A Post-Keynesian Approach to the Role of Peripheral Currencies in the International Monetary System

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ABSTRACT

This paper aims to empirically investigate the different types of currency internationalisation and their influence on shaping currency hierarchy. In the absence of a single universal currency that fulfils the money functions at the international level, multiple currencies are available for transactions in the international market. Yet, only a few currencies issued by developed countries are generally used. These asymmetries in the international monetary system creates a currency hierarchy, where central currencies issued by developed countries placed at the highest positions and peripheral currencies at the lowest. This paper proposes to shift the focus from the degree of currency internationalisation to the different types of currency internationalisation. I attempt to resolve this issue by implementing cluster analysis. This study contributes to the literature by introducing another type of currency internationalisation that is not discussed – the short term investment currency. The results show us that some currencies, particularly those issued by emerging countries, are only held for investment purposes in a short period of time. Speculative demand for short-term investment currencies boost exchange rate volatility and reduces their liquidity premium. The literature on this topic assumes that the higher degree of currency internationalisation can be translated into a higher position in the currency hierarchy. However, the evidence of a new role for currencies in the international market suggests that when a currency is internationalised only as a short term investment, its position at the hierarchy does not improve.

Key words: currency internationalisation, currency hierarchy, emerging countries.

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[1] PhD researcher under supervision of Dr Annina Kaltenbrunner and Prof Gary Dymski. The author takes responsibility for all mistakes.

A Post-Keynesian Approach to the Role of Peripheral Currencies in the International Monetary System [2]

Introduction

This article aims to empirically investigate the different types of currency internationalisation for countries issuers of central and peripheral currencies. The literature on currency internationalisation generally analyses it as a linear process, where a currency becomes more internationalised as it fulfils the international money functions (means of payment, unit of account and store of wealth). Some scholars also understand currency internationalisation as an accurate measure for currency hierarchy, where the currency position in the currency hierarchy increases with the higher degree of currency internationalisation. In other words, as a currency fulfil more international money functions, it will be more internationalised and have a higher position in the currency hierarchy.

Most studies regarding currency internationalisation and currency hierarchy analyse proxies for the international money functions to understand the currencies' power in the international monetary system. For instance, recent studies proposed an index based on the international money functions to analyse the process of internationalisation of the Chinese *renminbi* (Renmin University of China, 2016).

However, both linear and aggregate measures neglect the individual influence of each international money functions. The linear relationship among the international money functions, currency internationalisation and currency hierarchy presupposes that the currencies' position in the hierarchy will be equally influenced by the different international money functions. Thus, this approach does not account for the different types of currency internationalisation that emerges from the international money functions.

Similarly, an aggregate indicator for currency internationalisation gives the same weight for each international money functions. Also, analysing only an index

[2] Work in progress.

does not reveal the type of currency internationalisation. Therefore, the linear and aggregate measures allow one to understand the overall relevance of currencies in the international monetary system, but they do not identify the different types of internationalisation for each currency. I argue that these approaches are rather discretionary and meaningless to understand the currencies' roles in the international monetary system. For this reason, I adopt a cluster analysis technique to study proxies for the international money functions and to understand the different types of currency internationalisation.

The currency hierarchy, from a post-Keynesian perspective, is shaped by the liquidity premium, which is an opportunity cost that economic agents are willing to incur in order to hold more liquid assets. The more liquid a currency is, the higher the liquidity premium, which manifests itself in the different types of currency internationalisation.

The international demand for peripheral currencies, which are less liquid, is generally motivated by opportunities of higher returns in periods of prosperity, when the probability of exchange rate volatility or inflation in these countries are considered remote. Yet, often the returns in these peripheral currency countries are high enough to outweigh possible losses due to exchange rate volatility or inflation. Consequently, these countries may still experience short-term capital flows even in times of economic distress. I conclude that a higher degree of currency internationalisation is does not lead to a higher position in the international currency hierarchy when peripheral currencies are used in the international markets as short-term investment.

Our discussion unfolds in three steps. On the first and second sessions, the literature review on currency internationalisation and currency hierarchy are developed, respectively, and the different theoretical approaches to these literatures are critically presented. On the third session, I elaborate on the cluster analysis methodology proposed to address the research questions. At the end of this article, I present our main results and conclusion.

Currency Internationalisation and the International Monetary System

The concept of currency internationalisation in the International Political Economy (IPE) view refers to the process whereby currencies are used abroad for transactions across countries (Cohen, 1998). The literature on currency internationalisation is widely discussed by the IPE field, which establishes a bridge between international relations and international economics. IPE researchers are mainly interested in the relationship between politics and the international use of currencies, although they also take into consideration the economic factors that contribute to the internationalisation process.

Cohen (1971), from an IPE background, was the first researcher to analyse currency internationalisation through the application of the money functions in the international market. In his analysis, a currency is fully internationalised if it fulfils all the three money functions outside the domestic economy and between foreign agents. The main aim of Cohen's analysis was to understand the impact of each role of international money on state power. The fulfilment of the three international money functions is analysed at two different levels, a private and an official one. The private level considers the money functions in terms of individual behaviour, while the official one focuses on monetary authority decisions. The justification for this division in two levels of analysis is based on the fact that currency demand from private agents and public sector have different objectives. The three money functions from two different levels sum in total six roles, which are summarised in Table 1.

Table 1: The Roles of International Money

Function	Private	Official
Means of Payment	Vehicle currency and trade settlement currency	Intervention currency
Unit of Account	Invoice currency	Anchor currency
Store of Wealth	Investment currency	Reserve currency

Source: Adapted from Cohen (1971); Krugman (1984); Cohen and Benney (2013).

As discussed above, the means of payment[3] function refers to the ability of money to facilitate trade by serving as a general payment method, circumventing the 'double coincidence of wants' (Smithin, 2003). From a private perspective, a currency is an international means of payment if it is used as a vehicle for foreign exchange (forex) trading and an instrument for trade settlement. International money fulfils the means of payment function at the official level when central banks from other countries use it for foreign exchange interventions.

Another function of money in a closed economy is to measure the relative value of assets, goods and services, working as a unit of account. From an international perspective at the private level, a currency is more internationalised when foreign investors use it to invoice commercial and financial transactions. At the official level, a currency is an international unit of account when other countries adopt it as an exchange rate anchor (Cohen, 2013).

Domestic currency performs the store of value[4] function when it preserves its value through time. Economic agents store their wealth by investing in the currency as an asset per se or in assets denominated in the currency which they believe to have a stable value. From an official perspective, central banks hold their foreign exchange reserves in currencies that are able to preserve their worth, that is to transfer accumulated resources from the present to the future (De Conti, 2011).

I draw attention to four main implications from the money function analysis of international currencies. Firstly, in the international market, currencies do not necessarily perform all the international money functions. Since some currencies do not fulfil or partially fulfil these functions, currency internationalisation is not a binary concept, where currencies are regarded as international or not. Instead, this work understands currency internationalisation as an ordinal process where currencies have different

[3] The means of payments function refers to an asset's ability to be exchanged for goods and services (medium of exchange) and to settle debts. This research adopts the term 'means of payments' instead of the term 'medium of exchange' used in the literature because of its wider definition, as the latter only refers to transactions where there is an actual exchange involved.

[4] When a currency is analysed beyond its national scope, it is perceived as an asset instead of a pure form purchase power. Thus, in the international context, this function could be better translated as a store of wealth, as private or public agents seek to preserve assets' worth.

degrees of internationalisation, also across different functions[5]. Therefore, one should not only analyse the degree of internationalisation, but also consider the functions separately to analyse the different types of currency internationalisation.

Secondly, the means of payment, unit of account and store of wealth functions are intertwined. For instance, at the official level, the intervention currency or the anchor currency are usually a greater share of official reserves (Bénassy-Quéré et al., 1998). At the private level, the invoice currency is closely related to the currency used for trade settlement. Thus, each of the international money functions reinforce other types of currency internationalisation (Helleiner, 2008). The fact that the functions are intertwined gives evidence for an inertial component of currency internationalisation, as agents in the international market are resistant to relinquish the use of the most internationalised currencies and to accept less internationalised currencies.

Thirdly, the international use of a few currencies that fulfil all or most of money functions comes at the cost of not using less internationalised currencies. This conclusion implies the inherent hierarchical feature of the international monetary system, where only a few international currencies are generally used at the international market while the majority of currencies are considered irrelevant. Therefore, currency internationalisation accentuates the hierarchy among currencies in the international market (Helleiner, 2008).

Fourthly, the IPE literature on currency internationalisation is mainly concerned with the currencies that fulfil the international money functions, given their importance in the international market. Other currencies that partially fulfil the money functions, which are issued by emerging countries, are not discussed in this literature. For the reasons abovementioned, the aim of this research is to analyse the different types of currency internationalisation in emerging countries.

[5] Currencies that do not perform any of the international money functions are not used in the international market and, thus, considered non-internationalised currencies.

Asymmetries in International Monetary System and Currency Hierarchy

The literature on currency hierarchy was firstly introduced by the academic field of International Political Economy (IPE). Strange (1971) was the pioneer of using a hierarchy approach on international currencies to analyse the influence of politics on international monetary relations. She criticises the fact that most economists focus on rigorous mathematical and theoretical aspects, neglecting the influence of international relations and taking for granted other economic and political aspects. The aim of this qualitative analysis was, however, to emphasise the relevance of politics on the international monetary system rather than contributing with an original perspective to rank international currencies.

Cohen (1998) developed on the currency hierarchy proposed by Strange (1971) into a more detailed classification. Firstly, on the top of the hierarchy, denominated as "top currency", he categorizes those currencies that are mostly accepted for international transactions. The "patrician currency", the "elite currency" and the "plebeian currency", which embraces money from developing countries and oil exporters, were ranked in a descending order of relevance. The three last classifications, "permeated currency", "quasi-currency" and "pseudo-currency" are those that do not fulfil at least one of the three main functions of money, often leading to foreign currency replacement in the domestic market. Cohen (2003) recognized that the formulation of a currency pyramid is difficult to operationalise, but it helps to illustrate money competition in the international market.

The position of a currency in the pyramid proposed by Cohen (1998) depends on that country's authoritative domain, which combines the influence of state territoriality with transactional network. The former refers to the issuing country's political power and the latter to the extent which the currency is used abroad. For Cohen (1998), the wider use of a currency as means of payment, unit of account and store of value in both private and official levels affects the country's transactional network and, consequently, its authoritative domain. Thus, the better performance of a currency in terms of the international money functions enhances its position in the hierarchy.

The post-Keynesian literature on currency internationalisation is limited to the analysis of this process in relation to the currency hierarchy. Research in this field focuses on uncertainty and liquidity premium, which are neglected by the

orthodox and IPE literature to explain the demand for international money and the inherent hierarchy that is created between currencies.

Introducing the concept of uncertainty to economics was one of the main contributions of Keynes (1936). Under uncertainty, the set of possible events is unknown and agents will seek protection against adversity. Money, which is the pure form of purchasing power, ensures agents against the lack of confidence in their expectations (Carvalho, 2015). Thus, demand for money represents an increase in the preference for more liquid assets.

In the General Theory, Keynes (1936) introduced the 'own rate of interest' (*r*) in the context of a closed economy, which is determined by the nominal yield (*q*), carrying costs (*c*), liquidity premium (*l*) and the expected appreciation or depreciation (*a*), expressed in Equation 1. The liquidity premium is an essential attribute of money, which is defined as the price the asset buyer is willing to pay[6] in exchange for an asset that can be easily sold without significant losses (Carvalho, 2015). Individuals' preference for liquidity increases in periods of uncertainty, as more liquid assets allow them to quickly meet their obligations at a lower cost. Liquidity is, therefore, a protection against any kind of adversity, either risk or uncertainty.

Equation 1: The Own Rate of Interest

$$r = q - c + a + l$$

Although uncertainty and liquidity preference were also defined in the context of a closed economy, these concepts were analysed by some post-Keynesians in the perspective of an open economy to show the hierarchical relations between international currencies (De Conti et al., 2013; Fritz et al., 2014; De Paula et al., 2015; Kaltenbrunner, 2015).

From a Keynesian perspective, agents set their portfolio based on the expected returns for the chosen assets, which is measured by the 'own rate of interest'. As a result of the different degrees of liquidity, currencies have different levels of attractiveness for international agents. Agents require financial compensation to hold money from countries with less credibility, which are the issuers of currencies that have lower liquidity premiums and are positioned at

[6] This payment can be regarded as the opportunity cost which assets holders give up on the possibility to invest in more profitable assets in exchange an asset that provides more liquidity.

the bottom of the hierarchy (Kaltenbrunner, 2011). To compensate for the lower liquidity premium (*l*), DECs have to offer higher returns (*q*) to induce exchange rate appreciation (*a*) and, therefore, increase the expected returns (*r*) (Fritz et al., 2014).

International agents may be willing to pay a premium in order to invest in a currency that is unlikely to have a large depreciation. In other words, agents might prefer to invest in a country that issues a central currency but offers lower returns rather than in a country that issues peripheral currency, which is more volatile, but offers higher returns. The hierarchy is formed by a few top currencies, which have the highest currency premium, some intermediate currencies, with a relatively good capacity to store its value, and lastly the unstable currencies at the bottom of the hierarchy (Kaltenbrunner, 2015).

Therefore the international monetary system is asymmetric and, especially in times of uncertainty, investors demand only a few central currencies with higher liquidity premiums. These central currencies are placed at the hierarchy top. By contrast, developing and emerging countries are issuers of peripheral currencies, which are located at the bottom of the hierarchy. Therefore, currency hierarchy is shaped by the liquidity premium: the greater the liquidity premium, the higher the currency's position in the hierarchy.

I argue, however, that the speculative demand for money, which is related to currency stability, is not limited to the most liquid currencies in the international monetary system. In periods of economic prosperity in emerging countries, when the exchange rate is expected to be less volatile, agents may also demand assets denominated in less liquid currencies. For this reason, I propose the addition of another role of international money that is related to the speculative demand for money in the international market. The store of wealth function at the private level should be divided into two subcategories: the short and long-term investment currency, represented in Table 2.

A long-term investment currency is characterised by a high degree of confidence that the currency value will remain constant in the remote future. By contrast, a short-term investment currency is the one which is expected to store wealth only temporarily. Thus, the short-term investment currency is associated with speculative capital flows, such as carry trade operations. In the carry trade operations, agents seek for profit from the interest rates differentials between

the funding currency country and the target currency country, which is the short-term investment currency.

Table 2: Types of Currency Internationalisation

Function	Private	Official
Means of Payment	Vehicle currency Trade settlement currency	Intervention currency
Unit of Account	Invoice currency Funding currency	Anchor currency
Store of Wealth	Short-Term Investment Currency Long-Term Investment currency	Reserve currency

In the debate about the unit of account function, Kaltenbrunner (2015) focuses on the ability of a currency to work as an international means of contractual settlement to determine the demand for currency in a world characterised by uncertainty. Similar to a closed economy where agents demand money as the most liquid asset to meet their obligations, in an open economy context, international agents will demand the most liquid currencies to meet external liabilities. Creditor countries can induce other economies to accept debt denominated in their currencies. However, countries issuers of currencies at the bottom of the hierarchy face difficulties to issue debt denominated in domestic currencies, which is referred in the literature as the 'original sin' (Eichengreen et al., 2003).

The currencies that are used to denominate debt contracts are referred in the literature as 'funding currencies' (McCauley and Zukunft, 2008; Kaltenbrunner, 2015). Particularly in times of uncertainty, investors will seek internationalised currencies to meet their outstanding obligations. As a result, the exchange rate in peripheral countries depreciate and the economy is constantly subjected to currency volatility, regardless of fundamentals or monetary policy credibility. In order to account for the difference natures of contracts, I also divided the unit of account function in two subcategories: the invoice currency for trade

contracts and the funding currency for financial contracts, as demonstrated in Table 2.

I highlight here a few observations from the currency hierarchy literature. Firstly, the post-Keynesian literature on currency internationalisation is very limited. However, while the concept of currency hierarchy is underdeveloped by IPE scholars, post-Keynesians focus on this literature to stress the asymmetries between central and peripheral currencies. Secondly, some post-Keynesians understand currency internationalisation as an accurate measure of currency hierarchy, in a similar framework to the IPE scholars. This research, however, is different from other post-Keynesian theories on currency hierarchy since it emphasises the different types of currency internationalisation. Also, as there is no measure for liquidity premium, it would be impracticable to create a currency hierarchy.

The internationalisation as a short-term currency investment does not move a currency to a higher position in the hierarchy, since its liquidity premium, that is, the agents' confidence in the currency, remains the same. Moreover, while the post-Keynesian literature discuss the centre-periphery dichotomy, I am particularly interested in analysing the differences within peripheral currencies. The distinction between currencies from developing and emerging countries allow us to understand the differences of liquidity among peripheral currencies.

Thirdly, in the absence of international money, investors have to face the trade-off between liquidity and profitability, demanding peripheral currencies as assets *per se*. The speculative demand for peripheral currencies increase the volume of capital flows to emerging countries. Consequently, countries that issue currencies located in the lowest ranks of the currency hierarchy have more exchange rate volatility. This seems to create a downward spiral, where the volatility of peripheral currencies increases the risk of holding them and attract speculative operations, making them even more volatile. Therefore, the speculative demand for currencies leads to exchange rate volatility, so these currencies tend to be less internationalised.

Methodology and Data Source

The methodology proposed to this section is the cluster analysis, which differs from other econometric approaches for being a procedure to detect different patterns using a set of data. Among other cluster techniques, the hierarchical clustering produces several clusters ranked in a hierarchical order. At the bottom of this hierarchy are placed clusters of individual points and at the top there is a single cluster embracing all the points.

The objective of this method is neither to analyse currencies as individual clusters nor to analyse all of them in one single cluster. The idea behind the cluster analysis is to find an optimal number of clusters that groups together currencies that have similar functions in the international monetary system. The clusters are homogeneous within and heterogeneous across, that is, currencies with similar characteristics are grouped in the same cluster, which differs from other currencies grouped in other clusters.

The use of hierarchical cluster analysis has three main benefits for our analysis. The first advantage of this method is that it allows us to identify currencies with the same type of internationalisation within a cluster. The second benefit of the cluster analysis is to compare the different types of internationalisation across the clusters. As a result, I can analyse not only the differences between central and peripheral currencies, but also within peripheral currencies. The third advantage is that the hierarchical cluster analysis does not require the specification of the number of clusters a priori (Tan et al., 2006). The optimal number of clusters can be defined based on the analysis of some outcomes of this method.

The cluster analysis estimated in SPSS aims to identify homogenous subgroups in our database. Firstly, I defined a measure for the distance between the observations, which quantifies how similar these currencies are. The lower the distance between two observations, the more similar they are. The measure chosen was the squared Euclidean distance, which is the shortest length between two points. The Euclidean distance (d) between two points (p and q) in

a Cartesian coordinate system, where $p = p_1, p_2, \dots, p_n$ and $q = q_1, q_2, \dots, q_n$, is derived from the Pythagoras' theorem[7], represented in the following formula:

$$d(p,q) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

It is important to notice that the distance is measured by the square of the standard Euclidean distance (d^2), which gives more emphasis to observations that are further apart, such as outliers. This measure is affected by differences in scale (e.g. meters and centimeters), however, as our sample is all measured in percentage[8], our analysis is not affected by this problem. The formula for the square of the standard Euclidean distance is:

$$d^2(p,q) = (q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2$$

Secondly, I chose the Ward's method to calculate the distance between the clusters, which analyses the proximity between two clusters in terms of changes in the error sum of the squares (ESS)[9]. The larger the ESS, the more different the clusters merged are. In other words, if the observations of two clusters merged become more distant from these clusters' average, then the clusters merged are less similar. Although it is prone to create small clusters, this method attempts to minimise the clusters' variance. The tables with the results for the choice of the optimal amount of clusters are in the Appendix section.

In the hierarchical solution, there is no rule regarding the choice of optimal number of clusters. This is a subjective decision to be taken from the analysis of the agglomeration schedule or the dendogram.

The agglomeration schedule in the Appendix section shows the different stages of the cluster analysis and their respective coefficient, which represents the distance of the combined clusters. At the beginning of this analysis, each cluster is formed by a single currency. At the first stage, the two most similar currencies are grouped in one cluster. At the following stages the most similar currencies or cluster of currencies are grouped together to form another cluster and so forth, until all the currencies are grouped in one single cluster.

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[7] The Pythagoras' theorem states that for all right-angled triangles, the square of the hypotenuse (d) is equal to the sum of the squares of the other two sides (p and q).

[8] Since the observations were in percentage, they were not standardize the observations into Z-scores or any other transformed values.

[9] The error sum of the squares is the sum of the difference between each observation and the mean of the sample.

A possible method to guide the decision on the optimal number of clusters is to plot the coefficients from the agglomeration schedule table into a line graph. At the point where there is a large increase in the coefficients the clusters merged can be considered too heterogeneous and, thus, one should not merge those. Another way to choose the optimal number of clusters is by analysing the dendogram (Tan et al., 2006) in the Appendix. The dendogram is a diagram that orders the merged clusters, where similar clusters are grouped on earlier stages and different clusters are located further away from each other. The optimal number of clusters will be at the point where the clusters are far from each other (represented by a horizontal line) and, thus, they are too heterogeneous.

Our sample is composed by 24 currencies from both developed and developing economies, as follows: Australian dollar (AUD), Brazilian real (BRL), Canadian dollar (CAD), Chinese yuan (CNY), Danish krone (DKK), Euro (EUR), Hong Kong dollar (HKD), Hungarian forint (HUF), Indian rupee (INR), Japanese yen (JPY), Mexican peso (MXN), New Taiwan dollar (TWD), New Zealand dollar (NZD), Norwegian krone (NOK), Polish zloty (PLZ), Russian ruble (RUB), Singapore dollar (SGD), South African rand (ZAR), South Korean won (KRW), Swedish krona (SEK), Swiss franc (CHF), Turkish lira (TRY), Pound sterling (GBP), United States dollar (USD). The selection criteria for our sample size was based on availability. As our main data sources publish data for the abovementioned currencies, these 24 currencies were selected for our empirical work. The data used on the different types of currency internationalisation is summarised in Table 3.

Due to the lack of data for the public sector, this empirical exercise only analyses the international money functions from the private sector perspective. Thus, the cluster analysis only includes data related to the private sector for all currencies of which data is available, as abovementioned. This study is a cross-section analysis with data on the international money functions for each of those 24 currencies in April 2016. The invoice currency data is published annually, so it refers to 2016. The funding currency and the long-term currency are published quarterly, so data on the first quarter of 2016 was used as a proxy for April 2016.

Table 3: Data on the Types of Currency Internationalisation

Function	Private
Means of Payment	*Vehicle*: Share of Global Foreign Exchange Market Turnover (BIS)
	Trade Settlement: Share of Currencies on Customer Initiated and Institutional Payments (SWIFT)
Unit of Account	*Invoice*: Share of Currency Denomination of Imports to the Extra-EU Trade (Eurostat)
	Funding: Share of Currency Denomination of International Debt Securities issued by non-residents (BIS)
Store of Wealth	*Long-term*: Share of Domestic Currency in International Debt Securities issued by residents (BIS)
	Short-term: Share of Hedge funds and Proprietary Trading Firms in Total Turnover (BIS)

Data for vehicle currency is captured by the volume of transactions in the foreign exchange market. An indicator of this type of internationalisation, where currencies are used as means of payment, is the currency *Share of Global Foreign Exchange Market Turnover* published by the Triennial Survey of the Bank for International Settlements (BIS). The foreign exchange (forex) turnover captures the volume of transactions for the following instruments: spot, outright forward, forex swaps, currency swaps, options and other financial products. Another data used for this function is the *Share of Cross-Border Turnover*, that measures the share of the currency turnover outside the local country. This data is also analysed as a share of the Gross Domestic Product (GDP) of the issuer country.

I also analysed data on the currency use as intermediaries for transactions, that is the trade settlement currency, measured by the *Customer Initiated and Institutional Payments*. This data is available on the Renminbi Tracker study, published by the Society for Worldwide Interbank Financial Telecommunication (SWIFT). Although this data is published monthly, it only displays the top 20 most

traded currencies, which accounts for roughly 98% of international payments. For this reason, there was no data for some of the peripheral currencies in our studies, which are not internationalised as means of payment. As these currencies represent less than 0.2% of the international payments, I assume this missing data to be equal to zero.

The unit of account function at the private level, which is closely related to the trade settlement currency, can be analysed through surveys, although this data is still very limited (Cohen and Benney, 2013). As a proxy for trade invoice currency, I analysed the currency denomination Extra-European Union (EU) imports[10], available at Eurostat website. The downside of this data is that it does not present the currency denomination for other countries outside Europe, so that our database is incomplete. However, as most of the trade invoice is denominated in the major currencies of the international monetary system and the other currencies share on the invoice trade is very insignificant, I again assume the missing data to be equal to zero. Another limitation regarding this function is that I use Extra-EU imports to be representative of the world's import volume.

This function was not only analysed in terms of trade, but also in relation to the financial market. As a proxy for the funding currency, I collected data on the *Share of Currency Denomination of International Debt Securities issued by non-residents*, which is published by BIS. This data can be interpreted as the currency on which investors will borrow funds for transactions or speculation. However, there is no information for the South African rand and, for this reason, I assumed this currency to be zero.

Lastly, I proposed to analyse the store of wealth function for the private sector in a short and a long term perspective. Under normal conditions, investors will not hold a currency to store their wealth through time, as there is no interest paid on money. Instead, they will hold in their portfolio assets denominated in an investment currency. In the long term perspective, the currency is internationalised as an investment currency, which can be measured by the *Currency Denomination of International Debt Securities and Banking Liabilities*, published by BIS. For the short-term investment role, I use the data on the share

[10] Extra-EU refer to countries that do not belong to the European Union. I use imports instead of exports to avoid the overestimation of local currencies, which, in this case, would be the euro.

of hedge funds in total turnover, which are generally related to speculative activities, such as carry trade operations (McGuire and Upper, 2007).

Results

At the first stage of our study, I conducted a hierarchical cluster analysis[11] for the 24 currencies in our data basis, using all of the variables abovementioned that were available. The outcomes of the cluster analysis suggested that there should be between two and four different clusters for our sample. As one can observe on the Table 4, if I choose the optimal number of clusters to be two, it is merged together on a first cluster several currencies that have very different levels of importance and functions in the international monetary system such as pound sterling, Japanese yen, Mexican peso, Polish zloty and others. In a second cluster, it is grouped the US dollar and the euro, which seem to behave as outliers in this sample due to their high levels of internationalisation.

When I repeat the analysis with three clusters, the Japanese yen, the pound and the Chinese yuan are merged in a single cluster, the US dollar and the euro were grouped in another cluster and all of the remaining currencies were placed together in a third cluster. Lastly, when I analyse the data using four cluster, the previous structure remains the same, apart from the fact that the US dollar and euro are divided into single clusters.

This can be explained by the fact that the US dollar is the key currency of the international monetary system and fulfil all the international money functions. The literature also describes the Euro to be a currency that fulfils all the international money functions, although in a lower degree than the US dollar. Therefore, I can infer that both the US dollar and the Euro are outliers in our sample. For that reason, I excluded those two currencies from our database in order to be able to analyse and understand the differences in the types of currency internationalisation for the other currencies in our sample.

[11] In order to understand the cluster analysis' results and the reason why certain currencies were grouped together, one must take a look at the data collected, which is available at the end of the appendix. However, it is not the objective of this paper to study at this point the determinants of a currency to be internationalised in a certain type. At this stage, the types of currency internationalisation and which currencies belong to each group are being identified.

Table 4: Cluster Analysis 1 (all currencies)

Cluster Membership			
Currency	4 Clusters	3 Clusters	2 Clusters
INR	1	1	1
TWD	1	1	1
DKK	1	1	1
KRW	1	1	1
RUB	1	1	1
HKD	1	1	1
NOK	1	1	1
NZD	1	1	1
BRL	1	1	1
MXN	1	1	1
PLN	1	1	1
TRY	1	1	1
HUF	1	1	1
CHF	1	1	1
SGD	1	1	1
SEK	1	1	1
ZAR	1	1	1
AUD	1	1	1
CAD	1	1	1
CNY	2	2	1
GBP	2	2	1
JPY	2	2	1
EUR	3	3	2
USD	4	3	2

In a second stage of our analysis, excluding the US dollar and the Euro, I repeated the same hierarchical cluster analysis using the same method and measure for distance. After the outliers were excluded, it was possible to analyse the differences among the other currencies that were merged together in another cluster, although they are internationalised in different ways. The results have now suggested grouping the currencies into three to six clusters.

As demonstrated on the Table 5, when I choose 3 or 4 clusters, the Chinese yuan remains merged with other central currencies such as the Japanese Yen and the British pound, even though China is still considered an emerging country and the

literature often recognised its currency as peripheral. Other major currencies such as the Australian dollar, Canadian dollar, Swedish kronor and Swiss franc are grouped together in another cluster. One may notice that currencies such as South African rand and the Singapore dollar also showed up in the latter cluster due to their higher level of debt securities issued by residents denominated in local currency (long-term investment).

Table 5: Cluster Analysis 2 (excluding USD and EUR)

Cluster Membership				
Currency	**6 Clusters**	**5 Clusters**	**4 Clusters**	**3 Clusters**
INR	4	2	2	2
TWD	4	2	2	2
DKK	4	2	2	2
KRW	4	2	2	2
RUB	4	2	2	2
HKD	4	2	2	2
NOK	2	2	2	2
NZD	2	2	2	2
BRL	2	2	2	2
MXN	2	2	2	2
PLN	2	2	2	2
TRY	2	2	2	2
HUF	2	2	2	2
CHF	1	1	1	1
SGD	1	1	1	1
SEK	1	1	1	1
ZAR	1	1	1	1
AUD	1	1	1	1
CAD	1	1	1	1
CNY	3	3	3	3
GBP	5	4	3	3
JPY	6	5	4	3

If I choose the optimal number of clusters to be five, the only difference is that the Japanese yen, the pound and the Chinese yuan are unmerged into three single clusters, which highlight the differences among these currencies, particularly in terms of the degree of internationalisation as means of payment. The Japanese yean seem to be more internationalised as vehicle currency in the forex market, while the pound is more internationalised as trade settlement,

short and long term investments[12]. In a lower degree, the Chinese yuan is internationalised as means of payment (both vehicle and trade settlement) and, in a higher degree, it is also internationalised as long-term investment.

Finally, if I choose six clusters for our analysis, I can see that besides the clusters created as described above, the currencies which are less internationalised are also divided in two other clusters. The first cluster contains currencies mainly from emerging countries, such as the Turkish lira, Polish zloty, Mexican peso and the Brazilian real, which are all internationalised as short-term investment. It is important to highlight that this cluster also embraces currencies from developed countries, as the Norwegian krone and the New Zealand dollar. These currencies have a small contribution, but greater than other EME[13], in terms of means of payment. The second cluster groups those currencies that have very low degrees in every type of currency internationalisation and are, therefore, more irrelevant to the international monetary system.

[12] The pound is also more internationalised as trade invoice, however this data may be overestimated in comparison to the Japanese yen due to the greater importance of the United Kingdom in European trade (data used for the invoice currency).

[13] The Mexican peso also has a slight higher degree of internationalisation as means of payment.

Conclusion

As discussed in the literature review, this paper adopts a post-Keynesian approach in the sense that currency hierarchy is shaped by the liquidity premium. It is important to emphasise that the liquidity premium, which is the opportunity costs economic agents are willing to incur in order to hold a more liquid currency or assets denominated in a liquid currency, differs from the preference for liquidity. While the latter might increase in times of more uncertainty, the liquidity premium is rigid in the short term, as it reflects the agents' confidence degree in currencies. Thus, the demand for those liquid assets might also increase in times of higher uncertainty[14].

The results obtained from cluster analysis shows the increasing importance of the Chinese yuan in the international markets, particularly as means of payments. This result is consistent with the literature of the renminbi internationalisation. However, peripheral currencies are often analysed as a single group, which does not account for the differences among these currencies.

Another important result from the cluster analysis is that some currencies from emerging countries are only internationalised as short-term investments. I argue that these countries which issue short-term investment currencies experience large volumes of speculative capital flows, which consequently boosts exchange rate volatility and, in the long term, reduces currencies' liquidity premium. Therefore, I conclude that currencies internationalised as short-term investment do not improve their position in the currency hierarchy. In other words, the relationship between currency internationalisation and currency hierarchy is not linear.

Therefore, the concepts of liquidity premium and currency hierarchy can be used to provide explanation for the reason why currencies from emerging countries have been used for speculative purposes. Even though most currencies from emerging countries have an small share of the international market when compared to central currencies, it still very important to analyse the different types of currency internationalisation, in order to understand the

[14] I do not attempt to build a currency hierarchy based on this data, as this concept is rigid in the short-term and, this, this is outside the scope of this research.

determinants and implications for those currencies that are located at the bottom of the hierarchy.

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Appendix

Table 6: Data (All Currencies) *

Case	Currency	Vehicle	TradeSet	Invoice	Funding	LT Inv	ST Inv
11	INR	1.1%	0.0%	0.0%	0.0%	0.4%	2.3%
22	TWD	0.6%	0.0%	0.0%	0.0%	0.0%	2.6%
6	DKK	0.8%	0.4%	0.2%	0.0%	1.4%	3.0%
13	KRW	1.6%	0.0%	0.0%	0.0%	0.0%	3.6%
18	RUB	1.1%	0.0%	0.0%	0.1%	2.9%	3.8%
9	HKD	1.7%	1.1%	0.0%	0.3%	7.0%	2.4%
15	NOK	1.7%	0.7%	0.2%	0.3%	2.7%	10.1%
16	NZD	2.1%	0.4%	0.0%	0.2%	3.5%	9.5%
2	BRL	1.0%	0.0%	0.0%	0.2%	4.3%	10.2%
14	MXN	2.2%	0.3%	0.0%	0.1%	5.7%	9.7%
17	PLN	0.7%	0.6%	0.2%	0.0%	0.8%	7.6%
21	TRY	1.4%	0.3%	0.0%	0.1%	0.6%	6.8%
10	HUF	0.3%	0.2%	0.0%	0.0%	0.0%	9.7%
4	CHF	4.8%	1.5%	0.1%	1.2%	15.9%	7.8%
20	SGD	1.8%	1.0%	0.0%	0.2%	13.5%	6.0%
19	SEK	2.2%	1.1%	0.3%	0.5%	11.4%	9.2%
24	ZAR	1.0%	0.5%	0.0%	0.0%	9.3%	7.8%
1	AUD	6.9%	1.6%	0.0%	1.2%	9.1%	9.2%
3	CAD	5.1%	1.8%	0.0%	0.7%	11.5%	10.6%
5	CNY	4.0%	1.8%	0.0%	0.5%	28.3%	5.0%
8	GBP	12.8%	8.4%	3.2%	9.1%	37.9%	8.1%
12	JPY	21.6%	3.2%	0.0%	2.0%	23.8%	7.7%
7	EUR	31.3%	30.7%	35.8%	39.5%	68.2%	7.0%
23	USD	87.6%	41.9%	53.1%	43.1%	70.7%	7.3%

* Missing data in red.

Table 7: Agglomeration Schedule Coefficients (Excluding USD and EUR)

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	11	22	.251	0	0	4
2	17	21	.891	0	0	9
3	15	16	1.565	0	0	6
4	6	11	2.959	0	1	5
5	6	13	4.474	4	0	11
6	2	15	6.258	0	3	7
7	2	14	10.101	6	0	14
8	19	24	14.478	0	0	13
9	10	17	19.510	0	2	14
10	1	3	24.942	0	0	13
11	6	18	30.552	5	0	15
12	4	20	40.065	0	0	16
13	1	19	62.888	10	8	16
14	2	10	92.420	7	9	17
15	6	9	124.246	11	0	17
16	1	4	157.468	13	12	20
17	2	6	280.282	14	15	20
18	5	8	433.378	0	0	19
19	5	12	617.453	18	0	22
20	1	2	1037.077	16	17	22
21	7	23	2846.067	0	0	23
22	1	5	4804.429	20	19	23
23	1	7	26203.575	22	21	0

Figure 1: Agglomeration Schedule Coefficients (Excluding USD and EUR)

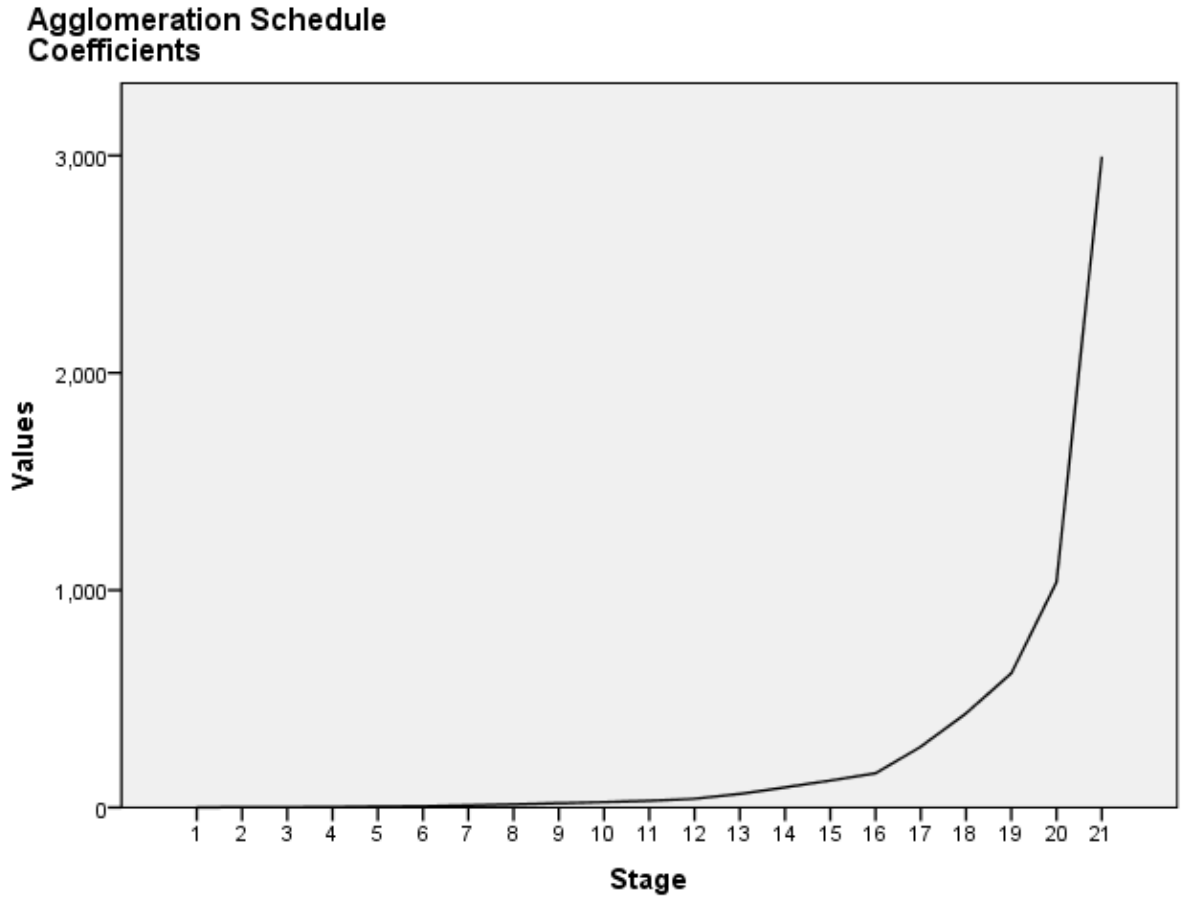

Figure 2: Dendogram (Excluding USD and EUR)