296,020.00	49,444,766,000.00	7,697,100,000.00	9,558,475,000.00	9,725,621,000.00
2014 Quarter 1	293,480,562,630.00	66,938,673,000.00	10,165,772,890.00	19,732,050,000.00	16,688,947,000.00	1,086,302,000.00	29,588,681,000.00	3,354,600,000.00	8,088,393,300.00	6,431,986,000.00
2013 Quarter 4	266,041,577,280.00	58,494,749,000.00	4,819,076,180.00	13,249,426,000.00	6,207,342,000.00	3,658,091,000.00	31,392,300,000.00	6,710,000,000.00	11,845,497,000.00	7,646,848,000.00
2013 Quarter 3	255,117,563,640.00	79,591,501,180.00	3,691,359,090.00	15,174,560,000.00	7,695,182,000.00	6,775,286,800.00	17,691,918,000.00	5,928,600,000.00	5,439,249,000.00	8,297,542,820.00
2013 Quarter 2	330,663,013,479.00	99,833,124,000.00	7,766,399,254.00	16,201,300,000.00	3,446,892,000.00	8,697,720,000.00	28,984,515,825.00	8,428,010,000.00	7,134,753,000.00	5,196,252,000.00
2013 Quarter 1	367,088,152,580.00	109,606,439,630.00	11,056,906,640.00	29,736,720,000.00	11,830,440,000.00	4,095,740,000.00	19,433,594,040.00	7,787,335,000.00	9,924,244,000.00	7,955,157,180.00
2012 Quarter 4	300,459,260,567.00	100,563,921,930.00	7,422,449,210.00	18,057,928,000.00	4,942,340,000.00	3,421,031,585.00	17,875,330,000.00	12,876,900,000.00	3,257,012,000.00	6,991,379,902.00
2012 Quarter 3	312,233,440,347.00	124,170,050,320.00	6,117,316,700.00	22,143,700,000.00	5,596,700,000.00	2,542,202,600.00	7,677,396,425.00	20,634,460,000.00	11,006,590,000.00	4,716,600,042.00
2012 Quarter 2	299,529,378,650.00	123,168,044,430.00	11,882,926,120.00	14,866,050,000.00	5,340,586,000.00	2,094,143,600.00	13,111,780,000.00	9,119,050,000.00	4,653,725,000.00	3,732,119,000.00
2012 Quarter 1	378,073,512,350.00	122,350,794,600.00	18,345,221,900.00	33,264,374,000.00	5,894,425,000.00	9,264,310,053.00	16,615,907,197.00	10,169,124,000.00	22,814,784,000.00	3,284,645,800.00
2011 Quarter 4	265,126,985,743.00	142,236,960,070.00	9,977,354,630.00	9,394,481,030.00	1,399,714,000.00	1,451,668,000.00	9,148,159,040.00	1,539,600,000.00	4,199,109,000.00	874,427,473.00
2011 Quarter 3	271,431,729,974.00	161,047,964,660.00	4,392,088,340.00	14,571,886,700.00	4,798,089,000.00	1,745,567,000.00	7,455,540,000.00	3,794,900,000.00	3,064,139,000.00	139,435,474.00
2011 Quarter 2	283,434,169,687.00	113,023,664,695.00	10,712,456,610.00	25,623,543,510.00	11,113,672,000.00	1,316,012,804.00	13,447,290,400.00	4,994,000,000.00	8,594,350,000.00	2,465,554,570.00
2011 Quarter 1	384,933,180,192.00	148,758,479,120.00	18,822,983,410.00	30,045,606,680.00	23,349,411,000.00	3,270,085,000.00	2,365,852,900.00	6,973,000,000.00	14,950,273,000.00	1,607,285,282.00
2010 Quarter 4	343,337,155,240.00	169,435,243,200.00	8,445,428,060.00	11,953,584,900.00	13,302,547,000.00	1,829,824,000.00	7,513,963,220.00	11,669,663,000.00	9,227,731,000.00	1,285,051,130.00
2010 Quarter 3	392,958,488,340.00	205,616,056,500.00	14,723,410,830.00	23,465,921,400.00	10,483,657,000.00	2,523,456,000.00	5,040,598,760.00	8,297,401,000.00	7,233,173,000.00	1,408,455,850.00
2010 Quarter 2	332,261,511,490.00	165,649,556,210.00	8,334,671,680.00	19,561,382,400.00	5,807,515,000.00	2,354,993,000.00	3,383,220,160.00	4,933,051,000.00	4,238,115,700.00	4,436,517,172.00
2010 Quarter 1	421,236,637,568.00	220,127,601,530.00	21,075,291,492.00	23,936,342,100.00	7,220,878,140.00	6,293,843,880.00	859,257,567.00	11,664,175,000.00	12,342,195,000.00	3,729,898,800.00
2009 Quarter 4	357,520,919,976.00	150,007,029,400.00	29,130,820,077.00	14,811,425,300.00	10,353,305,700.00	3,666,883,170.00	1,394,144,620.00	16,417,310,000.00	4,431,562,000.00	5,468,676,209.00
2009 Quarter 3	310,081,425,365.00	125,203,225,010.00	18,909,584,453.00	19,506,293,900.00	15,458,969,000.00	4,655,704,400.00	671,880,610.00	22,513,029,500.00	7,310,698,890.00	2,220,237,646.00

Note: Illustrative example. Ult. Parent Countries are not all represented in this figure.

Annex 6: Details of the Database

Table 10: Details of the Database

Variable	Currency	Source	Bloomberg Ticker	Observations
GDP	CNY	Bloomberg	CNGDGDP Index	China's quarterly GDP series starts in 2011Q1. Therefore, the remaining observations were obtained using the annual YoY growth rate.
	EUR	Bloomberg	EUGVEMU Index	
	GBP	Bloomberg	EUGVUKI Index	
	JPY	Bloomberg	JGDPOGDP Index	
	USD	Bloomberg	GDP CHWG Index	
TRADE SHARE	CNY	CEPII		
	EUR	CEPII		
	GBP	CEPII		
	JPY	CEPII		
	USD	CEPII		
Inflation	CNY	Bloomberg	CNCPIYOY Index	
	EUR	Bloomberg	ECCPEMUY Index	
	GBP	Bloomberg	UKRPCJYR Index	
	JPY	Bloomberg	JNCPIYOY Index	
	USD	Bloomberg	CPI YOY Index	
Volatility SDR	CNY	IMF	not applicable	Extracted through IMF Financial Data
	EUR	IMF	not applicable	Extracted through IMF Financial Data
	GBP	IMF	not applicable	Extracted through IMF Financial Data
	JPY	IMF	not applicable	Extracted through IMF Financial Data

	USD	IMF	not applicable	Extracted through IMF Financial Data
FDI	CNY	Bloomberg	CHCUNFE Index & CHCUNFER Index	Two ticker used because from 2010 onwards China started FDI in USD (CHCUNFER), and we segregate both amounts
	EUR	Bloomberg	EUCAYF56 Index & EUCAYF57 Index	EUCAYF56 Index: FDI from Monetary and Financial Institutions; EUCAYF57 Index: FDI from other sectors
	GBP	Bloomberg	UKCAHJYR Index	
	JPY	Bloomberg	JNBPFDEL Index	
	USD	Bloomberg	UACSIEQO Index	
Government 5-year yield	CNY	Bloomberg	GTCNY5Y govt	
	EUR	Bloomberg	GDBR5 Index	
	GBP	Bloomberg	GUKG5 Index	
	JPY	Bloomberg	GTJPY5Y govt	
	USD	Bloomberg	USGG5YR Index	
Market Capitalization	CNY	Bloomberg	WCAUCHIN Index	
	EUR	Bloomberg	not applicable	sum of all 19 countries from Eurozone, based on the respective tickers
	GBP	Bloomberg	WCAUUK Index	
	JPY	Bloomberg	WCAUJAPA Index	
	USD	Bloomberg	WCAUUS Index	

Table 11: Details of the GDP Variable Used

Country	Bloomberg Ticker	Obs
China	CNGDGDP Index	
UK	EUGVUKI Index	
Eurozone	EUGVEMU Index	
US	GDP CHWG Index	
Japan	JGDPOGDP Index	
EU	EUGNEU27 Index	
Argentina	ARADTOTL Index	
Australia	AUNAGDP Index	
Brazil	BZGDGDPQ Index	
Canada	CGE9MP Index	
India	IGQREGDP Index & INQGGDP Index	IGQREGDP Index: between 2011Q2 and 2015Q4; INQGGDP Index: between 2009Q3 and 2011Q1
Indonesia	IDGDP Index	
Mexico	MXGPLEVL Index	
Russia	RUDPGDPN Index & RUDPGL Index	RUDPGDPN Index: between 2011Q1 and 2015Q4; INQGGDP Index: between 2009Q3 and 2010Q4
South Africa	SAGDP Index	
South Korea	KOECSTOT Index	
Turkey	TUGPCU Index	

Annex 7: Countries and Regions for each Currency

Table 12: Countries per Currency

Currency	Region	Country ISO Code
CNY	**Asia, Oceania and Africa**	CN
		HK
		AU
		KR
		AE
		SG
		TW
		JP
		IN
		ZA
		MY
		QA
		RU
		NZ
		TH
		MN
CNY	**Europe**	GB
		FR
		DE
		NL
		LU
		CH
		SE
		IT
		ES
		AT
		IE
		HU
CNY	**Americas**	US
		CA
		MX
		KY
		VG
		BR
EUR	**Asia, Oceania and Africa**	CN
		AU
		JP

		KR
		ZA
		IN
		QA
		AE
		NZ
		RU
		IL
		HK
		LB
EUR	**Europe**	CH
		GB
		SE
		NO
		JE
		DK
		IS
		CZ
		HU
		PL
		TR
		GI
		RO
		HR
		BG
		LI
		FR
		DE
		NL
		LU
		BE
		IT
		ES
		AT
		PT
		IE
		GR
		FI
		EE
		CY
EUR	**Americas**	US
		KY
		CA
		BR

		BM
		AR
		MX
		VE
		CO
		CL
		VC
		JM
GBP	**Asia, Oceania and Africa**	AU
		CN
		JP
		SG
		HK
		ZA
		AE
		NZ
		IN
		KR
		RU
		MY
		KZ
		IL
GBP	**Europe**	ES
		NL
		IE
		SE
		DE
		JE
		NO
		LU
		FI
		CH
		IT
		AT
		FR
		IS
		PT
		DK
		GG
		BE
		IM
		GR
		GB
		GI

GBP	**Americas**	US
		CA
		KY
		BM
		VG
		BB
		BR
		MX
JPY	**Asia, Oceania and Africa**	JP
		AU
		KR
		AE
		CN
		HK
		NZ
		SG
		IN
		TW
		ZA
		MY
JPY	**Europe**	DE
		GB
		NO
		FR
		SE
		NL
		CH
		LU
		FI
		DK
		ES
		AT
		IE
		IT
		BE
		JE
		IS
		PT
		GR
		TR
JPY	**Americas**	US
		CA

		KY
		AR
		BR
		PA
		CL
USD	**Asia, Oceania and Africa**	CN
		AU
		JP
		KR
		HK
		IN
		TW
		AE
		RU
		SG
		ID
		ZA
		PH
		MY
		TH
		NZ
		KZ
USD	**Europe**	GB
		DE
		FR
		CH
		NL
		ES
		GG
		SE
		IE
		LU
		BE
		NO
		IT
		DK
		UA
		AT
		TR
		FI
		JE
USD	**Americas**	US
		CA

	BR
	MX
	AR
	PA
	KY
	CA
	BR
	MX
	AR
	CL
	KY
	BM
	CO
	PE
	VG
	JM

Annex 8: Cross-Equation Coefficient Tests

Table 13: GDP Share Coefficient Testing

Dependent Variables listed	EUR – America	EUR – Europe	USD – America	USD – Europe	USD – Asia, Oceania and Africa
EUR – America					
EUR – Europe	45.34 (0.00)				
USD – America	37.67 (0.00)	15.66 (0.0001)			
USD – Europe	26.42 (0.00)	10.90 (0.0011)	32.83 (0.00)		
USD – Asia, Oceania and Africa	60.06 (0.00)	4.96 (0.0266)	5.84 (0.0162)	31.37 (0.00)	

Note: Obtained using STATA post-estimation command: *test* [dep_var] gdp_share_i = [dep_var] gdp_share_i. Values of the F-statistic presented, p-values in parenthesis. Other coefficients were tested with the aforementioned in order to produce a combined F-Test, using the STATA command *accumulate* after each of the pairwise comparisons being made.

Table 14: Bilateral Trade Share Coefficient Testing

Bilateral Trade Shares	EUR - America	EUR - Europe	USD - Europe
EUR - America			
EUR - Europe	15.48 (0.0001)		
USD - Europe	2.77 (0.0972)	0.47 (0.4931)	

Note: Obtained using STATA post-estimation command: *test* [dep_var] gdp_share_i = [dep_var] gdp_share_i. Values of the F-statistic presented, p-values in parenthesis.

Table 15: Coefficient Testing Between Regions

F(3,304)	CNY - America	CNY - EUROPE
CNY – EUROPE	1.85(0.1388)	
CNY - ASIA	2.57(0.0544)	6.11(0.0005)
F(3,304)	EUR - America	EUR - EUROPE
EUR – EUROPE	62.50(0.0000)	
EUR - ASIA	13.64(0.0000)	3.95(0.0088)
F(3,304)	GBP - America	GBP - EUROPE
GBP – EUROPE	10.70(0.0000)	
GBP - ASIA	11.15(0.0000)	2.95(0.033)
F(3,304)	JPY – America	JPY - EUROPE
JPY - EUROPE	9.53(0.0000)	
JPY - ASIA	20.54(0.0000)	2.99(0.0191)*
*F(4,304)		
F(3,304)	USD – America	USD - EUROPE
USD - EUROPE	36.75(0.0000)	
USD - ASIA	26.78(0.0000)	11.52(0.0000)

Note: Obtained using STATA post-estimation command: *test* [eq. 1] = [eq. 2], common. Values of the F-statistic presented, p-values in parenthesis.

Annex 9: Amounts Issued in a Given Currency *per* Region

Figure 14: CNY amount issued per region

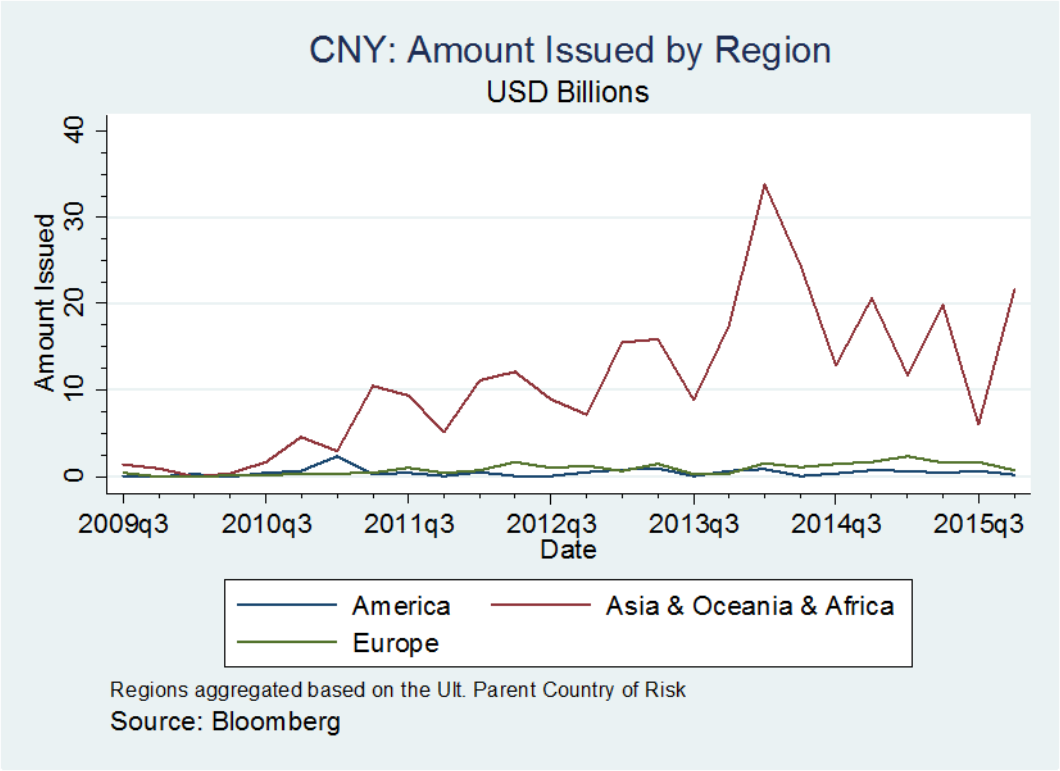


Figure 15: USD amount issued per region

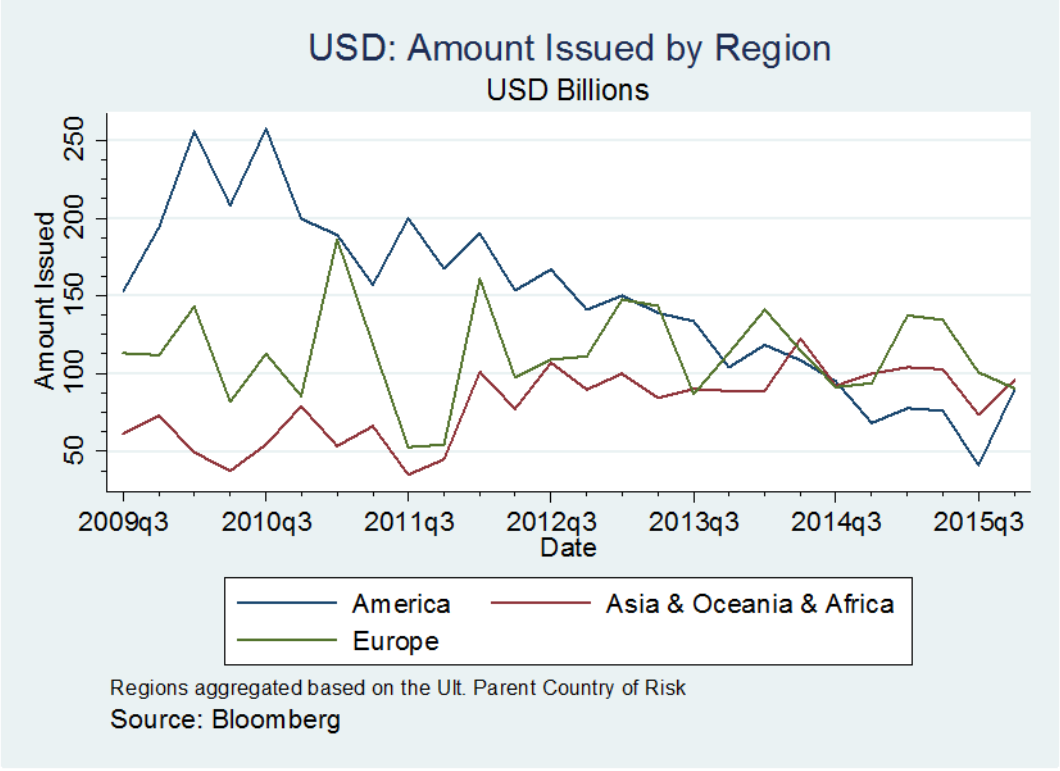


Figure 16: EUR amount issued per region

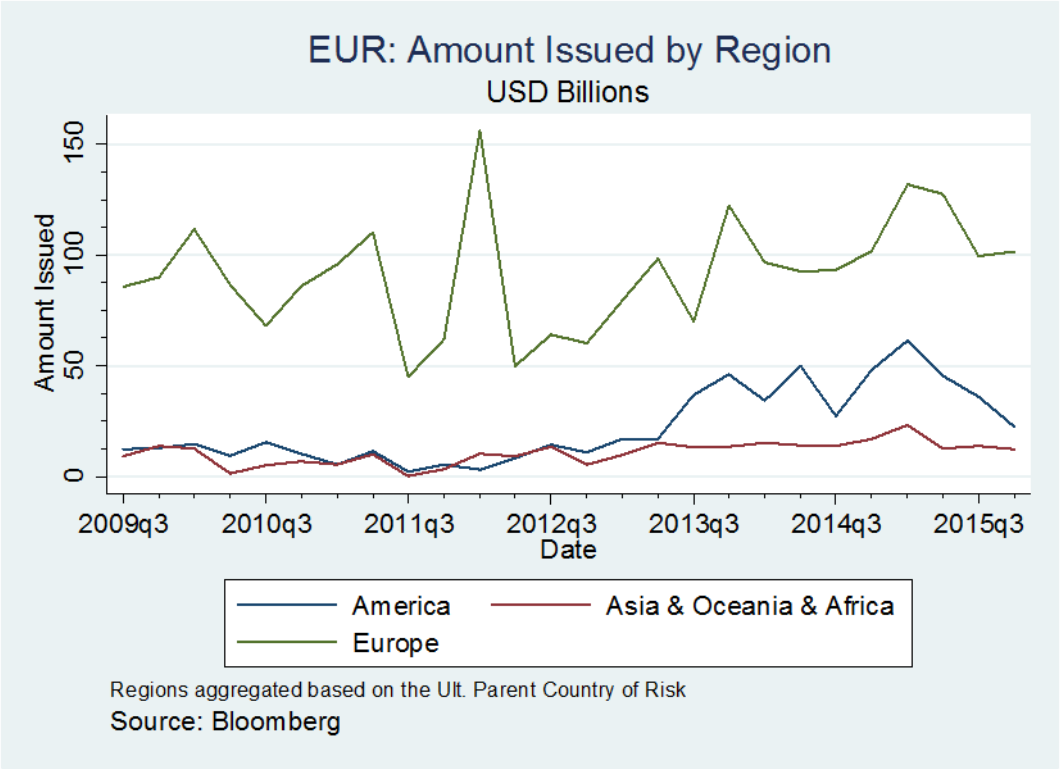


Figure 17: JPY amount issued per region

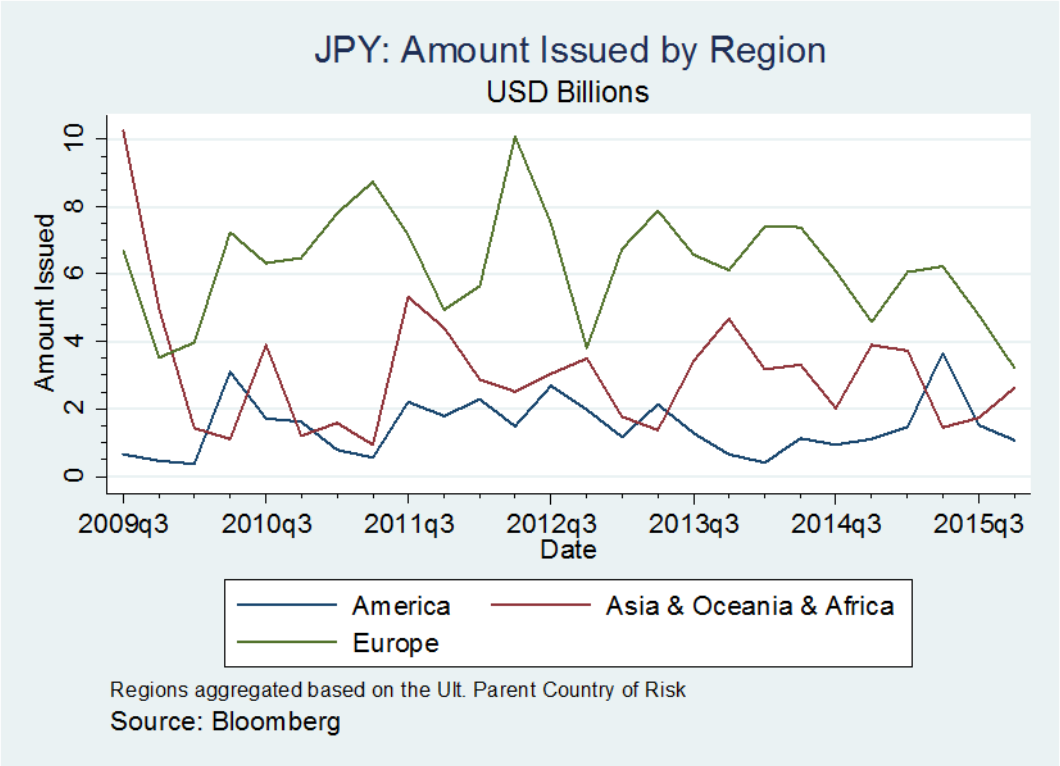


Figure 18: GBP amount issued per region