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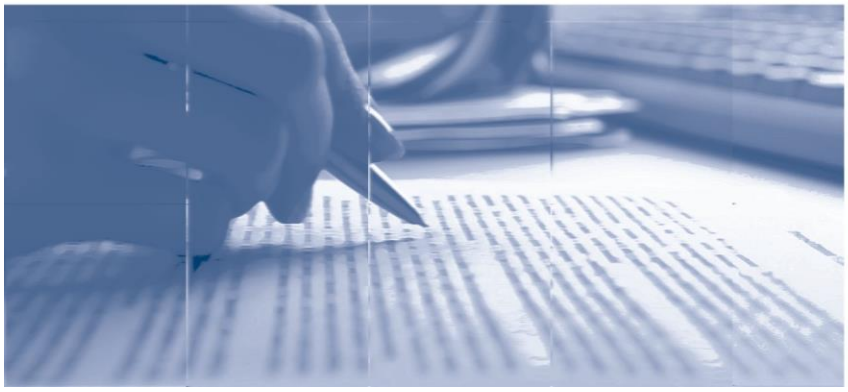

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Invoice Currency: puzzling evidence and new questions from Brazil*

Daniel Gersten Reiss**

Abstract

This article for the first time uses Brazilian trade data to draw conclusions about the invoice currency choice—both in general and as it pertains to the Brazilian real (BRL). We find that the Brazil-Argentina policy of providing payment orders associated to an exchange transaction between their currencies has had a significant impact on the currency chosen for invoicing, establishing a link between the availability of financial instruments and the invoice currency choice. Moreover, the evidence does not confirm some previous international results. We identify that in Brazil there is no coincidence regarding the use of BRL for invoicing and its use for making payments. Yet we find that the main exports denominated in BRL are homogenous goods—sugar and tobacco—suggesting that some bargaining power might remain even if goods are traded in international markets. From the BRL-specific perspective, we categorically move away from the idea that the BRL is not used in Brazilian international trade. Although it is used at a limited absolute volume, an exceptional ninefold growth between 2007 and 2011 is observed. New intriguing questions about Brazilian currency usage can therefore be proposed.

Keywords: trade invoicing; Brazilian real use; currency denomination; binational payment system.

JEL Classification: F14, F39, F20, E58, E42, F13, D23

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1 Introduction

Discussions about the Brazilian real (BRL)'s international role tend to suffer from the same difficulty—the question of whether the BRL even has any international role. Here, we settle this fundamental question, letting Brazilian debates on international trade and currency use to go further. Departing from a base definition in which international currency is one used beyond the limits of its issuing country, we report that some agents do use the Brazilian currency for invoicing foreign trade.

We register, for the first time, the Brazilian foreign trade according to its invoice currency, exploring the Brazilian Ministry of Development, Industry and Foreign Trade (MDIC) series from 2007 to 2011. Our description allows the proposition of fresh questions on Brazil's economic integration—both policy and analytic ones—, while the evidences we report challenge some previous findings and predictions in the economic literature. In this way, this study fills one gap in the studies of the Brazilian economy and the BRL use, besides contributing with new evidences for discussions on the international usage of currencies.

Understanding the international role of a currency have major policy implications. Scholars have been discussing the international stance of money in a large spectrum—from the ability to compel other economies (Kirshner, 1997; Andrews, 2006) to the inability to access international markets (Eichengreen et al., 2005; Hausmann and Panizza, 2011). Here, we deal with the currency's international role as a unit for setting price in trade, what is usually related to implications on the effectiveness of macroeconomic policies. Currency invoicing is one explanation for the connection between price rigidities and the exchange rate highlighted by Obstfeld and Rogoff (1995) (Betts and Devereux, 1996; Engel and Rogers, 2001; Bacchetta and van Wincoop, 2005). Regarding to Brazil, the exchange rate pass-through to the local economy has already caught some attention (Belaisch, 2003; Correa and Minella, 2010; Nogueira et al., 2013). The same cannot be said about the BRL-invoicing though.

The literature gap on the Brazilian currency international use may be explained by the historical fragility of the Brazilian economy, which was seen in numerous currency replacements, mainly in the late 1980s. From 1986 to 1993, Brazil had five different

currencies[1]. The BRL adoption in 1994 was a milestone of economic transformations in Brazil that allow the broadening of the country's current currency discussions.

Exports paid in BRL were not allowed in Brazil until April 2007. In the former shortage of foreign currency framework, export revenue was the main source of obtaining foreign exchange. The obligation to receive foreign trade revenue in a foreign currency was the way to deal with that restriction. The changes in the economic environment and the resulting increased availability of foreign currencies overcame this restraint in an environment where restrictions on foreign exchange were also progressively removed.

Alongside this policy change, another government policy affected BRL invoicing during the examined period. In October 2008, Brazil and Argentina launched a bilateral payment system, the Local Currency Payments System (SML, Portuguese acronym), which made available a financial instrument to set trade payments in the local currencies. One request to use the system is however that the trade operation had been invoiced in the exporter's national currency. So, traders willing to use the payment system were driven to invoice Brazilian exports in BRL or Brazilian imports in Argentinean pesos (ARS).

Because of the aforementioned Brazilian economic history, nearly all Brazilian exports are invoiced in United States dollars (USD). The residual share is invoiced in other international currencies. However, the BRL is indeed used to invoice trade and its usage grew by nine times in five years. We describe this growth to contribute to the understanding of the BRL on the international stage and to understand the behavior of currency invoicing from the point of view of a noninternational currency.

Moreover, after establishing that the BRL is voluntarily chosen to invoice some trade operations, we take another step in providing a new research agenda to the Brazilian currency and report interesting findings coming up from Brazilian data, surveying some current topics in currency invoicing. We notice that the government provision of a financial instrument—the SML—impacted the invoice currency usage. Setting up this link enhances the importance of assessing the BRL invoicing standards and confirms our claim that, although limited, the role played by the BRL in the international stage can contribute to answers a large set of questions. In addition, we find that being a homogeneous good is not sufficient to make it to be invoiced in an international currency, as sugar and to-

[1]The Brazilian currencies during that period were as follows: 1967–86, the cruzeiro novo, renamed cruzeiro in 1970 (BRB); 1986–89, the cruzado (BRC); 1989–90, the cruzado novo (BRN); 1990–93, the cruzeiro (BRE); and 1993–94, the cruzeiro real (BRR) (Banco Central do Brasil, 2007).

bacco are the products the most exported in BRL. This contradicts usual expectation that homogeneous products in the international market being traded in commodity exchanges are expected to be invoiced on an international currency (McKinnon, 1979; Krugman, 1980) and points towards the occurrence of some bargaining power in invoicing (Friberg and Wilander, 2008; Ito et al., 2012; Goldberg and Tille, 2013). We also find that in the Brazilian case the currency chosen to invoice is not the same one chosen for paying, as it has been consistently reported in the literature (Friberg and Wilander, 2008; Ito et al., 2013; Zhang, 2014).

This article is presented in six sections. In the following section, we provide some background on currency internationalization and the discussions on the use of vehicle currencies. Then, in section 3, we describe our database and the methodology. Section 4 describes in which currencies the Brazilian trade is invoiced. Besides the prevailing United States dollar (USD), we find that other international currencies and the local currency (BRL) are also used in trade. We find also that in imports a small amount of trade is also invoiced in the exporter's noninternationalized local currencies. In this section we also note that the BRL-invoicing share grew during the observed period. Section 5 deals with the BRL-invoiced data. We describe the main trade partners and the main products invoiced in the domestic currency. In this section, we stress that some outcomes of the Brazilian trade analysis challenge some previous findings from the literature, both theoretical and empirical. Section 6 concludes.

2 Currency internationalization and vehicle currencies

Currency internationalization is a process by which the functions of a domestic currency are acknowledged by economic agents beyond the issuing country's frontiers[2]. Two of these functions are the medium of exchange and the unit of account. They correspond in the international trade transactions with the currency that denominates the asset exchanged for a good and the currency used to denominate the invoice price of an operation. Although the currency used for invoicing a trade operation and for settling it may

[2]See Kenen (2011) for an accordingly international currency definition. However, even if the term country is used throughout this article, we use it in order to represent not only a country but also a set of countries forming a coalition intended to issue a single currency. For example, the Eurozone comprises fifteen countries that, through a common monetary authority (the European Central Bank), issue the euro. The euro is legal tender in all of these countries' territories.

not be the same, some researchers found that they usually match–the same currency is used in both cases (Friberg and Wilander, 2008; Ito et al., 2013).

Following these considerations, the incidence of a currency being used for denominating foreign trade is an indicator of the level of its international acceptance[3]. By choosing a currency to invoice their trade, the exporter and the importer endorse their understanding that the chosen currency is acknowledged as a unit of account for both and confirm it as a medium of exchange.

We may then ask which currency is to be chosen. It can be the currency issued by the exporting country, the one issued by the importing country, or a currency issued by a third party. This third-party currency, different from those issued by the trading countries, is known as vehicle currency. In this article, the term invoice currency is the currency in which the trade operation amount was invoiced.

Three literature approaches on vehicle currency choice are summarized by Goldberg and Tille (2008). The first one focuses on financial transactions instead of trade. In this approach, transaction costs arising from the currency use are essential to the choice of the currency in which an agent invoices. Transaction costs are primarily associated with currency liquidity characteristic of international financial markets (Swoboda, 1968, 1969). The second approach focuses on relating the invoice currency choice of a product to specific characteristics of its industry. Agents trading products with homogenous characteristics and trading in specific markets would present a higher propensity to point to a single international currency, which allows pricing and trading to occur without adding extra costs (McKinnon, 1979; Krugman, 1980). The third approach relates the invoice currency choice to the currency's macroeconomic predictability. Accordingly, an agent chooses the invoice currency in order to minimize the expected revenue volatility (Baron, 1976).

In addition to the reasons why an agent chooses to invoice in a particular currency, other core questions about trade invoicing may be summarized in how the invoice currency choice influences the internationality[4] of a currency and how the currency's internationality influences agents when choosing a currency to invoice their operations. It

[3]For a discussion on advantages and disadvantages of having an international currency, see, for example, Papaioannou and Portes (2008), Frankel (2012), and Cohen (2012).

[4]We understand internationality to be the tendency for a currency's properties to be acknowledged by nonresident agents.

is a reasonable assumption that international currencies are more likely to be chosen as invoice currency by two different parties, mainly because of the net externalities effect reported by Flandreau and Jobst (2009). A specific invoice currency is chosen because everyone else made the same choice. Yet an international currency's acceptance is a function of its share in international trade payments, as summarized by Wu et al. (2010), who investigated conditions of the currency internationalization process. Therefore, an understanding of the BRL's international role and its world positioning relates in part to its use in Brazilian foreign trade, as we describe in this article to register the BRL's standing.

The research on the BRL as invoice currency intends to analyze the ninefold growth between 2007 and 2011 in its total share in Brazilian foreign trade, up from 0.13% to 1.25%. Although limited the BRL's total share as an invoicing currency, the usage-level difference over five years is significant.

3 Data and methodology

3.1 Trade data

We analyzed the Ministry of Development, Industry and Foreign Trade (MDIC)'s monthly exports and imports data from 2007 to 2011. The MDIC records every export and import transaction made from and to Brazil. Both export and import values are recorded as their FOB[5] values (without freight or insurance costs) by the MDIC. The data are obtained from the export declaration presented by an exporter to the MDIC and from the import declaration presented by an importer to the federal revenue service (*Receita Federal do Brasil*, RFB). Traders declare each operation's invoice currency and amount. The declared amount is converted into USD, according to the daily exchange rate, and stored at the database in this currency.

The evaluated data are detailed by country and by subitem according to the Mercosul Common Nomenclature (NCM, Portuguese acronym; 8 digit level). This nomenclature is an extension of the World Customs Organization's Harmonized Commodity De-

[5]Following the INCOTERMS 2010, the free on board (FOB) value is the one that considers the good's value without the addition of freight and insurance costs. This is distinguished from the CIF value, which considers the good's value plus the values of insurance and freight and is the usual method to register import data according to World Trade Organization (WTO) statistics.

scription and Coding System (HS). In the NCM, two additional digits are aggregated to the original six from the HS system, and the NCM is standardized for Mercosul customs purposes.

We could not obtain data detailed by firm, so it was not possible to verify, in particular, the hypothesis that registers in local currency are due to the multinational firms' internal accounting. Firms with Brazilian and foreign operations have their international intrafirm logistics accounted as exports and imports as they are different firms. Nonetheless, it is arguable that the accounting factor outweighs the commercial factor, so invoicing in the domestic currency would be because of the will to avoid foreign exchange volatility in one firm's balance and not because of an unrestricted currency choice. The unavailability of detailed data by firm prevents verifying this hypothesis.

The amounts registered in the Brazilian trade database are in US currency. The use of this currency as the record currency is significant. It explicitly shows how the domestic economy is dependent on an external reference. This is similar to the situation in other countries, as discussed later. However, Brazil depends highly on the US dollar as a reference. So although the present study is focused on the invoice of Brazilian foreign trade in BRL, the data are shown in USD.

From the data, we dropped the records resulting from ships and aircraft supply unless otherwise noted. The operations registered for this purpose, like fuel, maintenance spare parts, and food supply, take place to supply needs of foreign ships and aircraft while in transit in Brazil. Although exports, these expenditures are due to local consumption. Thus, we assume there is a natural bias when traders choose the domestic currency to invoice. A significant share of BRL invoices are due to these operations, on average: 71% from 2007–8 and 23% from 2009–11. Not dropping them would overestimate transactions in the Brazilian currency resulting from cases when the buyer has limited ability to choose a currency other than the local one.

Regarding import data, we must be particularly cautious concerning their interpretation. The MDIC's database records as origin country the one where the merchandise was produced, not the nationality of the foreign firm that carried out the sale (Ministério do Desenvolvimento, Indústria e Comércio Exterior, 2013). So there is merchandise for which the documented origin is Brazil. This merchandise was formerly exported to a foreign country and later exported back to Brazil, being registered as a Brazilian import

of Brazilian merchandise. These Brazilian-origin merchandise data were also dropped from data tables because they do not provide a significant explanation of the origin of BRL-invoiced products, which is the goal here. This Brazil-originated merchandise did not reach 0.05% until 2009 but showed a significant share in 2010 at 17.68% and in 2011 at 8.65%. Most of these later figures are related to train imports: 12.56% and 5.03% are due to these operations.

We assume the difference in inflation between domestic and foreign currency is absorbed by the exchange rate between the two currencies. Additionally, deflating by the USD inflation (8.5%) or by the BRL inflation (24.6%) would bring us different relative results with little contribution to our work[6]. Studying the BRL use with data recorded in USD has a natural choice of which unit is used as reference. As the magnitude of BRL use growth (960%) is considerably higher than inflation rates (8.5% and 24.6%), we do not consider these rates to be the exclusive cause for the overall result. Thus, the exchange rate volatility during the period replaces the series deflating, and we present in nominal current values for each year. We discuss the exchange rate volatility later in this article.

3.2 Trade-related financial data

We also use two different sets of data to identify BRL-denominated payments and contrast trade and financial figures on subsection 5.4. The first set comes from the Central Bank of Brazil (BCB) TIR database. It registers the payment orders between a resident and a nonresident in Brazil in BRL, which are known as international transfer of BRL (*Transferência Internacional de Reais* [TIR], Portuguese acronym).

Financial institutions are required to report all operations above BRL 10,000. This is the same limit an individual would face to legally carry money in cash on a cross-border movement without having to report it, according to the anti–money laundering regulations. Additionally, we assume that financial institutions outside Brazil do not significantly provide services in BRL–if so, the account is available through a corresponding bank offering an account held in fact in Brazil. So any payment made in BRL is assumed to be held in Brazil, meaning that financial institutions providing BRL transfer services are under Brazilian market regulation, thus having to register these operations at the Cen-

[6]The USD inflation is the 2007–11 United States Consumer Price Index (CPI) variation and the BRL inflation is the 2007–11 Brazil Extended National Consumer Price Index (IPCA) variation.

tral Bank of Brazil.

The second BRL-denominated financial source is the BCB's SML data. The SML payment order is another option for internationally settling in BRL and applies only for Brazil-Argentina trade. A SML payment order is a cross-border remittance of BRL from Brazil to Argentina, which may be used to receive payment for Brazilian exports. According to regulation, these Brazilian exports must have been invoiced in the exporter's national currency. Thus, Brazilian exports paid in BRL through SML correspond to an equivalent BRL-invoiced exports amount. The SML payment for Brazilian imports is not considered for our purposes as it is fixed in ARS even if the importer's payment is indeed made in BRL.

3.3 International currency definition

Throughout this paper, we consider a currency that is sufficiently used in international trade to be an international currency, whereas a noninternational currency is one whose use is limited to the issuing country borders.

As criteria for a sufficiently used and convertible currency in international trade, we set those currencies available for use in the Continuous Linked Settlement system (CLS). The CLS is a private settlement system that offers the international settlement of transactions between different currencies. We choose the CLS participation as the criteria for convenience. The binary answer to the currency internationalization issue substantially simplifies the evaluation of currency characteristics regarding the perception by agents worldwide. This is why we consider a continuous index more appropriate to represent a currency's international status. Nevertheless, the binary answer given by the CLS participation is a sufficiently comprehensive set and is adequate for the considerations of this article. Accordingly, the 17 currencies available in the CLS are those we consider to have the international status[7] (CLS GROUP, 2012).

[7] In order to join the CLS, a currency shall be considered *sufficiently convertible*. For that reason, we use this market perception to determine the internationally convertible currencies in this article. Clearly, CLS membership is also subject to political criteria, as, for example, the US Federal Reserve (Fed) shall approve the currency. We understand these issues to be noneconomical restrictions on a currency being part of the CLS. This consideration is beyond this article's objective. Aware of that, we understand that a currency being part of the CLS is enough to indicate that it shows a high internationality level due to its *sufficiently convertible* considerations.

4 Invoice currencies in the Brazilian foreign trade

In this section, we look into the distribution of currency usage in Brazilian foreign trade. Here, our aim is to show which currencies are used to invoice in Brazil and to stress the BRL-invoicing occurrence. Common wisdom drives to the idea that in no occasion the domestic non-international currency is preferred to any other currency in Brazil, allowing no international role to the Brazilian currency. Regardless the argument used to state so—whether it is consequence from the existence of a much more efficient global currency or that it is consequence from a center-periphery relationship—, we establish that this absence of international role is not true. We report that the BRL is indeed voluntarily used to invoice trade and establish that it plays some international role, at least as a medium of exchange for some group of agents.

As mentioned in section 1, Brazilian exporters were forbidden to receive their payment in domestic currency until 2007, the year our data series begins. From 2007 to 2011, we see that the Brazilian exports' distribution by invoice currency is highly concentrated. Eleven currencies were used to invoice, having the USD been used to invoice approximately 95% of the total exported amount. All currencies used to invoice exports are international currencies, except the domestic BRL. Besides the USD, the remaining amount is invoiced mainly in euro (EUR) and residually in the other nine currencies, including the BRL[8]. Table 1's left columns (exports) shows a summary of these data.

Unlike Brazilian export invoicing, the invoice of imports does not occur exclusively in international currencies or BRL. Although the international currencies' share is at 99.98% of imports, other noninternational national currencies are also identified in addition to the BRL. The remaining 0.02% (about USD 220 million) is distributed among a large set of currencies. Brazilian importers accept different currencies to invoice minor operations. During the analyzed period, the number of currencies in this set increased slightly from 32 (in 2007) to 36 (in 2011). The right side of table 1 (imports) consolidates the data on international currencies and the BRL share. Figure 1 explicits the BRL-invoicing ninefold growth in the five-year period in exports and the fourfold growth in imports.

[8]The nine additional currencies are the BRL, the pound sterling (GBP), the Japanese yen (JPY), the Swedish krona (SEK), the Canadian dollar (CAD), the Australian dollar (AUD), the Swiss franc (CHF), the Norwegian krone (NOK), and the Danish krone (DKK).

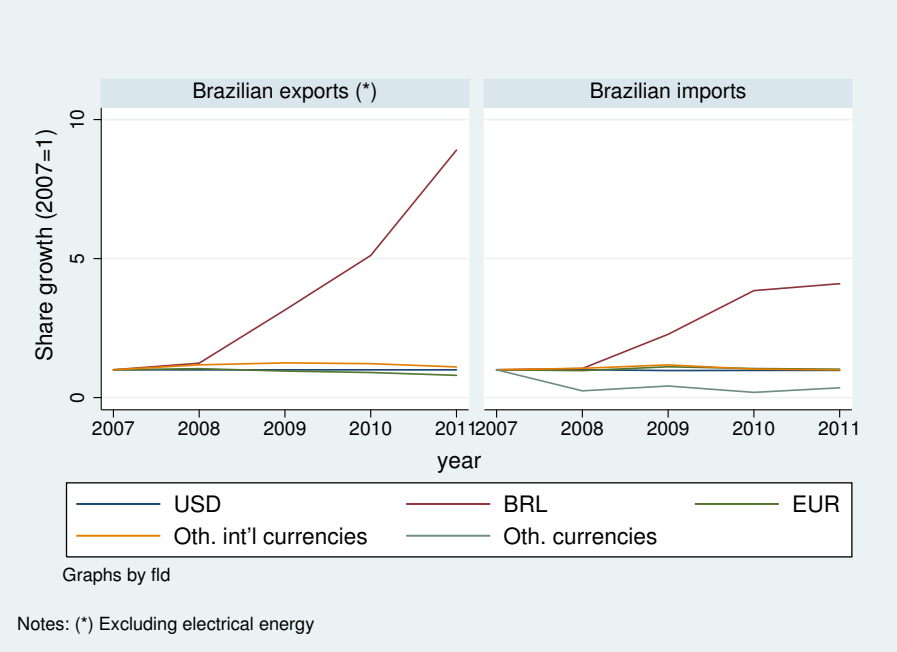
Table 1: Currency share of invoicing value of Brazilian exports and imports, by currency, 2007–11 (%)

Currency		Exports					Imports				
		2007	2008	2009	2010	2011	2007	2008	2009	2010	2011
US dollar	USD	94.7	94.4	93.8	94.3	94.5	85.5	85.7	83.2	83.6	83.8
Euro	EUR	4.76	4.95	4.51	4.28	3.80	11.1	10.7	12.2	11.6	11.3
Brazilian real	BRL	0.13	0.16	1.11	0.82	1.25	0.48	0.50	1.08	1.83	1.95
Other int'l currencies		0.44	0.52	0.55	0.54	0.49	2.95	3.11	3.47	3.02	2.94
Other currencies		-	-	-	-	-	0.07	0.02	0.03	0.01	0.02

Source: Ministry of Development, Industry and Foreign Trade

Note: Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding. The currencies represented as "other international currencies" are: the pound sterling (GBP), the Japanese yen (JPY), the Swedish krona (SEK), the Canadian dollar (CAD), the Australian dollar (AUD), the Swiss franc (CHF), the Norwegian krone (NOK), and the Danish krone (DKK).

Figure 1: Currency share growth, by currency (2007–11)



While still being predominant in Brazilian import invoicing, the USD has a smaller share: approximately 85%. On the other hand, the EUR import share is twice as large as its export share. It stayed steady at an 11% level. The BRL is third, growing from 0.5% to almost 2% in 2011, at a level similar to the JPY and above the GBP. When comparing BRL-invoiced exports and imports, it is clear that imports in BRL experienced less growth. However, its 1.95% share is higher than the 1.25% export share.

One drawback challenging growth of BRL use is the foreign exchange variation. As reported in the previous section, Brazil's foreign trade is recorded in USD. Thus, changes in other currencies' share could be attributed to their exchange rate against USD variation. Consequently, we might be cautious in concluding that there was a substitution of invoicing in one currency for another by only evaluating the trade flow data detailed by the operation's invoice currency.

Figure 2: Exchange rate variation (2007–11)

Source: Central Bank of Brazil

Figure 2 displays the variation of the BRL and the EUR against the USD from 2007 to 2011, normalized for the first day. During this period, the BRL pursued an appreciation trend against the USD, strongly reversed during the international financial crisis worsening. The EUR followed a similar trend during the early period on a smaller scale. After the crisis worsened, EUR appreciation weakened, and the gap between the two currencies' rates suggests some impact over the analysis of the nominal Brazilian trade data recorded in USD.

We focus on the BRL-invoicing share increase. Even considering the exchange variation in the period, the increase in invoice share was significant for the BRL: exports grew from 0.13% to 1.25%. The BRL invoicing share was nine times higher while the annual average exchange rate fluctuated by less than 15%. Compared to the 2007 level, the daily closing rate average was 6% lower in 2008, 2% higher in 2009; 10% lower in

2010, and 14% lower in 2011. As argued for inflation, the exchange rate variation is not sufficient as the only explanation for BRL use growth.

While the USD share in export invoicing remained stable during the series plotted in table 1, the BRL share significantly increased with the decrease of the EUR and other currencies' share. This confirms our curiosity about the BRL increase phenomenon. The BRL was used as invoice currency in operations in 24 different countries in 2007; in 2011, the number of countries of destination increased to 96 countries.

5 Trade-in-BRL outlook

The following subsections deal with the BRL usage. After establishing in the last section that the BRL is used in trade, here we observe that the BRL usage has grown in subsection 5.1. In subsection 5.2, we report that this growth was remarkably significant when looking into Brazilian trade with Argentina and we suggest that the bilateral payment system implemented by the national governments has driven the invoice choice. In Subsection 5.3, we remark that the main exports in BRL are homogenous products and, in subsection 5.4, we test if the choice on invoice currency matches with the currency chosen to make the payments.

5.1 BRL invoicing became more common

We depart from describing BRL invoicing by country. Table 2 details BRL-invoiced exports. This table displays all countries whose 2007–11 average of its share in total exports invoiced in BRL was over 1%. Table 3 shows the import flow.

Two different levels of BRL-invoiced exports exist, but we cannot definitively proclaim a growth trend because of the short evaluation period. Nonetheless, it is clear that invoicing in BRL was at a higher level in the 2010-11 period than in previous years.

Table 2 shows the main export destination list, listing those countries that presented a share greater than 1% in BRL-invoiced Brazilian exports on the series average. There are three columns for each year. The one on the left shows the total amount of BRL-invoiced exports, in USD (millions); the one in the middle shows the country's share in total BRL-invoiced Brazilian exports; and the one on the right shows the BRL-invoicing

Table 2: BRL-invoiced Brazilian exports' main destinations, by country (2007–11)

Export destination	**2007**			**2008**			**2009**			**2010**			**2011**		
	Amount USD M	Ctr/TBE %	BRL/TE %	Amount USD M	Ctr/TBE %	BRL/TE %	Amount USD M	Ctr/TBE %	BRL/TE %	Amount USD M	Ctr/TBE %	BRL/TE %	Amount USD M	Ctr/TBE %	BRL/TE %
Argentina	4.3	2.2	0.0	12.4	4.1	0.1	1,361	82	11	1,106	67.5	6.0	1,327	42.5	5.8
Paraguay	151.7	75.3	9.2	216.7	71.0	8.7	187.5	11	11	249.4	15.2	9.8	261.4	8.4	8.8
Uruguay	28.4	14.1	2.2	36.9	12.1	2.2	32.2	1.9	2.4	40.5	2.5	2.6	61.6	2.0	2.8
Bolivia	5.8	2.9	0.7	25.7	8.4	2.3	17.4	1.0	1.9	18.7	1.1	1.6	71.4	2.3	4.7
Belgium	-	-	-	0.1	0.0	0.0	0.0	0.0	0.0	124.4	7.6	3.6	170.3	5.5	4.3
United States	-	-	-	3.8	1.2	0.0	17.5	1.1	0.1	27.8	1.7	0.1	197.1	6.3	0.8
U Arab Emir.	-	-	-	-	-	-	0.0	0.0	0.0	-	-	-	126.9	4.1	5.8
Germany	-	-	-	0.8	0.3	0.0	13	0.8	0.2	10.5	0.6	0.1	68.9	2.2	0.8
Netherlands	0.6	0.3	0.0	3.8	1.2	0.0	0.5	0.0	0.0	0.0	0.0	0.0	63.9	2.0	0.5
France	6.1	3.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	4.1	0.1	0.1
U Kingdom	0.1	0.0	0.0	-	-	-	15	0.9	0.4	18.7	1.1	0.4	22.8	0.7	0.4
Canada	-	-	-	0.0	0.0	0.0	2.6	0.2	0.2	4.5	0.3	0.2	71.5	2.3	2.3

Source: Ministry of Development, Industry and Foreign Trade

Note: Countries whose 2007–11 average share in total exports invoiced in BRL was over 1%. Each year is split into three columns: the left column (Amount) shows the total amount exported to the country in millions of USD; the middle column (Ctr/TBE) shows the country's share in total Brazilian exports in BRL; the right column (BRL/TE) shows the BRL invoicing share in total exports to the country.

Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

share in total exports to the country.

Even if twelve countries are listed as main destinations, the three Brazil Mercosul partners (Argentina, Paraguay, and Uruguay) represent over 85% of BRL-invoiced exports in the years between 2007 and 2010 and over 53% in 2011. Mercosul partners showed outstanding leadership in BRL invoicing in the earlier period, and invoicing in this currency spread across export partners in the last year. This diffusion suggests that exporters are becoming more likely to use their domestic currency in invoicing. While just 24 countries were destinations for exports invoiced in BRL in 2007, this number rose to 96 different countries in the last year. This number gradually increased until 2010 (60 countries), and then it increased steeply the next year.

Argentina and Paraguay are two special highlights on the list in Table 2. Paraguay was the leading country in 2007 and 2008 with more than two-thirds of total BRL-invoiced exports. Argentina replaced Paraguay in that position in the following years, representing a maximum of 82% in 2009. But this was not a reduction in the amount exported in BRL to Paraguay but a sharp increase of Brazilian exports to Argentina in BRL. Considering the deflated values, BRL exports to Argentina have risen by more than 28,000% between 2007 and 2011, while the ones to Paraguay have risen by 59%. Subsection 5.2 goes deeper into the Argentinean case.

Now let us contrast the export figures with the import figures. Table 3 shows 90% of the total amount of these imports by country. Data are displayed by year in two columns. The left column shows the total BRL-invoiced amount imported from that origin, in millions of USD, and the right column shows the share of BRL-invoiced imports compared to total Brazilian imports from that country.

As shown in table 1, the imports in BRL share is 1.95% against the export share of 1.25%. Like Brazilian export destinations, the number of countries exporting in BRL gradually grew from 53 to 81 during the evaluated period. Similarly, the set of countries with the most BRL imports is substantially different from the exports-in-BRL set.

Table 3 demonstrates that the countries that exported the most invoicing in BRL were those in which currencies with international acceptance are legal tender. Among the fifteen top exporters in BRL, only three have noninternational currencies: China, South Korea, and India. Indeed, the United States had the second largest amount invoiced in

Table 3: BRL-invoiced Brazilian imports' main origins, by country (2007–11)

Import origin	2007		2008		2009		2010		2011	
	Amount USD M	BRL/TI %	Amount USD M	BRL/TI %	Amount USD M	BRL/TI %	Amount USD M	BRL/TI %	Amount USD M	BRL/TI %
Germany	110	1.3	170	1.4	213	2.2	399	3.2	684	4.5
United States	202	1.1	214	0.8	273	1.4	357	1.3	536	1.6
China	1	0.0	5	0.0	80	0.5	309	1.2	467	1.4
Brazil	0	0.1	0	0.2	0	0.0	588	74	381	51
Switzerland	118	5.4	136	6.1	179	8.7	320	11	380	13
United Kingdom	1	0.1	2	0.1	46	1.9	145	4.6	373	11
South Korea	0	0.0	100	1.8	112	2.3	281	3.3	343	3.4
Sweden	11	0.8	15	0.9	18	1.6	115	6.7	129	5.9
Japan	9	0.2	15	0.2	51	0.9	100	1.4	116	1.5
Denmark	18	5.0	29	6.3	18	5.1	39	7.2	116	16
Italy	9	0.3	14	0.3	28	0.8	121	2.5	116	1.9
Ireland	21	4.8	24	4.8	55	11	66	12	87	13
France	32	0.9	23	0.5	43	1.2	109	2.3	85	1.6
India	1	0.0	55	1.5	127	5.8	23	0.5	72	1.2
Israel	1	0.2	2	0.1	5	0.7	6	0.6	68	7.5
Malaysia	0	0.0	6	0.4	14	1.1	42	2.4	63	2.8
Puerto Rico	-	-	-	-	17	11	68	32	59	22
Mexico	0	0.0	0	0.0	8	0.3	57	1.5	46	0.9
Taiwan	0	0.0	2	0.0	9	0.4	39	1.3	41	1.2
Thailand	0	0.0	0	0.0	8	0.6	22	1.2	33	1.4
Argentina	2	0.0	3	0.0	5	0.0	23	0.2	29	0.2
Belgium	0	0.0	0	0.0	6	0.5	9	0.6	27	1.5
Austria	0	0.0	0	0.0	3	0.3	8	0.6	22	1.5
Netherlands	0	0.0	4	0.2	18	1.8	19	1.1	22	1.0
Spain	0	0.0	0	0.0	0	0.0	6	0.2	12	0.4
Canada	11	0.7	15	0.5	9	0.6	4	0.2	11	0.3
Chile	0	0.0	-	-	-	-	0	0.0	11	0.2
Uruguay	5	0.7	5	0.5	3	0.2	1	0.1	11	0.6

Source: Ministry of Development, Industry and Foreign Trade

Top 90% in amount origins of BRL-invoiced Brazilian imports. Each year is split in two columns: left column (Amount) is the total amount imported from the country in millions of USD; right column (BRL/TI) is the BRL-invoicing share in total imports, by origin.

Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

BRL. When the noninternational BRL is contrasted with the leading USD as the invoice currency choice, there are occasions on which the former was chosen, suggesting the existence of characteristics other than international use (network externality gains) as a determinant in invoicing.

Regarding the distribution among countries, imports are concentrated in a few. Germany, the United States, and China account for two-fifths of the total amount. The Mercosul partners do not show the same share in imports as in exports. Argentina is on the list, but its USD 25 million in exports invoiced in BRL is far from the USD 1.25 billion imported using the neighbor's currency. The bilateral balance of payments is not as negative as it is in BRL. Imports from Paraguay and Uruguay are not likely to be invoiced in BRL.

We also note that some countries have a high share of BRL invoicing regarding

Brazilian total imports. Switzerland and the UK draw attention for having relatively high values in absolute terms for BRL-invoiced imports when listed by origin and also for presenting a relatively values in relative term—more than one-tenth of BRL-invoiced imports from these countries in the later years. Analysis of the products sold in BRL can contribute to an understanding of these values, so it is what we do next.

After observing origins and destinations, we now seek to understand what sort of products are being invoiced in BRL. Tables 4a and 4b give us an overview of exports and imports, respectively. Both tables present, for each year, two information for each detailed product. The information on the left is the total amount of BRL-invoiced trade in millions of USD; the information on the right is the product's share of total BRL-invoiced trade flow.

The top exported products are electrical energy, tobacco, and sugar. They represent a significant portion of BRL invoicing in exports, and they are going to be explored in depth in subsections 5.2 and 5.3. The subsection 5.2 containing the discussion about Argentina focus on electrical energy, as Argentina was the only destination of this product. A special subsection discusses tobacco and sugar.

Motor vehicle parts and footwear are the major products on the exports list. Motor vehicle parts are exported in BRL mainly to Argentina (95.9%). Paraguay holds 3.7%, and the remaining share is split among Germany (0.18%), Bolivia (0.16%), Mexico (0.04%), and India (0.02%). Footwear holds a similar pattern, with Argentina holding 95.7% and Paraguay holding 3.7%. Minor destinations are Bolivia (0.34%), Uruguay (0.28%), Japan (0.01%), and France (0.003%). Iron and noniron steel rolled products, white goods, and shampoo and other hair preparations follow a similar pattern. Mercosul countries were primary destinations for ceramic building products, which are mainly exported to Paraguay (94.4%).

The pattern in which regional partners are the primary destinations does not hold for the other listed products. Alcoholic beverages are exported in BRL to the United States (41.3%), Paraguay (18.0%), Jamaica (14.4%), Trinidad and Tobago (13.2%), the Netherlands (5.3%), and five other destinations with less than 5% each. The United Kingdom (28.8%), Germany (25.1%), the United States (21.5%), Australia (9.9%), Canada (5.5%), and six others (less than 5% each) are gelatin and derivatives destinations.

The main product that Brazilian importers invoice in BRL is pharmaceuticals. They

represented 60% of total BRL-invoiced imports in the series' first year. Despite its amount growing during the observed period, its share has declined, which is attributed to the diversification of the products in the list of BRL- invoiced products.

Some confusion may arise from pharmaceutical BRL invoicing because they are produced by large companies exporting worldwide. We would expect them to be invoiced in the exporter's currency, which is the usual assumption for invoice currency choice.

Table 4: BRL-invoiced trade, by product(2007–11)

(a) Exports

Products	2007		2008		2009		2010		2011	
	USD M	%	USD M	%	USD M	%	USD M	%	USD M	%
Electrical energy	-	-	-	-	1066.0	64.8	343.2	21.3	274.3	8.9
Tobacco	-	-	-	-	-	-	135.8	8.4	495.5	16.1
Sugar	0.2	0.1	2.7	0.9	2.5	0.2	5.8	0.4	515.5	16.8
Motor vehicle parts	3.9	2.0	7.5	2.6	18.5	1.1	128.7	8.0	291.4	9.5
Footwear (end product)	4.5	2.3	4.8	1.6	71.8	4.4	142.1	8.8	158.4	5.2
Alcoholic beverages	11.3	5.7	13.8	4.7	15.2	0.9	16.2	1.0	295.5	9.6
Iron/nonalloy rolled steel products	5.4	2.8	11.2	3.8	42.6	2.6	121.5	7.5	122.1	4.0
White goods	6.0	3.1	8.0	2.7	48.6	3.0	116.0	7.2	65.9	2.1
Gelatin and derivatives	0.0	0.0	0.0	0.0	44.3	2.7	43.0	2.7	42.5	1.4
Shampoo and other hair preparations	0.7	0.4	0.6	0.2	29.6	1.8	39.2	2.4	41.8	1.4
Ceramic building products	13.5	6.8	21.0	7.1	17.3	1.0	26.1	1.6	30.2	1.0

Source: Ministry of Development, Industry and Foreign Trade
Note: Products accounting for over 3% a year are detailed. The left column contains BRL-invoiced product amounts in millions of USD per year. The right column is the product's share of total BRL-invoiced exports.
Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

(b) Imports

Products	2007		2008		2009		2010		2011	
	USD M	%	USD M	%	USD M	%	USD M	%	USD M	%
Pharmaceuticals	349.3	61.4	429.0	49.8	643.6	46.6	1.306	39.3	1.601	36.3
Electrical equipment	25.4	4.5	163.0	18.9	364.6	26.4	756.6	22.8	924.5	21.0
Railway vehicles and materials	-	-	-	-	-	-	570.9	17.2	369.9	8.4
Machinery and appliances	48.2	8.5	67.5	7.8	82.2	5.9	154.5	4.6	284.6	6.5
Land vehicles other than railway	0.0	0.0	0.0	0.0	0.4	0.0	0.9	0.0	221.0	5.0
Organic chemicals	8.7	1.5	3.9	0.4	11.2	0.8	28.8	0.9	209.6	4.8
Miscellaneous chemical products	51.6	9.1	81.5	9.5	76.2	5.5	91.4	2.7	177.4	4.0
Optical and medical instruments	42.3	7.4	54.2	6.3	78.4	5.7	149.5	4.5	171.6	3.9
Beverages and spirits	-	-	0.0	0.0	31.0	2.2	55.2	1.7	128.3	2.9

Source: Ministry of Development, Industry and Foreign Trade
Note: Products accounting for over 2% a year are detailed. The left column contains BRL-invoiced product amounts in millions of USD per year. The right column is the product's share of total BRL-invoiced imports.
Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

One explanation we offer is that these large companies also have local subsidiaries in the destination country. So invoicing pharmaceuticals in BRL may be related to international shipment within the same corporate group. Within the same corporate group, choosing the remitter's or the remittee's currency may be the suitable solution for re-

vealing exchange risk from one firm's accounts. Pharmaceuticals make up most of the BRL-invoiced imports from Germany (44%) and the United States (75%) and constitute nearly all imports from Switzerland (90%). Indeed, 28.1% of BRL-invoiced pharmaceuticals come from the Unites States, 24.3% from Switzerland, and 16.7% from Germany. Twenty other countries are also on this origin list.

Table 5: BRL-invoice share on total trade, by product and by country (2007–11)

BRL-invoiced exports			BRL-invoiced imports		
Product (destination)	USD M	%	Product (origin)	USD M	%
Fiber-cement articles (Paraguay)	42.4	91	Chemicals: phenols (Germany)	11.2	92
Tomato preparations (Paraguay)	28.3	90	New pneumatic tires (Slovakia)	11.8	87
Iron flat-rolled products (Paraguay)	18.8	89	Antisera and other blood fractions (Switzerland)	916.9	85
Electrical energy (Argentina)	1,938.5	87			
Poultry meat (Bolivia)	13.2	83	Electronic hardware (Ireland)	24.6	81
Brazil nuts (Bolivia)	17.5	77	Composite diagnostic or laboratory reagents (Germany)	368.6	78
Soya-bean oil (Paraguay)	27.1	77			
Candles and the like (Paraguay)	17.4	76			

Source: Ministry of Development, Industry and Foreign Trade
Note: Products listed are those for which total flow is over USD 10 million and whose share is 75% or higher. Amounts reflect the Brazilian total trade flow. The reported share is the BRL-invoiced flow divided by the total flow.

Electrical equipment is next as the main BRL-invoiced import: 30.7% originated from South Korea, and 29.7% from China. India (10.3%), Japan (6.7%), and 50 other countries follow. China and South Korea are the highlights in terms of total amount imported in BRL. India, however, is important when considering the BRL-invoicing share. Nearly half of the BRL-invoiced electric equipment imports came from India in 2009. For the entire period, 25.3% of these BRL-invoiced products came from India.

The equipment to build railway tracks is the next product listed on table 4b, and they have Brazil registered as their origin. The operations listed as these products are those operations, which the imported product was manufactured in the importing country. This sort of import seems to have a transitory characteristic as it is intended to fulfill particular needs. As they are in the last years of the series, additional observations to confirm this idea were required. The other listed products follow a pattern in which a few countries are the major BRL-invoice origins, and the remaining amount is distributed among several minor countries of origin.

Concluding our description of BRL-invoiced trade, we focus on the products for which the BRL was the main choice of invoicing. We consider the entire period and only

products with USD 10 million or greater flow. Shares above 75% are shown in Table 5. Observe that BRL invoicing share is relevant to neighbor countries in exports but the same do not occur in imports.

5.2 Significant impact from the payment system introduction

A number of countries have shown significant increases in BRL invoicing, as observed on table 2; the 2011 figures are remarkably higher and more widespread among countries than the previous figures. Argentina is the highlight, showing a distinct pattern. It presented an increase from USD 4.3 million in 2007 to USD 1.3 billion in 2011. BRL-invoiced exports that was approximately zero in 2007, accounted in 2010 and in 2011 for 6% of total exports to Brazil's largest trade partner.

Electrical energy explains much of the BRL invoicing growth in exports to Argentina. The growth began in 2009, and it accounted for over 75% of total exports in BRL in that year. This strong share decreased to 20% in 2011, suggesting that the increase in BRL-invoicing was not just a result of the addition of electrical energy to the exports list.

The government's influence on large energy contracts suggests the possibility of some bias in invoice currency choice. Thus, we detach electrical energy figures from other traded products and present them in table 6, which shows products that accounted for 3% or more of the BRL-invoiced exports in at least one observed year. From 2009–10, all electrical energy exported to Argentina was invoiced in BRL. This number changed in 2011, when just slightly more than half was invoiced in BRL. Although the electrical energy addition to the exports portfolio invoiced in BRL added weight, it does not explain the overall change in BRL invoicing. Other products on the export basket also began to be invoiced in the domestic currency, contributing to Argentina becoming a leader in BRL use in trade.

Footwear, motor vehicle parts, and rolled products of iron or steel were the primary ones exported through BRL invoicing. In 2011, these three accounted for a total exports amount of over USD 100 million and an expressive growth on the series beginning in 2007. In 2011, more than 75% of footwear was invoiced in BRL. The BRL-invoiced share in that year for motor vehicle parts was 13%; for iron and steel products, it was

24%. Conversely, wooden planks, bananas, tuna, and other main products in the earlier years maintained the same level until later years. A wider BRL-invoiced exports basket is the explanation for the overall growth in Argentina and began in 2009.

The Argentinean-Brazilian Local Currency Payment System (SML) launched in late 2008 could be a reason for such noteworthy change in behavior in invoicing of exports to Argentina. The SML is operated by the both countries' central banks, and its payment orders provide an aggregated exchange transaction between BRL and ARS. The convenience of the central bank providing an exchange transaction within the international wire transfer is an appeal for traders. Traders who use the payment system are required to invoice exports in their domestic currency.

Table 6: BRL-invoiced exports to Argentina, by product (2007–11)

	2007	2008	2009	2010	2011
Total BRL-invoiced exports (USD M)	4.3	12.4	1361.2	1106.0	1327.3
Electrical energy exports in BRL (USD M)	-	-	1066.0	343.2	274.3
... share in exports in BRL to Argentina (%)	0	0	78	31	21
... share in total electrical energy exports (%)	0	0	100	100	52
Exports, excl. electrical energy (USD M)	4.3	12.4	295.2	762.8	1053.1
Products (USD M)					
Footwear	-	-	79.7	152.6	191.7
... End products	-	-	*69.5*	*135.4*	*150.0*
... Parts of footwear	-	-	*10.2*	*17.2*	*41.6*
Motor vehicle parts	-	0.3	13.5	121.2	283.9
Rolled products of iron or steel	-	1.9	32.6	108.2	108.1
White goods	-	-	43.6	111.3	60.0
Shampoos and other hair products	-	-	29.1	38.3	40.7
New pneumatic rubber tires	-	-	-	12.2	58.5
Television receivers	-	-	3.0	39.8	19.9
Furniture	-	0.1	9.6	18.0	19.3
Wooden planks	2.7	2.0	1.5	1.9	1.7
Bananas	1.0	1.3	2.3	2.2	1.8
Tuna	-	0.5	3.5	3.8	5.0
Cellular polyurethane plates or sheets	-	0.6	4.1	2.0	3.1
Electric boards and panels	-	0.5	0.0	-	0.3
Onions and shallots	0.6	0.1	0.0	0.0	0.2
Iron reservoirs or tanks	-	0.4	0.3	0.0	-
Parts of heaters	-	0.7	3.2	0.0	-
Electrical transformers and inductors	-	1.4	0.2	0.0	0.0
Other goods	0.2	2.5	68.9	151.3	259.0

Source: Ministry of Development, Industry and Foreign Trade
Note: Products accounting for over 3% a year are detailed.
Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

Roughly 51% of the amount invoiced in BRL was paid through SML payment orders from its launch until 2011. The comparison of our MDIC database to SML may be misleading, however. We have to be aware of the methodology mismatch when such a comparison is made. MDIC's data consists of shipped goods, and the price registered is the FOB price converted from BRL to USD by the export declaration date exchange rate. SML's data consists of financial payments registered in BRL and reported monthly. For the magnitude comparison we presented, we converted monthly SML data to USD using the month's average exchange rate. In subsection 5.4, we will go deeper in comparing these two databases.

The SML launching overlaps the worsening of the 2007–8 international financial crisis, which could be an alternative explanation for two major partners relying on their domestic currencies as an invoicing reference. The financial crisis affected Brazilian relationships with countries, creating a possible explanation for the overall BRL-invoicing effect. Evaluating precisely this effect and evaluating whether the BRL-invoicing growth is a trend would require a more extensive time series. Nevertheless, the policy that established the SML certainly gave traders a convenient way to use the domestic currency; as a result it affected their decision on currency choice.

We then use the available data to evaluate whether the introduction of SML payment orders has had significant correlation to the BRL use on trade invoicing in exports. Due to the large set of corner results on BRL invoicing, we apply the tobit model on the panel data and regress BRL-invoicing share on the SML availability, controlling for the effects of the international financial crisis, the relevance of trade between Brazil and its counterpart, the trade volume level, and the exchange rate volatility. We run six regressions considering product-and-country specific effects (products as HS2 level), following the general regression equation as follows:

$$\begin{aligned} \text{SHARE}_{c,p,t} = \max\{&\beta \cdot \text{SML}_{c,t} + \alpha \cdot crisis_t + rel_{c,p,t}\delta_1 + tv_{c,p,t}\delta_2 + \\ &+ xrt_{c,t}\delta_3 + hs_p\gamma_1 + cnt_c\gamma_2 + u_{c,p,t}, 0\Big\} \end{aligned} \tag{1}$$

where $\text{SHARE}_{c,p,t}$ is the BRL share in Brazilian exports and the explanatory variables are:

- $\text{SML}_{c,t}$ is country and time specific and indicates the SML availability. It is constructed from the interaction between the *dummy* indication whether the SML was operative during the year and the share of months it was available;
- $crisis_t$ is time specific and indicates the BRL-invoicing effects across all countries after the Lehman Brothers bankruptcy and the worsening of the 2008 international financial crisis;
- $rel_{c,p,t}$ is the product (HS2), country and time specific vector containing how trading with Brazil is important to the country of destination. Brazil is evaluated as supplier, destination and trade partner and variables are constructed from the UN Comtrade Database, from each counterpart reported data. Relevance as supplier ($rel_{s_{c,p}}$) is country's imports from Brazil divided by country's total imports. Relevance as destination ($rel_{d_{c,p}}$) is country's exports to Brazil divided by country's total exports. Relevance as trade partner ($rel_{tp_{c,p}}$) is calculated from the trade current shares;
- $tv_{c,p,t}$ is the product (HS2), country and time specific vector containing the logarithm of MDIC's data on exports (tv_x) and imports (tx_m) to the counterpart at current prices. Observing our comments on the use of current prices on subsection 3.1, the regression results showed no significant difference between current prices and deflated data;
- $xrt_{c,t}$ is the country and time specific exchange rate volatility of the destination country's currency. The exchange rate volatility is the currency's coefficient of variation during the given year;
- hs_p and cnt_c are the vectors containing the *dummy* variables aggregating respectively product specific and country specific effects.

Results are shown in table 7 and the six regressions are displayed on columns (1)–(6). We apply different setups to understand how the choice in different models affect the conclusion about the SML effect. On (1)–(3) in addition to the country-product effects, we account for specific effects for each product and for each country. Different setups are used on (4)–(6). Relevance is jointly significant in (1) and (2). No matter which model is chosen, the SML is found significant at the 0.1%-level. This result confirms the link between the Brazilian government policy of introducing the SML payment orders and the

higher level of invoicing in BRL. Therefore, a link between the availability of financial instruments and the invoicing choice arises.

Table 7: SML and BRL-invoice share in Brazilian exports

Dependent variable: share of exports invoiced in BRL, by country						
	(1)	(2)	(3)	(4)	(5)	(6)
SML	0.208***	0.209***	0.206***	0.204***	0.250***	0.282***
Crisis	0.0809***	0.0801***	0.0944***	0.0929***	0.0924***	0.0866***
Relevance as. . .						
..supplier	-0.0102	0.0157				
..destination	-0.0116	0.0390	0.0302	-0.0304	0.582***	0.434***
..trade partner	0.0924					
Trade volume						
..total exports	0.0171***	0.0170***	0.0182***	0.0228***	0.0416***	0.0291***
..total imports	0.000811*					
Exchange rate volatility	0.000772*	0.000798*	0.00105**	0.00102**	0.0000603	0.000153
Product specific effects	yes	yes	yes		yes	
Country specific effects	yes	yes	yes	yes		
Constant	-1.520	-1.539	-1.901	-1.837	-1.340***	-1.054***
σ_u	0.141***	0.141***	0.151***	0.184***	0.248***	0.276***
σ_e	0.149***	0.149***	0.165***	0.164***	0.163***	0.161***
Log likelihood	-615.77	-619.45	-892.48	-1146.2	-1561.6	-1773.7
N	14487	14487	24556	24556	24556	24556
N (uncensored)	1102	1102	1453	1453	1453	1453

Note: Relevance as supplier is country's imports from Brazil divided by country's total imports. Relevance as destination is country's exports to Brazil divided by country's total exports. Relevance as trade partner is calculated from trade current shares.
Conventions used: Standardized beta coefficients * p < 0.05, ** p < 0.01, *** p < 0.001.

As we will discuss in subsection 5.4, the SML accounted for almost 80% of Argentina figures in 2010 and 2011. The remaining 20%—even excluding the electrical energy figures—is higher than the amount observed before the SML availability. Payment orders in local currency may have not only impacted currency invoicing directly though the payment order availability but also though the coalescing effect—what we leave for a future evaluation on a longer series.

Unlike exports, no governmental intervention may be credited to the BRL use growth in imports, at least in a direct way. We suggested that the Local Currency Payment System (SML) was a partial reason for export growth invoiced in BRL. In the case of payments related to Brazilian imports, the bilateral payment system required them to be invoiced in ARS. Thus, there is no direct impact on BRL use. In subsection 5.4 we will analyze financial data.

As observed in subsection 5.1, Argentina is not major origins of products denominated in BRL like it is a major destination for BRL-invoiced products. Indeed, invoices in

the Brazilian currency are just 0.2% of total imports. Only 30 products used the BRL as invoice currency during the observed period. Pharmaceuticals accounted for almost 70% of total imports in BRL throughout the period, with veterinary vaccines taking a 44% share. They are almost entirely invoiced in BRL. Medicaments accounted for another 25%, and other pharmaceuticals and some plastic products were only invoiced in BRL in 2007 and 2008. In later years, the number increased to 20 different products level, confirming some basket diversification, as reported for exports.

5.3 Homogeneous commodities exported in BRL

Sugar and tobacco[9] are the two main products exported in BRL (table 4a). The leading of these products on the list raises an intriguing question. As homogeneous products in the international market and being traded in commodity exchanges, we would expect traders to resort to an international currency to invoice (McKinnon, 1979; Krugman, 1980). Accordingly evidence has been reported by Goldberg and Tille (2008) and Devereux et al. (2010). What we find from Brazilian trade data is the opposite, however. The exporter's noninternational local currency, the BRL, was used to invoice.

One possible explanation is to account for the existence of some bargaining power impacting the invoice currency choice (Goldberg and Tille, 2013). Brazil accounts for more than 40% of world sugar exports and more than 12% world tobacco exports. So, this large relevance in world exports suggests that some bargaining power may arise in addition to the preference for the use of international currencies in international markets.

In 2011, sugar topped the list by total amount of exported products invoiced in BRL. In this year, 3.5% of the total exported sugar was invoiced in BRL, a larger share than the 1.25% reported to total exports. Table 8 lists Brazilian exports of sugar invoiced in BRL by country. The United Arab Emirates were the destination for about a quarter of the total in that year, the only year it happened to this country during the series. Sugar was also a relevant product for BRL-invoiced exports to the United States; it was the second most significant product revenue for this destination. Two other destinations were also prominent in exports of this product: Canada (USD 66 million) and Nigeria (USD 44

[9]Throughout this paper, we mean by sugar the HS 1701—cane or beet sugar and chemical pure sucrose, solid form and by tobacco the HS 2401—unmanufactured tobacco and tobacco refuse; unless stated otherwise.

Table 8: Brazilian BRL-invoiced sugar exports, by country (2007–11)

Destination of sugar exports (USD M)	2007	2008	2009	2010	2011
United Arab Emirates	-	-	-	-	126.8
Canada	-	-	-	-	65.9
Nigeria	-	-	-	-	48.9
Ghana	-	-	-	-	28.0
Colombia	-	-	-	-	24.5
Yemen	-	-	-	-	22.1
Venezuela	-	-	-	-	21.7
South Africa	-	-	-	-	20.7
Angola	-	-	-	-	15.8
Paraguay	0.1	1.7	2.3	5.3	4.4
United States	-	-	-	-	12.5
China	-	-	-	-	12.4
Algeria	-	-	-	-	11.6
Bolivia	0.1	0.9	0.2	0.5	8.6
Mexico	-	-	-	-	10.1
Total countries (qty)	2	3	3	3	40

Source: Ministry of Development, Industry and Foreign Trade
Note: Countries accounting for over 1.5% of BRL-invoiced exports during the 2007–2011 series are listed.
Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

million). Ghana, Colombia, Venezuela, Yemen, and South Africa are destinations that imported sugar invoiced in BRL from USD 20 to 30 million each. At least an attempt to invoice this homogenous product in the exporter's currency may be stated from the last year's data.

Like sugar, tobacco stood out in BRL invoicing. Nonmanufactured tobacco, which represents almost all Brazilian tobacco exports, was the form that presented the higher BRL-invoicing share. In 2011 (Table 9), 17% of tobacco exports was invoiced in BRL; this was 5% in the previous year and did not exist at all before that. In manufactured form, only 1% was billed in BRL in 2011. Main destinations were Belgium, Russia, Germany, the Netherlands, Poland, Turkey, and China.

Like the overall data, tobacco exports in BRL were spread among destinations. There were no events until 2009, but the number of destination countries rose sharply to 31 in 2011. Even if the same companies exported tobacco denominated in BRL, a larger number of importers accepted this denomination.

Tobacco was the main exported product to Belgium, which presented just few other items invoiced in BRL. To this destination, machinery parts were also denominated in

Table 9: Brazilian BRL-invoiced tobacco exports, by country (2007–11)

Destination of tobacco exports (USD M)	2007	2008	2009	2010	2011
Belgium	-	-	-	124.42	167.12
Russian	-	-	-	-	69.25
Germany	-	-	-	-	52.03
Netherlands	-	-	-	-	44.29
Poland	-	-	-	-	24.69
Turkey	-	-	-	-	20.35
China	-	-	-	-	15.37
Portugal	-	-	-	-	13.91
Ireland	-	-	-	-	11.83
United Kingdom	-	-	-	9.17	0.47
Total countries (qty)	-	-	-	6	31

Source: Ministry of Development, Industry and Foreign Trade
Note: Countries that exported at least USD 10 million in unmanufactured tobacco (NCM 2401) in the 2007–11 series are listed.
Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding.

BRL at amounts comparable to those of Brazil's neighbor countries. The main destinations for BRL-invoiced exports were Germany and the Netherlands in terms of tobacco, considering the largest exported volume during the whole evaluated series. Russia did not see a similar situation because exports to Russia in BRL only began in 2011.

5.4 Do payment and invoicing currencies match?

After analyzing the invoicing in BRL, an immediate question is how the BRL-invoiced operations are paid. Invoicing in a selected currency mainly implies the exchange rate risk distribution between the exporter and the importer. Paying in a selected currency highlights the dependence on the currency's availability as a medium of exchange for the parties. Are BRL-invoiced trade operations also settled in Brazilian currency? Do invoice and settlement currencies match for Brazilian trade? How does the payment currency choice work for a currency that is not widely available in international markets?

Some researchers are similarly interested in this issue for other countries and currencies. Friberg and Wilander (2008) reported on a Swedish exporter's survey that found that payment and invoicing currencies are usually the same, while studying the Swedish krone use. Analogously, Ito et al. (2013) promoted a wide-ranging study questioning all Japanese manufacturing firms listed in the Tokyo Stock about currency invoicing. They also found that invoicing and payment currencies match. The theoretical model on inter-

national currencies developed by Zhang (2014) resulted in compatible outcomes in terms of empirical findings.

Here, we do not use firm questionnaires to deal with this issue. Conversely, we benefit from the large-scale oversight of the Brazilian supervisor on foreign transactions. Although in compliance with banking secrecy regulations, no firm level data can be used, the wide coverage of registered operations may assist us in identifying whether the invoice and payment currency-matching hypothesis holds for Brazilian trade.

Financial settlement (payment) and good settlement (shipment) do not typically happen on the same date. The shipment date may also not match the trade declaration record date. Thus, comparing trade data with financial data may be tricky. In addition, reported trade data usually include the FOB value[10] while the financial transaction would include the freight and insurance when possible. Keeping these issues in mind, we correlated both datasets in order to assess the payment-invoicing currency match.

Table 10: Relationship between trade-related financial operations in BRL and BRL-invoiced trade, 2007–11

Country	Payments share on trade (\%)		Trade-related financial current
	Incoming transfers / Exports	Outgoing transfers / Imports	(USD million)
World	28.6	0.1	1,967.0
... TIR	*0.2*	*0.1*	*17.6*
Argentina	51.3	-	1,949.8
... TIR	*0.0*	-	*0.3*
... SML *	*51.4*	*n/a*	*1,949.4*
Italy	11.6	-	0.4
Japan	3.3	-	0.4
Paraguay	0.8	-	8.3
United States	0.5	-	1.0
Angola	-	863.0	0.2
Germany	-	0.4	6.8
China	-	0.0	0.0

Source: Ministry of Development, Industry and Foreign Trade; Central Bank of Brazil
Note: TIR and SML refer, respectively, to TIR payment orders and SML payment orders. Trade refers to MDIC's trade data. As SML payment orders are invoiced in the remittee's currency, SML outgoing transfers are exclusively invoiced in ARS, not in BRL.
* Calculated for the October 2008–December 2011 period, when the SML was operative. Data was converted from BRL into USD by the monthly average of daily average exchange rate (PTAX).
Conventions used: 0.0: numerical data resulting from rounding an originally positive numeric data, -: numeric data equals zero, not due to rounding; n/a: not applicable.

From 2007 to 2011, only 0.03% of total TIR was trade related. During the entire

[10]Following the INCOTERMS 2010, FOB value is the one that considers the good's value without freight and insurance.

period, figures for financial payments denominated in BRL were slightly over 11% of the BRL-invoiced trade amount. The SML accounted for USD 1.96 billion and trade-related TIR for just USD 18 million for a total BRL-invoiced trade current of USD 17.40 billion.

This 11%-share in BRL-related transactions is a significant contrast to the 98%-share observed in the transactions' total amounts, when disregarding the currency of denomination. This finding could challenge our initial assumption that all transactions would be under Brazilian regulation[11] and then, in addition to the considerations we have previously made, we would expect a downward bias when comparing total trade-related financial records to trade records. However, figures for trade-related financial records are almost the same as the ones for trade from 2007 to 2011 in Brazil and there is no evidence that points to the provision of financial services in BRL overseas, what strengthens our mismatch finding.

Similar mismatch was also reported by Bo (2013) for Chinese data but on the opposite direction. For China, the invoiced amount in renminbi (CYN) is smaller than the payments' amount by a 56%-share.

Table 10 shows the share of reported financial payments denominated in BRL over the bilateral trade invoiced in this currency. All counterpart countries for TIR payment orders during the 2007–2011 period are presented. For Argentina, we include the SML payments in the calculation. In this case, the period under consideration starts in October 2008, when the payment service was launched.

From the table, we can see that Angola is the only country where payments in BRL surpass the invoicing in BRL. Payments from Angola only occurred at the end of 2008. Therefore, the related shipment might have occurred during the observed series, suggesting that the invoice currency was not BRL.

All countries show BRL-denominated payments in one year and no payments in the preceding or in the following years. Denominating payments in the Brazilian currency seem to be substantially unusual. The United States and Germany are exceptions. Respectively, eighty-four and sixty-seven payments were made from or to these countries spread along several years, suggesting a more common use for some agents, albeit making up a small portion of total trade.

[11] Until August 2006, Brazilian exporters were required to repatriate all payments received from trade. Since then, maintaining abroad part of their revenues became allowed. Since March 2008, no revenue repatriation is required anymore.

An interesting issue comes from Argentina's figures. BRL-denominated payments did not take place from or to this country before the SML launch. After this service was provided by the central banks, just a few TIR payments were made. However, SML payments represent over half of total BRL-invoiced Argentinean payments during the operational period. If we analyze the latter two-year period, the amount of SML payments equates to more than 80% of the exported amount.

Looking into large numbers, we find that the currency used for invoicing and for payment do not match in the Brazilian BRL-invoiced trade data. Thus, the reported growth in BRL-invoiced trade does not indicate a growth in the use of BRL as a medium of payment. The growth in invoicing seems to have been created by causes rather than liquidity improvements for this currency.

6 Final remarks

We reported that the BRL is being used to invoice Brazilian foreign trade. For the first time, to our knowledge, a Brazilian foreign trade database was evaluated using invoice currency. As a result, a number of intriguing questions were raised. It is quite clear that future developments in the present research may provide additional interesting results about Brazilian currency and its use on the international stage.

Understanding domestic currencies—most of which have considerably limited international use—in an environment where a leading global currency largely prevails highlights the regional economy's particularities. This study requires the utmost attention to minor effects caused on agents and the effects caused by them. This reinforced the sensitivity of these developing issues.

We have shown how the BRL is used to invoice in Brazilian foreign trade. From a trade viewpoint, we also pointed a variety of questions concerning BRL status on the international stage—these questions allow and demand furtherer specific analysis. Overall, we dispelled the notion that the Brazilian currency cannot survive when contrasted with other currencies with acknowledged international character. In Brazil-United States trade, when contrasted with the current most prominent international currency, we observed that economic agents choose to invoice in BRL in some cases. The conditions for this occurrence remain unsettled, suggesting future studies.

Puzzling issues in international invoicing arose from Brazilian evidence. We found that the BRL-invoiced products that result in the largest exported volume are not what we would have determined based on theory. Tobacco and sugar, both homogenous and traded in global markets, lead on the BRL-invoiced export list.

We also found that exports to Argentina presented outstanding growth in BRL use. We highlighted then the governmental stimulus due to the provision of bilateral payment orders combined with exchange transactions as its cause. The lack of exchange liquidity and financial instruments may be costly for traders; dealing with that restriction may influence the agents' invoice currency choice.

In addition, we found that invoicing and payment currencies in BRL do not match. This result in terms of the Brazilian trade invoicing in BRL does not correspond to previous findings from Swedish and Japanese firms, for which the same currency performs both roles in trade operations. But we found that in Brazil, the BRL-denominated amounts for invoicing and payments diverge. Conditions that imply BRL invoicing for local agents survive even if the BRL use as a medium of payment is greatly constrained. This is a similar result to the one found in China but in the opposite direction—there, the payments in the local currency happen even if the invoicing is incipient.

Ultimately, in the work reported here, we show that the BRL is openly used to invoice trade. If the USD prevails in Brazilian trade, the presence of the BRL in the remaining share has grown with respect to other international currencies. So the discussion of whether there is any role in foreign trade must change to the causes of BRL invoicing and the level of its use. These questions add to an understanding of the international use of BRL.

When does a trader prefer to use the BRL? What are the conditions for BRL invoicing? To what degree does the decision of a noninternational local currency issuance in Brazil affect resident agents' production? In the absence of restrictions caused by BRL noninternationality, what would be the expected trade in the BRL share? If now these seem appealing questions to be answered, this paper has fulfilled its mission—new questions are now on the table.

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