Exorbitant Privilege and Economic Sanctions*

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Abstract

This paper documents a substantial change in the composition of currencies used to invoice Russian imports, precipitated by the war on Ukraine and the introduction of economic sanctions on Russia. Over the course of 2022-23, the share of Russia's imports invoiced in renminbi (CNY) increased by 33 percentage points (pp), while the use of renminbi as a vehicle currency increased by 11 pp. The analysis of transaction-level import data suggests that the existence of CNY swap lines in third countries, the perceived threat of secondary sanctions and the rising cost of clearing cross-border payments in US dollars played a role, with trends reinforced by strategic complementarity in the use of currency of invoicing. The increased use of CNY as a vehicle currency was driven by Russia's trading partners that have an active renminbi swap line and did not impose economic sanctions on Russia. The share of CNY invoicing increased disproportionately for trade in sanctioned dual-use goods and in the case of smaller traders. The number of importing firms dealing with CNY invoices increased sharply, while the numbers of importers dealing with USD and EUR invoicing dropped.

Keywords: sanctions, international trade, currency of invoicing, vehicle currency, China, Russia

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1 Introduction

International trade is disproportionately denominated in US dollars (Gopinath and Stein (2020), Boz et al. (2022), Gopinath et al. (2020)), contributing to the demand for US dollars and the dollar's exorbitant privilege (Gourinchas et al. (2010)).[1] The prevalence of US dollar in trade between third countries reflects to a large extent the size of the US market, firms' efforts to keep their prices in line with those of competitors and input suppliers, exchange rate risks and the dominant role of the US dollar as a store of value (Bacchetta and van Wincoop (2005), Goldberg and Tille (2008), Goldberg and Tille (2016), Amiti et al. (2022), Gopinath and Stein (2020)). For these reasons, the rising importance of China and other emerging markets as trading partners and the declining share of the US in global trade may not by themselves lead to the decline in the US dollar (USD) share of invoicing (Georgiadis et al. (2021), Mukhin (2022)).

The dominance of the US dollar makes international sanctions more effective, as firms engaged in international trade invoiced in USD require payments to be cleared through the US banking system. At the same time, the use of economic sanctions, which is becoming increasingly widespread (Felbermayr et al. (2020)), may over time reduce attractiveness of the US dollar as a vehicle currency and hence its dominance (Bianchi and Sosa-Padilla (2023)). However, empirical evidence on such shifts is scarce, in part due to limited application of economic sanctions in the past.

This study sheds light on the impact of trade sanctions on the choice of currencies used to denominate international trade transactions. Our analysis focuses on the sanctions imposed on Russia by the European Union (EU), the United States and a number of other advanced economies in the aftermath of Russia's full-scale invasion of Ukraine on 24 February 2022. These comprehensive sanctions present a unique setting for studying the changes in the choice of invoicing currency. This episode stands out in terms of its size, comprehensive nature and the size of the targeted economy. In 2021, Russia's GDP at market exchange rates amounted to US$1.8 trillion making Russia 11th largest economy in the world.[2] Moreover, in response to sanctions, the BRICS economies (Brazil, China, India, Russia and South Africa subsequently joined by several others) announced their intention to develop an alternative cross-border payments system, BRICS pay.

Our analysis exploits transaction-level data on Russia's imports between January 2016 and December 2023, covering the period before and after the start of the sanctions regime. Each record includes the value of goods and information about their quantity or weight, product description and its code, importing firm (identified by a unique number), trading partner country, currency of invoicing and the date of customs clearance.

Some remarkable shifts are already visible in summary statistics. Prior to March 2022, up to 80 percent of Russia's imports had been invoiced in USD or euros (EUR), with the shares of various currencies fairly stable over time. After Russia's invasion of Ukraine in February 2022 and the imposition of economic sanctions, Russian imports became increasingly invoiced in renminbi (CNY). By the second half of 2023, invoices in renminbi accounted for 36 percent of Russia's import value, up from 3 percent two years earlier, while the share of the US dollar

[1] The exorbitant privilege being the low interest paid on US liabilities relative to the return on US dollar assets.

[2] Sanction packages imposed restrictions on exports of various goods to Russia as well as on certain imports from Russia. They limited financial services that could be provided to Russian entities and discontinued access of some major Russian banks to SWIFT, the dominant system for cross-border payments. A major part of assets of the Russian Central Bank was frozen, and sanctions further covered transactions with more than 1,200 individual entities.

and the euro declined to less than 50 percent. A broader increase in the use of CNY in global trade is also visible in SWIFT data (see Figure 1).

Only part of this shift reflects a drop in exports from the sanctioning economies and the rise of Russia's trade with China and other neutral partners (see Chupilkin et al. (2023), Steinbach (2023)). Renminbi invoices accounted for 82 percent of imports from China in the second half of 2023, up from 28 percent two years earlier, having displaced primarily the US dollar as well as the Russian ruble (RUB) as the currency of choice. In trade with third countries (i.e., other than those using the US dollar or the euro as producer currency), the share of renminbi went up from 0.6 percent in the second half of 2021 to 4.9 percent in the second half of 2022 to 12 percent in the second half of 2023.

Zooming in on individual importing firms, the data show a sharp rise in the number (as well as the share) of firms processing CNY invoices and a decline in the number of firms dealing with USD and EUR invoices. Particularly relevant to our paper is the change in the share of firms engaged in imports using CNY as vehicle currency. Their share went up from 2.2 in the second half of 2021 to 10.1 in the second half of 2023. At the same time, the share of firms with invoices in USD as a vehicle currency dropped from 54 to 32.8 percent.[3] We also see an increase in the average share of firms using multiple currencies to invoice imports of a given product from a particular country, with this share going up from 2.2 to 5.5 percent during the same period.[4]

In our econometric analysis, we investigate mechanisms that may be responsible for these changes, such as changes in the relative costs of dealing in various currencies or perceived risks associated with the currency choice. We focus on the share of a Russian firm's imports of a given product from a given country in a given month, invoiced in a given currency. We follow a difference-in-difference approach comparing (i) Russia's imports before versus after the imposition of economic sanctions; (ii) various characteristics of Russia's trade, for example, trade with sanctioning economies versus trade with other ("neutral") economies, trade with economies with and without a swap line with China, trade in sanctioned versus non-sanctioned products or trade done by large versus small firms. The use of comprehensive sets of fixed effects enables us to isolate various mechanisms driving the switching behaviour away from dealing with USD invoices towards the use of producer currencies of neutral economies and CNY as a vehicle currency. Our results can be summarized as follows.

First, we explore whether the choice of invoicing currency is related to the geopolitical stance of partner countries by comparing imports from China and other neutral countries to those from sanctioning economies. Three findings stand out. When compared with sanctioning economies, China has substantially shifted away from using the USD as a vehicle currency and towards greater reliance on the CNY in the post-war period. Similarly, neutral economies (other than China) decreased their reliance on the USD and increased the share of CNY invoicing. The differential increase in the CNY share in imports from China was around 24 pp, while the corresponding figure for neutral countries was around 4 pp. Neutral economies have also increased (albeit to a lesser extent) reliance on their national (producer) currencies. These patterns are in line with geopolitical considerations playing a role in the choice of invoicing currencies.

Second, we examine the impact of financial infrastructure by considering the effect of having an active currency swap line with the People's Bank of China (PBOC) on CNY invoicing. Our

[3]These figures compare July-December period in both years and focus on flows observed in both; trends are similar looking at March-December of each year, see Table 1.

[4]These figures compare July-December period in both years and focus on flows observed in both. Product refers to 6-digit Harmonized System (HS) code.

interest stems from the fact that such swap lines make it easier for an exporter to use renminbi received from, say, a Russian importer (see Bahaj and Reis (2020), Bahaj and Reis (n.d.)). We show that the use of renminbi as a vehicle currency increased on average by an extra 4.5 percentage points for trading partners that have an active currency swap line with the PBOC, such as Mongolia or Pakistan. This effect is found only for third countries that did not impose economic sanctions on Russia.

Third, we examine whether the threat of secondary sanctions could have played a role by comparing goods under sanctions to non-sanctioned goods. Exporters of sanctioned goods may prefer invoicing in currencies other than the USD as such transactions would be less traceable. And indeed we find that USD invoicing became less prevalent in dual-use goods and industrial goods under sanctions (but not sanctioned luxury goods), while at the same time an increase in CNY invoicing was registered, with CNY used both as producer and vehicle currency. No statistically significant effect are detected for EUR invoicing suggesting that the threat of secondary sanctions is more likely be associated with the US than with the EU (see Geranmayeh and Rapnouil (2019)).

Fourth, we focus on strategic complementarity in the use of currencies of invoicing. The exit of Western competitors, who predominantly relied on USD invoicing, would have weakened the incentives to use USD invoicing, working through this channel. To capture the relevant markets, we create an indicator variable for products where the share of 2021 Russian imports coming from the sanctioning economies and invoiced in USD was in the top tercile. The results show a disproportionate increase in the reliance on CNY invoicing and producer-currency invoicing in these products. This effect is robust to allowing for differential effects for various types of sanctioned goods.

Finally, we shed light on the role of the rising fixed costs of clearing transactions denominated in Western currencies. Cutting off many Russian banks from the SWIFT system made it much more difficult and costly for importers to gain access to Western currencies.[5] The war has also drastically diminished the attractiveness of the Russian ruble. Both factors increased the relative attractiveness of renminbi, particularly for firms facing higher costs of trading in Western currencies. As mentioned earlier, the raw data show a sharp increase in the number of firms dealing with CNY invoices and a drop in the number of importers dealing with USD and EUR invoices, which is consistent with the rising fixed costs of clearing such payments under sanctions. The econometric analysis suggests that the firm size is the best predictor of changes in invoicing currency composition, with smaller importers increasing their reliance on CNY and RUB invoicing at the expense of the USD/EUR invoicing.

To summarize, our transaction-level analysis suggests that the CNY financial infrastructure, the perceived threat of secondary sanctions and the rising fixed cost of clearing cross-border USD payments all influenced the choice of invoicing currencies, with trends reinforced by strategic complementarity. We find no evidence suggesting that switching was driven by the hedging motive among firms already exporting in CNY.

Our paper contributes to several strands of the economic literature. First, we contribute to the literature on the choice of invoicing currency (Goldberg and Tille (2008), Gopinath et al. (2010)) by showing that trade and financial sanctions affect this choice through several channels: geopolitical stance of trading partners, payment infrastructure, threat of secondary sanctions and costs of processing payments. Our analysis benefits from using variation across

[5]For example, Raiffeisen bank was reported to have started charging a 50 per cent commission on incoming USD transfers in Autumn 2023 (Cordell (2023)).

multiple trading partners and multiple vehicle currencies.[6] We also contribute to the growing literature on factors supporting the rise of international currencies, and in particular China's (Coppola et al. (2023), Clayton et al. (2022), Bahaj and Reis (2020)), by documenting the interplay between policies to promote internationalisation of renminbi through the use of currency swap lines and an exogenous shock to trade flows arising from Russia's full-scale invasion of Ukraine.

We contribute to the literature on the effectiveness of economic sanctions (for instance, Crozet and Hinz (2020), Tyazhelnikov and Romalis (2024), Chupilkin et al. (2025b), Itskhoki and Ribakova (2024)) by showing that the effectiveness of sanctions is attenuated, among other things, by the endogenous choice of currency of invoicing of imports and exports, which diminishes the ability of sanctioning economies to monitor and restrict trade in sanctioned goods. This switching reinforces and is, in turn, reinforced by diversion of trade to neutral trading partners (Yang et al. (2009), Chupilkin et al. (2023), Babina et al. (2023), Corsetti et al. (2024)), rerouting of trade and financial flows from the sanctioning economies via third jurisdictions (Efing et al. (2023), Besedeš et al. (2017), Chupilkin et al. (2023), Crozet et al. (2021)) and misclassification of goods at customs (Chupilkin et al. (2023)). The currency switching in international trade complements the shift away from the US dollar in the composition of international reserves of the sanctioned economies as documented by Goldberg and Hannaoui (2024).

We also contribute to the growing literature on fragmentation of global trade and investment flows (see, for instance Gopinath et al. (2025), Fajgelbaum et al. (2024), Freund et al. (2023), Alfaro and Chor (2023)). This literature has documented increasing trade and investment flows among economies that are more closely aligned geopolitically and decreasing flows across rival blocs. Gopinath et al. (2025) show that these trends have become particularly pronounced since Russia's invasion of Ukraine and imposition of economic sanctions on Russia in February 2022. We further show that this fragmentation of trade flows is accompanied by fragmentation in terms of currencies used to invoice trade. Among economies that did not participate in sanctions on Russia, the renminbi has become more widely used as a vehicle currency while the share of the US dollar as a vehicle currency has declined.

The rest of the paper is structured as follows. Section 2 sets the stage by outlining the economic sanctions imposed on Russia in 2022, presenting the data sources and describing the broad patterns found in the data. Section 3 lays out hypotheses to be tested, while Section 4 presents our empirical approach and discusses the results and their implications. The last section concludes.

2 Setting and Data

2.1 Sanctions on the Russian economy: An overview

Prior to Russia's full-scale invasion of Ukraine in February 2022, a narrow set of sanction was already in place, predominantly targeting specific companies and individuals. Those earlier sanctions were introduced in response to the annexation of Crimea in 2014 and the armed conflict in Eastern Ukraine that started in the same year. In retaliation, Russia introduced a number of trade restrictions, notably a ban on import of various food products from the EU,

[6] A related paper by Berthou (2023) shows that after the start of the Western sanctions on Russia in 2014, the propensity of French exporters to invoice their contracts in US dollars decreased, whereas the propensity to invoice in the local currency (ruble) increased.

the US and the UK (see Peeva (2019) for an overview). Those sanctions and counter-sanctions resulted in a broad-based reduction in Russia's trade with the sanctioning countries (Crozet and Hinz (2020)), an increase in prices of the affected goods (Hinz and Monastyrenko (2022)), weaker performance of sanctioned companies (Ahn and Ludema (2020)) and possibly an increased popular support for the government (Peeva (2019)).

The EU expanded its sanctions first on 23 February 2022 and then in subsequent multiple waves, with most export restriction being put in place already by 15 March 2022 when luxury goods were added (as part of the fourth package) to technology-related and dual-use goods (see Annex Figure A6). Overall, export prohibitions have covered arms, advanced and dual-use technology, quantum computing, advanced semiconductors, sensitive machinery, transportation and chemicals, goods for use in the oil industry and maritime navigation and goods seen to enhance Russia's industrial production capacity as well as luxury products (see Chupilkin et al. (2023)).

In addition to exports, sanctions have also applied to investments in a number of sectors; use of public funds; imports from Russia of certain goods such as coal, iron and steel, and wood; aviation, Russian freight operators; and financial services including transactions with Russia's Central Bank. As a result, a large part of foreign assets (reserves) of the Bank of Russia was frozen. Sanctions also included travel bans and financial measures targeting more than 1,200 individuals and 100 companies.

Under targeted provisions, transactions with a number of major Russian banks, including state-owned ones, were restricted and some banks were effectively disconnected from SWIFT, an international messaging system for clearing payments. At the same time, transactions with other banks, including some major subsidiaries of international banking groups in Russia as well as certain state-owned banks remained outside the scope of sanctions.[7]

In addition to the members of the European Economic Area, Australia, Canada, Japan, Korea, New Zealand, Switzerland, Taipei China, the UK and the US adopted their own sanction packages incorporating some form of trade sanctions, typically closely aligned with those of the EU (in particular, as far as dual-use technology and industrial goods are concerned) as well as some form of financial-sector sanctions. Overall, our analysis includes 45 sanctioning trading partners (see Annex Table A1 for a list). At the same time, China, Turkiye, India and the UAE are among Russia's main trading partners that did not impose economic sanctions.

2.2 Data on imports

Our analysis draws on transaction-level data of imports and exports going through Russia's customs. In 2022, for instance, the data contain more than 12 million import records associated with more than 74,000 unique importing firms. Over the years, the data tracks closely Russia's aggregate international trade, whether reported by Russia or by its trading partners via UN Comtrade, both on the import side and on the export side (see Annex Figure A1). Such data were used, for instance, by Korovkin and Makarin (2023) to analyze Ukraine-Russia trade after 2014 and by Babina et al. (2023) to examine exports of oil products from Russia in 2022-23.

Each import record contains information on the product (classified according to the Harmonized System of classification, HS), its value, quantity or weight, the sending (exporting) country, the location of the trading company acting as a seller (referred to as trading country),

[7] see Drott et al. (2023) for a detailed discussion and evidence that these measures were fairly effective in excluding the targeted Russian banks from clearing payments via Target2 payment system.

the importing firm in Russia as well as the currency of invoicing. The data only systematically cover transactions with counterparts outside the Eurasian Economic Union – a customs-free bloc comprising Armenia, Belarus, Kazakhstan, the Kyrgyz Republic and Russia.[8]

In our analysis, trading partners are defined by the location of trading company, as this location seems most relevant for the choice of currency of invoicing. In around 40 percent of cases, traders are located in the country of origin of goods (for example, Hong Kong SAR and Switzerland are more common as a location of a trading company than a location of goods origin). Table A2 summarizes descriptive statistics for Russia's imports aggregated to the level of a partner country and month.

To identify products or product groups, on which the EU introduced sanctions on exports to Russia after Russia's full-scale invasion of Ukraine, we follow the approach of Chupilkin et al. (2023). It is based on the information from the EU Council Regulation 833/2014 and its subsequent amendments as well as on the EU list of dual-technology products. We focus on the 6-digit HS products as the level of disaggregation, the highest level at which HS codes used by different countries are fully aligned. For each 6-digit HS product, we record the date when sanctions enter into force and define the subsequent month as the first period when a given product is under sanctions (for instance, April 2022 for sanctions adopted in mid-March 2022).

In some cases, sanctions cover HS6 codes only partially. For example, exports of "luxury" sports equipment or clothing with prices in excess of a certain threshold (typically €300) are subject to sanctions, while cheaper items belonging to the same product code may not be subject to restrictions. There are also cases where some products within an HS6 code are under sanctions, while others are not.[9] Numerous other exemptions from sanctions may apply, for instance, in relation to goods required by Russia to fulfill its contractual obligations with respect to deliveries of gas and oil to Europe or on health and environmental grounds.

As in Chupilkin et al. (2023), we distinguish between three major groups of sanctioned products: (i) dual-use and military technology goods, (ii) goods critical for industrial capacity and (iii) luxury goods (see Annex Figure A6). Each of these mutually exclusive groups contains between 500 and 1,100 HS6 product lines (as of December 2022), with the base category of non-sanctioned products comprising the remaining 3,186 HS6 codes.

2.3 First look at the data: Broad patterns

When looking at the currency of invoicing, we distinguish between contracts invoiced in the local currency of the importer (in our case, the Russian ruble), producer currencies (the currencies of partner countries) and vehicle currencies (i.e., currencies not used as domestic currencies by either the exporter or the importer). Among vehicle currencies, we focus on the US dollar and the euro (historically accounting for the bulk of Russia's trade and global trade) as well as CNY, the currency that has been gaining share of central banks' international reserves over the past two decades (Arslanalp et al. (2022)).

Prior to Russia's full-scale invasion of Ukraine in February 2022, the shares of Russia's imports invoiced in each major currency were fairly stable (see Figure 2, right panel). After March 2022, the share of Chinese renminbi (CNY) in imports started rising, up from around 3

[8] See Isakova et al. (2016) for a discussion of the union.

[9] The list of product groups partially covered by the sanctions is an eclectic mix of 2,182 HS6 codes (as of December 2022) combining: weapons (HS 9301), semi-conductor media (852352), engines and pumps (8412, 8413), containers (860900), aircraft and parts (88), ammonia (281420), steel pipes for oil pipelines (730411), navigation instruments (9014), ski suits (611220), and others.

percent of the total before the war to around 36 percent by the end of 2023. This trend is similar whether shares are calculated by volume of trade, by number of transactions invoiced in each currency or by number of firms dealing with invoices in each currency. The increased use of CNY is found both in exports from China (CNY as producer currency) as well as in exports from third countries (CNY as vehicle currency). Although these trends are more pronounced when looking at the shares of trade by currency, they are mirrored in trends in terms of volumes of trade invoiced in a given currency as well (see Figure 2, left panel).

The rise of CNY was most notable in payments for goods coming from China, where renminbi overtook the US dollar in the second half of 2022 (see Figure 3, top left panel). However, CNY also started being used for settling trades with third countries, such as Bangladesh, Laos, Mongolia or Pakistan (where the share of CNY rose to 40-80 percent in 2022 from nil in 2021) as well as Taipei China, Malaysia, South Africa, Thailand, Chile and Singapore among others (see Annex Figure A2). A small percentage of trades with the EU, US and UK (1-2 percent by volume or by number of transactions) also started using CNY as a vehicle currency.[10]

Among the top users of CNY, the majority of economies had currency swap lines in place with the PBOC (see Annex Table A3). The shift from the US dollar to CNY was much more pronounced in the sample of neutral economies (excluding China) while the composition of currencies of invoicing in trade with sanctioning economies remained broadly stable (see Figure 3, bottom panel).

We also observe an increased use of producer currencies in Russia's imports from major neutral trading partners, including India, Turkiye and the UAE (see Figure 3, bottom left). On average, the amounts are considerably more modest than in the case of CNY in absolute terms and in relative terms (amounting to 6 percent of bilateral trade in 2023) and these currencies are rarely, if at all, used as vehicle currencies. However, in bilateral trade, some of those currencies gained considerable importance with more than a third of exports from India invoiced in Indian rupee towards the end of 2023 (see Figure 3, top right).

2.4 Zooming in on importing firms

Historically, the numbers of firms dealing with invoices in a given currency (USD, EUR, CNY or RUB) in a given month have been fairly stable over time (see Figure 4). However, after the introduction of sanctions, the number of firms dealing with invoicing in CNY started to increase rapidly, while the numbers dealing with USD and EUR declined. Many of the firms dealing with CNY invoices were newly established (see Figure 5). In fact, in 2022 the entry rate among firms dealing with invoicing in CNY has far exceeded the entry rate for importers dealing with other currencies. When it comes to ruble invoicing, we document a high turnover of firms: more firms started working with ruble invoicing even as the share of ruble invoicing, if anything, declined as many firms have exited that line of business.

In Annex Table A4, we take a look at firms that deal with invoices in a given number of currencies (1, 2, 3 or 4 and more) in the pre-sanctions baseline period (March-December 2021) versus the same months of 2023 (period under the sanctions). We focus on transactions at the level of the importing firm, HS6 product and trading country. In the top panel, we consider firms that operated both before and after sanctions, while new entrants are considered in the

[10]This trend is also observed for Russia's exports, albeit to a lesser extent given the dominance of oil, gas, coal and other commodities typically traded in US dollars in Russia's export mix. Trading partners paying for Russia's exports in CNY are geographically more diverse: the top users already in 2022 including Costa Rica, El Salvador, Cote d'Ivoire, Thailand, the UAE, Cameroon, Colombia and Nicaragua.

bottom panel. Three striking patterns emerge. First, there was a pronounced drop in the share of firms, the share of transactions and the share of import volume relying on a single currency of invoicing. For instance, the single-currency share of transactions declined from more than 83 percent to less than 77 percent. The corresponding decline for the share of firms was from 95.2 to 89.0 percent. Second, there was a substantial increase in the fraction of firms, transactions and import volume with two currencies of invoicing. The share of transactions relying on two currencies rose from 15.7 to 20 percent. Third, among new entrants, i.e., the triplets that did not exist prior to the war, more than 16 percent of trade relied on two currencies. The tables also depicts cases of 3 or 4 and more currencies being used, though these are rather rare.

To trace the typical switches in terms of currency of invoicing dealt with, we focus on the vast majority of cases where firms dealt with a single currency in 2021 when importing a given product from a given country and look at the probabilities of using a given currency in the corresponding import operations two years later (see Table A5, where rows add up to 100 percent). Unsurprisingly, most firms continue dealing in the same currency but while this is true for 96-98 of firms using CNY, this holds for only 52 percent of firms dealing with the US dollar as a vehicle currency. The dominant switching patterns is from USD as a vehicle currency to CNY as a producer or vehicle currency (conditional probability of more than 40 percent). In addition, a notable share of firms historically using the ruble (local currency) switched to the euro or CNY or the US dollar.

Finally, Table 1 presents the share of imports, transactions and firms using a particular currency, distinguishing between producer and vehicle currencies. Echoing earlier observations, it shows a decline in the prominence of the USD as a vehicle currency with its share of imports dropping from 41 to 28 percent of import value. This trend is also visible in the share of importing firms, though not in the share of transactions. It also depicts a striking steady increase in the use of CNY as a vehicle currency from essentially a nil level. This increase in visible in the share of transactions, firms and import values. The same is true of CNY as a producer currency. Not surprisingly, the Russian ruble loses importance in terms of its share of transactions and import volume, though not the share of firms using it. The patterns for the euro as a vehicle currency are mixed.

2.5 Decomposing changes in the shares of currencies of invoicing

Total change in the share of invoicing for each currency j (for instance, the US dollar) can be decomposed into changes driven by shifts in import shares of various trading partners and changes in invoicing practices with each trading partner. The latter component can be further decomposed into average changes observed for each importing firm, changes in market shares of importing firms and entry and exit of new importing firms, as described in detail in the Annex.

The results of this decomposition are presented in Annex Table A7. Overall, the share of the US dollar in Russia's imports declined by 12.2 percentage points. Changes in the partner composition of imports worked in the opposite direction. By themselves, they would have increased the share of the US dollar by 13.7 percentage points as before sanctions economies such as China and Turkiye tended to invoice higher shares of their exports in US dollars than EU economies.[11]

Within firms and countries, the use of the US dollar declined by 18.2 percentage points. Another 9 percentage points are due to changes in market shares of existing firms – more

[11] In contrast, for the euro, country shifts account for 11.6 percentage points of the drop in the use of the currency, more than explaining the total change.

business done by firms that previously dealt relatively more with invoicing in other currencies. Entry and exit of firms made a small positive contribution (1.3 percentage points) on account of new firms specializing in processing of US dollar invoices.

For CNY, all components make positive contributions to the 30 percentage point increase in its use in invoicing. The greatest contribution comes from changes experienced on average by each importing firm (19.6 pp), followed by changes in country composition of trade (increased trade with China, 7.3 pp), changes in market shares of existing importing firms (more business by those firms that previously dealt with CNY invoicing, 2.3 pp) and entry and exit of firms (0.8 pp).

3 Hypotheses to be tested

In what follows, we investigate various mechanisms that may be behind the shift towards CNY and other producer currencies and away from the US dollar as a vehicle currency documented so far. These mechanisms may involve changes in perceived benefits and risks associated with different currency choices and changes in relative costs of processing payments in various currencies.

Geopolitical alignment Sanctions introduced on Russia in the aftermath of its full-scale invasion of Ukraine, and in particular freezing of a large part of Russian foreign reserves, have renewed interest of countries not aligned with the West in shifting away from reliance on the US dollar and creating an alternative international currency.[12] We hypothesize that different choices with respect to invoicing currencies may be made by countries participating in the sanctions and those not doing so. Thus in our analysis we will distinguish between imports from sanctioning countries versus neutral countries. We expect to see a greater shift away from the USD and towards CNY (or producer currency) invoicing among neutral countries.

Financial infrastructure Financial infrastructure is likely to matter for the costs of trading in certain currencies. In particular, firms in partner economies with an active currency swap line with the People's Bank of China may find it easier to invoice in renminbi. This is in line with Bahaj and Reis (2020) who argue that swap lines can be instrumental to jump-starting an international currency. Thus we anticipate that among neutral countries (that is those that have an incentive to change their choice of invoicing currency) those with PBOC swap lines will register a larger shift towards CNY invoicing.

Threat of secondary sanctions Switching away from the US dollar may in part reflect concerns about secondary sanctions. Indeed, in 2023 the US sanctioned a number of traders across multiple jurisdictions, from the Kyrgyz Republic to the UAE, for their role in facilitating trade in sanctioned goods with Russia. In this case, we can expect alternative currencies to disproportionately displace the US dollar in trades involving sanctioned products, in particular those classified as dual-use or crucial for building and maintaining industrial capacity.

[12] BRICS countries have featured particularly prominently in discussions of reducing the reliance on the US dollar (for instance, Savage (2023)).

Changes to relative costs of processing payments Trade sanctions and the associated complex compliance checks may drive up the cost of making cross-border payments in US dollars across the board (consistent with evidence in Crozet and Hinz (2020)). These are largely fixed costs that apply per bank customer (when it comes to certain know-your-customer compliance procedures). They are thus likely to affect smaller importers to a greater extent, irrespective of product characteristics.[13]

Strategic complementarity Firms have been shown to invoice in currencies used by their main competitors (e.g., Goldberg and Tille (2008)). Sanctions may thus act as an exogenous shock affecting such strategic complementarity calculations, as companies in sanctioning jurisdictions can be widely expected to abandon the Russian market. We anticipate that products that had been historically supplied by Western exporters and had been invoiced in USD are going to see greater changes in invoicing currencies.

Hedging Traders may also seek to limit currency risk. Some importers may have been previously using other currencies, notably CNY, to invoice their exports. Those importers may have additional incentives to hedge their cash flow and / or utilize available liquidity by seeking to pay for imports in CNY.

To shed light on these mechanisms empirically, we will work with a very fine level of detail where each observation is specific to an importing firm, month, partner country and product. This grid enables us to saturate specifications with comprehensive sets of fixed effects and thus isolate various mechanisms. For example, we can zoom in on the role of firm characteristics while controlling for the types of goods traded and partner countries and, conversely, zoom in on the currencies of invoicing used by the same firms to pay for different products.[14]

4 Empirical results

4.1 Is there a shift away from USD invoicing in imports from neutral economies?

To examine whether there are differential patterns in the choice of invoicing currencies between sanctioning and neutral economies, we will follow a difference-in-difference approach and estimate the following specification:

$$CurrencyShare_{fpct} = \beta PostSanctions_t * CountryGroup_c + \alpha_{fpc} + \alpha_{fpt} + \epsilon_{fpct} \quad (1)$$

where the dependent variable is the share of Russia's imports of HS6 product p by firm f from trading partner country c in a given month t that are denominated in a particular currency. We consider each currency or the type of currency separately. The shares are calculated in terms of value. Across specifications, we look at the use of CNY as a producer currency (focusing on trade with China), CNY as a vehicle currency (focusing on trade with all other

[13] See also Crowley et al. (2020) for evidence that fixed costs of dealing with a currency play a significant role in shaping firms' choices of the currency of invoicing.

[14] Our results are robust to aggregating the data at the product-partner country-month level or country-month level, thus ignoring the firm (and product) dimension. In some cases, we will show these results as well.

economies), USD as a vehicle currency, EUR as a vehicle currency, other producer currencies (excluding CNY, USD and EUR) and the ruble.[15] Where trade is not observed for a given firm-product-country-month combination, the corresponding observations are considered to be missing for all currencies. Where trade is observed in at least one currency, the corresponding observations are defined for all currencies (as zeros or otherwise).

We distinguish between the pre-sanction and the post-sanction period (the latter defined from March 2022 onwards) by means of an indicator variable *PostSanctions*. We group countries depending on whether they participated in sanctions, with sanctioning economies (listed in Annex Table A1) forming the omitted baseline group. We separate China from the rest of neutral economies, given China's role as Russia's main trading partner, and our interest in distinguishing between the role of CNY as a producer versus vehicle currency. Recall that the broad trends, discussed in section 2.3, pointed to a diminishing use of the US dollar in trade with neutral economies accompanied by an increasing use of CNY and producer currencies such as those of the UAE, India and Turkiye.

The econometric specification includes firm-product-country fixed effects and firm-product-month fixed effects. The former mean that we consider changes to currencies of invoicing holding the importing firm, the product and the trading country triplet constant and comparing the pre-sanction to the post-sanction period. In other words, we look for changes made by a given trading firms which imports a particular product from a particular partner country in the aftermath of the introduction of sanctions. The latter set of fixed effects allows us to control for anything specific to a given product sourced by a given firm in a particular month, such as a preference for sourcing a particular type of product in a particular currency across all source countries, or firm-month specific changes in the cost of clearing payments in a given currency. We cluster standard errors at the country-month or product level.

The results from our difference-in-difference analysis presented in Table 2 (where sanctioning economies represent the omitted category) are in line with the broad patterns visible in raw data discussed earlier and depicted in Figure 3. In the case of Russian imports from China, the within-firm use of producer currency (CNY) increased by an extra 24 pp under sanctions (relative to pre-invasion trade and trade with sanctioning economies, column 1).[16] This effect is statistically significant at the one percent level and is mirrored by the 23 pp drop in the share of the US dollar (column 2). The results also indicate a very small drop in the use of the euro as a vehicle currency (column 3) and a small increase in reliance on the ruble (column 5).

A similar pattern is observed for neutral trading partners other than China, though the economic magnitudes are smaller. Columns 1 and 2 point to an increase in the use of CNY as a vehicle currency (4.2 pp) and a decline in reliance on the USD as a vehicle currency (-7 pp), respectively. There is also evidence of statistically significant, albeit smaller, shifts towards producer currencies and the ruble.

In sum, these results point to geopolitical alignment of trading partners playing a role in the choice of invoicing currencies.

[15] Vehicle currencies other than USD, EUR and CNY accounted for less than 0.5 percent of third-country trade with Russia. In addition to the United States and the euro area, a number of economies use the US dollar and the euro as domestic currencies, for example Panama, Ecuador, Kosovo and Montenegro. In these cases, the US dollar and the euro are considered to be producer currencies.

[16] Identification in these regressions comes from firms that import a given product from multiple countries in a given month. Such firms are a minority, both internationally (see, for instance, Antràs et al. (2017)) and in Russia, and hence the numbers of observations are smaller than in other firm-level specifications.

Our results so far have been identified based on firm-product-country triplets with continued import flows (due to the inclusion of firm-product-country fixed effects) and have not captured the contribution of new entrants, which may have been substantial (recall Figure 5). One would expect the estimated effects to be larger when accounting for both within-firm effects (reported above) and the turnover of firms (as firms tend to specialize in trading partners and currencies of invoicing). Therefore, we also consider trade aggregated across firms at the product-country-month level. We estimate a specifications similar to equation (1), which now includes product-country and product-month fixed effects:

$$CurrencyShare_{pct} = \beta PostSanctions_t * CountryGroup_c + \alpha_{pc} + \alpha_{pt} + \epsilon_{pct} \quad (2)$$

The results presented in the bottom panel of the Table 2 are qualitatively similar and the coefficients tend to be larger. We now also observe a significant shift away from the euro in trade with China and other neutral economies relative to the pre-sanctions baseline and trade with sanctioning economies.

4.2 Do PBOC swap lines help CNY to gain ground as a vehicle currency?

Prior to 2022, the use of CNY as a vehicle currency in Russia's imports was very rare. Subsequently, the share of CNY-denominated imports with third countries increased from 0.6 percent in the second half of 2021 to 12 percent in the second half of 2023 (see Annex Figure A3).

Motivated by the work of Bahaj and Reis (2020) who argue that swap lines can be instrumental in jump starting an international currency and by the earlier observation that the top users of CNY tend to have swap lines with the People's Bank of China, we further investigate this question in a difference-in-difference setting. Swap lines make it easier for an exporter in a third country to use renminbi received from, say, a Russian importer. We update a list of swap lines in Bahaj and Reis (2020) using information from the People's Bank of China (PBOC) website (see Annex Table A3 for a list).

In the analysis, we focus on the share of trade invoiced in CNY as a vehicle currency, which means that we exclude imports from China. This share is calculated either in terms of value (the results are similar looking at the shares calculated using the numbers of transactions, which are not affected by movements in exchange rates). We distinguish between economies with an active swap line with the PBOC and economies without such a swap line. Among economies with a swap line, a total of 31 imposed trade sanctions on Russia while 25 did not, which enables us to conduct this analysis separately on a full sample (excluding China), a subsample of neutral economies (excluding China) and a subsample of sanctioning economies.[17] Although the establishment of swap lines is not random as far as China's trade patterns are concerned, it is arguably unrelated to Russia's trade with third countries.

The specification represents a modified version of equation (1). It includes a swap line indicator ($Swap$) which takes on a value of one if partner country c has an active line swap line with the PBOC in month t, and zero otherwise. It also includes the post-sanctions indicator, an interaction between the two indicators and two sets of fixed effects (described earlier):

[17] The ECB-PBOC swap line is assigned to all euro area countries.

$$CurrencyShare_{fpct} = \beta_1 PostSanctions_t * Swap_{ct} + \gamma Swap_{ct} + \alpha_{fpc} + \alpha_{fpt} + \epsilon_{fpct} \quad (3)$$

The results are summarized in Table 3. Under sanctions, the share of Russia's CNY-denominated imports from economies with a CNY swap line (irrespective of their position on sanctions) was around 0.9 pp higher than could have otherwise been expected (column 1). Prior to the invasion, swap lines seem to have had an economically negligible effect on invoicing in CNY. In part, this may reflect the fact that this effect is identified only based on a small subset of economies where a swap line was introduced after 2016 (for almost four fifth of economies, pre-existing swap lines are subsumed in the firm-product-country fixed effect).

In columns 2-3, we consider separately the subsamples of economies participating in sanctions and those not doing so. The positive effect of a swap line on CNY invoicing in the post-sanction trade with Russia is only observed for economies not participating in trade sanctions. For these economies, the effect is considerably larger, at around 4.5 pp. For the sanctioning economies, the corresponding effect is very small and, if anything, negative.

As anticipated, when more aggregated data are used, the estimated effect of the swap lines is considerably larger (columns 4-6). It is close to 2 pp in the full sample and 12 pp in the subsample of neutral economies.

A similar picture can be seen in Figure 6 presenting aggregate currency shares for imports from neutral economies with a PBOC swap line (left) and without one (right). The share of USD declined markedly faster, and the share of CNY as a vehicle currency rose much more rapidly, in the subsample of neutral economies with a swap line.

The results are thus consistent with an interplay between geopolitical fragmentation of trade and the existence of swap lines, whereby CNY swap lines nudge neutral (and only neutral) exporters towards contracts invoiced in CNY.

4.3 Is USD used less when sanctioned goods are traded?

Next, we focus on the role played by the threat of secondary sanctions. In particular, as USD denominated payments need to be cleared through the US banking system, entities trading products under international sanctions may choose alternative currencies of invoicing to reduce the likelihood of detection and being subjected to secondary sanctions.

In a difference-in-difference framework, we consider three treated groups of sanctioned products ($ProductType$) – dual-use, industrial, luxury goods – with non-sanctioned products, the latter constituting the omitted baseline category.[18] We control for firm-product-country and firm-country-month fixed effects that capture, among other things, any unobservables driving invoicing decisions related to a firm's imports of a given product from a given country as well as any unobservables related to invoicing by a given firm in a post-sanction period of imports from a given trading partner across various products. We thus zoom in on differences that can be attributed to traded products while controlling for firm and country characteristics. The estimating equation 4 is similar to the one used in the previous exercise (except the $PostSanctions$ indicator is product-specific, mainly to account for a slightly later application of sanctions to luxury goods):

[18] See section 2.2 for a description.

$$CurrencyShare_{fpct} = \beta PostSanctions_{pt} * ProductType_p + \alpha_{fpc} + \alpha_{fct} + \epsilon_{fpct} \quad (4)$$

The results are presented in Table 4. They point to a decline in the share of trade invoiced in USD when industrial and dual-use goods are imported in the post-sanction period. This decline is mirrored by an increased use of CNY as producer currency and, in the case of dual-use goods, an increased use of CNY as a vehicle currency.

When data are aggregated at the product-country-month level, the magnitudes increase, as anticipated (see Table 4, bottom panel). The estimates point to the share of USD invoicing declining by 1-2 pp for both dual-use and industrial products in the post-sanction period, a 5-7 pp increase in the use of CNY as producer currency and a smaller (albeit also statistically significant) increase in reliance on CNY as a vehicle currency. There is also evidence of greater use of other producer currencies when these two product groups are being traded.

Luxury goods exhibit a completely different pattern. This may be for two reasons. First, our indicator variable only imperfectly captures flows of luxury goods that are subject to western sanctions. As discussed earlier (see section 2.2), in some cases only products above a certain price threshold are subject to sanctions or only some of the products belonging to an HS6 group are under sanctions. For instance, ski suits that cost more than 300 euros are under sanctions, while their cheaper versions are not. Similarly, within the HS6 product category of sparkling wines, champagne and asti spumante are under sanctions, while prosecco is not. Second, sanctioning countries tend to pay more attention to trade in goods seen to enhance the sanctioned country's military and economic prowess than to flows of luxury goods.

The patterns emerging from the above regressions are also visible in the raw data. Figure 7 shows currency breakdown of Russian imports depicted separately for dual use goods, industrial goods and non-sanctioned goods. Although in all cases the importance of USD invoicing goes down, this change is less pronounced for non-sanctioned goods. This holds in the top panel (imports from China) and in the bottom panel (imports from neutral economies other than China).

4.4 Strategic complementarity

Firms have been shown to be more likely to invoice their goods in currencies used by their competitors (see, for instance, Goldberg and Tille (2008), Goldberg and Tille (2016)). The imposition of sanctions changed the nature of competition in the Russian market precipitating exit of firms from sanctioning economies (see Chupilkin et al. (2025a)). We test if these exits had a bearing on the choice of currency of invoicing through the strategic complementarity channel.

In particular, for each product we compute the share of Russian imports in 2021 that came from the sanctioning economies and were invoiced in US dollars. Where these shares were high, incentives of other exporters to invoice in US dollars may have weakened substantially after the introduction of sanctions and exit of Western competitors. Where these shares were low, equilibrium choices of other exporters were unlikely to be affected by changes in strategic complementarity considerations. We rank products by the calculated shares of pre-sanctioned imports from sanctioning economies invoiced in USD and split them into terciles. Products with a relatively high share of pre-sanction imports from sanctioning economies invoiced in USD, for instance, include aircraft (sanctioned) as well as soya beans while relatively low shares are observed for trailers (sanctioned) and medical suppliers.

To shed light on the strategic complementarity channel, we augment the specification from Equation 4 by adding interactions between the categorical variable capturing the terciles of pre-sanctions exposure to USD invoicing by Western firms and the post-sanction dummy. The results, presented in Table 5, are consistent with our expectations. Focusing on the lower panel where trade is aggregated at the product-country-month level, for products with high "exposure" to prior USD invoicing by exporters from sanctioning economies, the share of USD invoicing declined by an additional 1.2 pp points in the post-sanction period, with increases observed in the shares of CNY as a vehicle currency and other producer currencies. These shifts are observed in parallel with the shifts associated with certain products being subject to sanctions, and the magnitudes of the effects estimated for various types of sanctioned goods remain similar to those reported earlier.[19] The patterns emerging from the above regressions are also visible in the raw data. Annex Figure A4 shows currency breakdown of Russian imports depicted separately for goods with high and low USD exposure pre-sanctions. Good with high USD exposure saw a greater decline in the share of trade invoiced in USD.

4.5 What kind of firms invoice imports in CNY?

We extend the regression analysis to shed light on the propensity to work with different invoicing currencies among different types of firms. In particular, we investigate whether the shift towards the use of renminbi and other alternative currencies after the introduction of sanctions was led by large companies, systemically important firms, state-owned enterprises (SOE) or new firms.

We measure firm size with the logarithm of total firm-level imports, taking the maximum value across calendar years. We further identify 1,186 state-owned importers in our sample (those with state ownership in excess of 25 percent) based on information about ultimate owners in Bureau van Dijk's Orbis database. We also identify 705 privately-owned importers that appear on the list of systemically important (strategic) firms published by the Russia's Ministry of Economic Development. The enterprises on this list are important producers and employers in their industry, their region or their market (as defined by the competition authority) or they are considered to be important for national defence, advanced technologies, information and telecommunication technologies or transport connectivity. The list also includes an additional 167 state-owned systemic importers.

Finally, we define new importers as firms that are neither state-owned nor systemic and first appear in the dataset within the 12-month window preceding the transaction. Thus, an indicator for new firms is time varying. For example, firms appearing in February 2019 for the first time are counted as new from February 2019 to January 2020.

We estimate the following specification:

$$CurrencyShare_{fpct} = \beta PostSanctions_t * FirmType_f + \gamma New_{ft} + \alpha_{fpc} + \alpha_{pct} + \epsilon_{fpct} \quad (5)$$

where $FirmType$ pertains to firm size (captured by the logarithm of imports, as defined above), SOEs, private strategically important firms and new firms. Note that the new firm

[19] A similar analysis can be performed for measures of prior exposure to invoicing in euros. It yields conceptually similar results with invoicing shifting significantly from euros to CNY as producer currency, in particular, for products with higher prior exposure.

indicator is time varying and thus enters separately as well. As before, the specification includes firm-product-country fixed effects. We also include product-country-time fixed effects.

The results, presented in Table 6, suggest that it is the firm size, rather than its systemic importance or the SOE status, that is the best predictor of invoicing decisions. Namely, we find that large importers tend to deal more with invoices in USD and less with invoices in CNY as producer currency under the sanctions. The remaining interactions involving the firm size either produce economically negligible or statistically insignificant effects.

As for the new firms, they are less likely to deal with invoices in rubles and more likely to deal with CNY invoicing in their trade with China (with the latter effect being true both before and during the sanctions period). Perhaps not surprisingly, state-owned firms rely more on invoicing in rubles and less on invoicing in euros (as a vehicle currency) once sanctions are imposed.

The coefficients on the interaction terms between the systemic-firm dummy and the sanctions period are small and not statistically significant.

These results are consistent with increasing fixed costs and complexity of making cross-border payments in currencies of the sanctioning economies (notably in US dollars) pushing smaller firms more strongly towards alternative currency arrangements.

4.6 Invoicing in the case of exporters

Finally, we investigate the extent to which currency switching by firms may be driven by a hedging motive. In particular, we look at a subset of importers in the dataset (a total of 44,889 firms) that also export their products directly. The majority of firms that deal with CNY invoicing do so only on the import side (close to 45 percent in the second half of 2023, see also Annex Figure A5). Only 3 percent of firms dealt with CNY invoicing of both imports and exports at the time and a further 4 percent invoiced exports in CNY but did not pay for imports in renminbi.

In other words, relatively little, if any, switching from USD to CNY in import transactions reported earlier could be attributed to hedging behaviour on the part of firms invoicing their exports in CNY (or attempt by these firms to utilize spare CNY liquidity from export receipts).

Firms that start importing (but not exporting) in CNY during the sanctions period have a significantly higher conditional probability of invoicing their exports in CNY in the next quarter than firms that neither exported nor imported in CNY (around 5 percent vs below 1 percent), pointing to hedging behaviour and / or learning on the part of importer-exporter firms. The evidence is not fully conclusive, however, as firms only importing in CNY had a significant conditional probability of not dealing in CNY at all in the next quarter (8 to 12 percent, see Annex Table A6).

5 Robustness checks and extensions

Transaction share. Throughout the analysis, the shares of each currency of invoicing were calculated using volumes of trade in a given month. These calculations may be affected by

movements in exchange rates. The results are similar if the shares are calculated based on the number of transactions using a given currency of invoicing in a given month.

Timing of sanctions. The results are also similar if a time-invariant categorization of sanctioned versus non-sanctioned products is used throughout the analysis, for instance, classifying products based on application of sanctions as of end-2022.

Event study: geopolitical alignment. Our setting lends itself well to an event-study analysis given the unanticipated nature of the war and the clear-cut timing of the introduction of the sanctions. The underlying econometric specification aggregates trade at the level of product, partner country and month:

$$CurrencyShare_{pct} = \sum_t \beta_t Month_t * CountryType_c + \alpha_{pt} + \alpha_{pc} + \epsilon_{pct} \tag{6}$$

The dependent variable is the share of imports of product p from a given country c in a given month t denominated in a given currency. The interactions of interest are those between an indicator for China as the partner country and month fixed effects or an indicator for other neutral economies as trading partners and month fixed effects, with sanctioning economies being the base group. January 2022 serves as the base (omitted) period.

Although monthly trade is volatile, a number of striking patterns emerge from this analysis (see Figure 8). Up until February 2022, there had been no clear differential trends in the use of USD as a vehicle currency between China and sanctioning economies or between other neutral economies and sanctioning economies, and no differential trends across groups of economies when it comes to the use of CNY (as a producer or vehicle currency).

However, between March 2022 and mid-2023, the estimated "deficit" share of USD in trade with neutral economies kept rising steadily from month to month, as payment systems and mechanisms were being set up, before stabilizing in the second half of 2023. This gradual decline in the use of USD is mirrored by an equally gradual and significant increase in the share of CNY in trade between neutral economies and Russia (as well as China-Russia trade) relative to what could have been expected based on the broad import patterns. Below we further zoom in on the use of CNY as a vehicle currency in Russia's imports.

Event study analysis: PBOC swap lines. The effect of swap lines can also be traced in an event study format. We estimate a simplified two-way fixed-effects model in the subsamples of sanctioning and neutral countries, additionally interacting the dummy for the existence of swap line (as of March 2022) with month-specific dummy variables (see Equation 7). As before, January 2022 serves as a base period.

$$CurrencyShare_{pct} = \sum_t \beta_t Month_t * Swap_{pct} + \alpha_{pc} + \alpha_{pt} + \epsilon_{pct} \tag{7}$$

The results, presented in Figure 9, are consistent with our baseline regressions.[20] They show no pre-trends in differential use of CNY by different groups of Russia's trading partners prior to sanctions. They further indicate that among neutral economies, countries with PBOC swap lines steadily increased their reliance on CNY relative to countries without swap lines. No statistically significant differential is detected among sanctioning economies.

6 Conclusion

Using transaction-level data on Russia's international trade, we document a number of striking patterns with respect to the choice of currency of invoicing in the aftermath of Russia's invasion of Ukraine in 2022. The share of Russia's imports denominated in renminbi increased by 33 percentage points. The dominant switching behaviour was for importing firms to move from paying in USD as a vehicle currency to paying in CNY as a producer or vehicle currency.

The use of renminbi as a vehicle currency increased by up to extra 12 percentage points, on average, for trading partners that have an active renminbi swap line. This effect, however, is present only for third countries that did not impose economic sanctions on Russia.

The increase in CNY invoicing was more pronounced for trade in internationally sanctioned dual-use (and industrial) goods, pointing to the role likely played by the perceived risk of secondary sanctions being imposed on entities facilitating trade in internationally-sanctioned goods. These trends appear to be further reinforced by strategic complementarity considerations on the part of exporters.

The number of Russian importing firms working with renminbi invoices has increased sharply, mirrored by a drop in numbers of firms dealing with USD and EUR invoicing. This may reflect the rising fixed costs of clearing US dollar payments under sanctions, owing to increased compliance checks. Consistent with this mechanism, switching away from the US dollar is estimated to be more prevalent for smaller firms. We do not find evidence that switching was driven by the hedging motive among firms already exporting in CNY.

The analysis covers a relatively small part of international trade – bilateral transactions of the 11^{th} largest economy in the world. At the same time, by revealing rapid shifts in the choice of currency of invoicing in response to trade and financial sanctions imposed on Russia, the paper invites further research into ways in which the use of major international currencies responds to sanctions.

The analysis also illustrates a broader point: rising geopolitical tensions in general, and the use of trade sanctions in particular, may reduce the attractiveness of the use of US dollar as a vehicle currency in international trade in certain segments of the increasingly fragmenting global market. This can facilitate the rapid rise of new international currencies as well as greater use of producer or importer currency to settle trades among important subsets of trading partners. This, in turn, might lead to a greater fragmentation of global payment systems and reduce the effectiveness of economic sanctions in the future.

[20] Note that the left panel (sanctioning economies) and the right panel (neutral economies excluding China) are using different scales.

References

Ahn, Daniel P., and Rodney D. Ludema (2020) 'The sword and the shield: The economics of targeted sanctions.' *European Economic Review* 130, 103587

Alfaro, Laura, and Davin Chor (2023) 'Global supply chains: The looming "great reallocation".' NBER Working Papers 31661, National Bureau of Economic Research, Inc, September

Amiti, Mary, Oleg Itskhoki, and Jozef Konings (2022) 'Dominant currencies: How firms choose currency invoicing and why it matters.' *The Quarterly Journal of Economics* 137(3), 1435–1493

Antràs, Pol, Teresa C. Fort, and Felix Tintelnot (2017) 'The margins of global sourcing: Theory and evidence from US firms.' *American Economic Review* 107(9), 2514–64

Arslanalp, Serkan, Barry Eichengreen, and Chima Simpson-Bell (2022) 'The stealth erosion of dollar dominance and the rise of nontraditional reserve currencies.' *Journal of International Economics* 138, 103656

Babina, Tania, Benjamin Hilgenstock, Oleg Itskhoki, Maxim Mironov, and Elina Ribakova (2023) 'Assessing the impact of international sanctions on Russian oil exports.' CEPR discussion paper 58455, Centre for Economic Policy Research

Bacchetta, Philippe, and Eric van Wincoop (2005) 'A theory of the currency denomination of international trade.' *Journal of International Economics* 67(2), 295–319

Bahaj, Saleem, and Ricardo Reis (2020) 'Jumpstarting an international currency.' Bank of England working papers 874, Bank of England, June

_ 'Central bank swap lines: Evidence on the effects of the lender of last resort'

Berthou, Antoine (2023) 'International sanctions and the dollar: Evidence from trade invoicing.' Banque de France Working Paper 294, Banque de France

Besedeš, Tibor, Stefan Goldbach, and Volker Nitsch (2017) 'You're banned! The effect of sanctions on German cross-border financial flows.' *Economic Policy* 32(90), 263–318

Bianchi, Javier, and César Sosa-Padilla (2023) 'International sanctions and dollar dominance.' NBER Working Paper 31024, National Bureau of Economic Research

Boz, Emine, Camila Casas, Georgios Georgiadis, Gita Gopinath, Helena Le Mezo, Arnaud Mehl, and Tra Nguyen (2022) 'Patterns of invoicing currency in global trade: New evidence.' *Journal of International Economics* 136, 103604

Chupilkin, Maxim, Beata Javorcik, Aleksandra Peeva, and Alexander Plekhanov (2025a) 'Decision to leave: Economic sanctions and intermediated trade.' EBRD Working Paper Forthcoming, European Bank for Reconstruction and Development

_ (2025b) 'Economic sanctions and intermediated trade.' *American Economic Review: Papers and Proceedings*

Chupilkin, Maxim, Beata Javorcik, and Alexander Plekhanov (2023) 'The Eurasian roundabout: Trade flows into Russia through the Caucasus and Central Asia.' EBRD Working Paper 276, European Bank for Reconstruction and Development

Clayton, Christopher, Amanda Dos Santos, Matteo Maggiori, and Jesse Schreger (2022) 'Internationalizing like China.' NBER Working Papers 30336, National Bureau of Economic Research, Inc

Coppola, Antonio, Arvind Krishnamurthy, and Chenzi Xu (2023) 'Liquidity, debt denomination, and currency dominance.' Working Paper 30984, National Bureau of Economic Research, February

Cordell, Jake (2023) 'Raiffeisen's Russian division imposes 50% commission on incoming dollar transfers.' *The Moscow Times.* Accessed: 2023-09-16

Corsetti, Giancarlo, Banu Demir, and Beata Javorcik (2024) 'Trading around geopolitics.' Working Paper August, University of Oxford

Crowley, M. A., L. Han, and M. Son (2020) 'Dominant currency dynamics: Evidence on dollar-invoicing from UK exporters.' CEPR Discussion Paper 15493, CEPR

Crozet, Matthieu, and Julian Hinz (2020) 'Friendly fire: The trade impact of the Russia sanctions and counter-sanctions.' *Economic Policy* 35(101), 97–146

Crozet, Matthieu, Julian Hinz, Amrei Stammann, and Joschka Wanner (2021) 'Worth the pain? Firms' exporting behaviour to countries under sanctions.' *European Economic Review* 134, 103683

Drott, Constantin, Stefan Goldbach, and Volker Nitsch (2023) 'The effects of sanctions on Russian banks in Target2 transactions data.' Technische Universität Darmstadt Working Paper, Technische Universität Darmstadt

Efing, Matthias, Stefan Goldbach, and Volker Nitsch (2023) 'Freeze! Financial sanctions and bank responses.' *The Review of Financial Studies* p. Forthcoming

Fajgelbaum, Pablo, Pinelopi K. Goldberg, Patrick J. Kennedy, Amit Khandelwal, and Daria Taglioni (2024) 'The US-China trade war and global reallocations.' *American Economic Review: Insights*

Felbermayr, Gabriel, Aleksandra Kirilakha, Constantinos Syropoulos, Erdal Yalcin, and Yoto V. Yotov (2020) 'The global sanctions data base.' *European Economic Review* 129, 103561

Freund, Caroline, Aaditya Mattoo, Alen Mulabdic, and Michele Ruta (2023) 'Is US trade policy reshaping global supply chains?' Policy Research Working Paper Series 10593, The World Bank, October

Georgiadis, Georgios, Helena Le Mezo, Arnaud Mehl, and Cedric Tille (2021) 'Fundamentals vs. policies: Can the US dollar's dominance in global trade be dented?' GRU Working Paper 28, City University of Hong Kong

Geranmayeh, Ellie, and Manuel Lafont Rapnouil (2019) 'Meeting the challenge of secondary sanctions.' In *Strategic Sovereignty: How Europe Can Regain the Capacity to Act,* ed. Mark Leonard and Jeremy Shapiro (London: European Council on Foreign Relations)

Goldberg, Linda S., and Cédric Tille (2008) 'Vehicle currency use in international trade.' *Journal of International Economics* 76(2), 177–192

_ (2016) 'Micro, macro, and strategic forces in international trade invoicing: Synthesis and novel patterns.' *Journal of International Economics* 102, 173–187

Goldberg, Linda S., and Oliver Hannaoui (2024) 'Drivers of dollar share in foreign exchange reserves.' Staff Report 1087, Federal Reserve Bank of New York, March

Gopinath, Gita, and Jeremy C Stein (2020) 'Banking, trade, and the making of a dominant currency.' *The Quarterly Journal of Economics* 136(2), 783–830

Gopinath, Gita, Emine Boz, Camila Casas, Federico J. Díez, Pierre-Olivier Gourinchas, and Mikkel Plagborg-Møller (2020) 'Dominant currency paradigm.' *American Economic Review* 110(3), 677–719

Gopinath, Gita, Oleg Itskhoki, and Roberto Rigobon (2010) 'Currency choice and exchange rate pass-through.' *American Economic Review* 100(1), 304–36

Gopinath, Gita, Pierre-Olivier Gourinchas, Andrea F. Presbitero, and Petia Topalova (2025) 'Changing global linkages: A new Cold War?' *Journal of International Economics* 153, 104042

Gourinchas, Pierre-Olivier, Helene Rey, and Nicolas Govillot (2010) 'Exorbitant privilege and exorbitant duty.' IMES Discussion Paper Series 10-E-20, Institute for Monetary and Economic Studies, Bank of Japan

Hinz, Julian, and Evgenii Monastyrenko (2022) 'Bearing the cost of politics: Consumer prices and welfare in Russia.' *Journal of International Economics* 137, 103581

Isakova, Asel, Zsoka Koczan, and Alexander Plekhanov (2016) 'How much do tariffs matter? Evidence from the customs union of Belarus, Kazakhstan and Russia.' *Journal of Economic Policy Reform* 19(2), 166–184

Itskhoki, Oleg, and Elina Ribakova (2024) 'The economics of sanctions: From theory into practice.' Brookings Papers on Economic Activity Forthcoming

Korovkin, Vasily, and Alexey Makarin (2023) 'Conflict and intergroup trade: Evidence from the 2014 Russia-Ukraine crisis.' *American Economic Review* 113(1), 34–70

Mukhin, Dmitry (2022) 'An equilibrium model of the international price system.' *American Economic Review* 112(2), 650–88

Peeva, Aleksandra (2019) 'Did sanctions help Putin?' Discussion Papers 2019/7, Free University Berlin, School of Business Economics

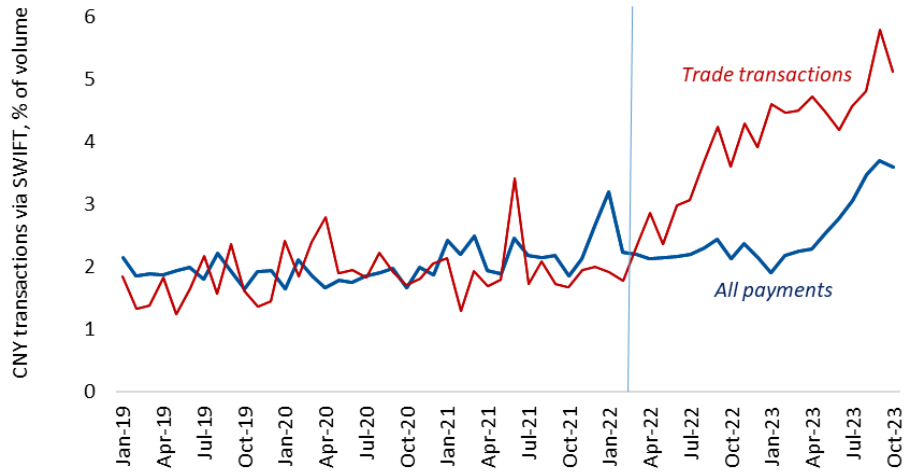
Savage, Rachel (2023) 'What is a BRICS currency and is the U.S. dollar in trouble?' *Reuters.* Accessed: 2023-09-16

Steinbach, Sandro (2023) 'The Russia–Ukraine war and global trade reallocations.' *Economics Letters* 226, 111075

Tyazhelnikov, Vladimir, and John Romalis (2024) 'Russian counter-sanctions and smuggling: Forensics with structural gravity estimation.' *Journal of International Economics* 152, 104014

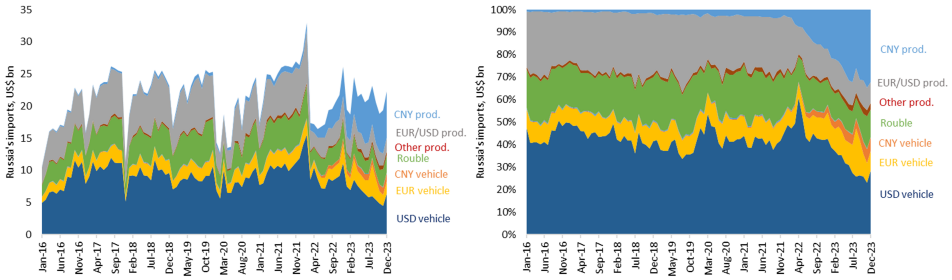
Yang, Jiawen, Hossein Askari, John Forrer, and Lili Zhu (2009) 'How do us economic sanctions affect EU's trade with target countries?' *The World Economy* 32(8), 1223–1244

Figure 1: Share of CNY in SWIFT messages



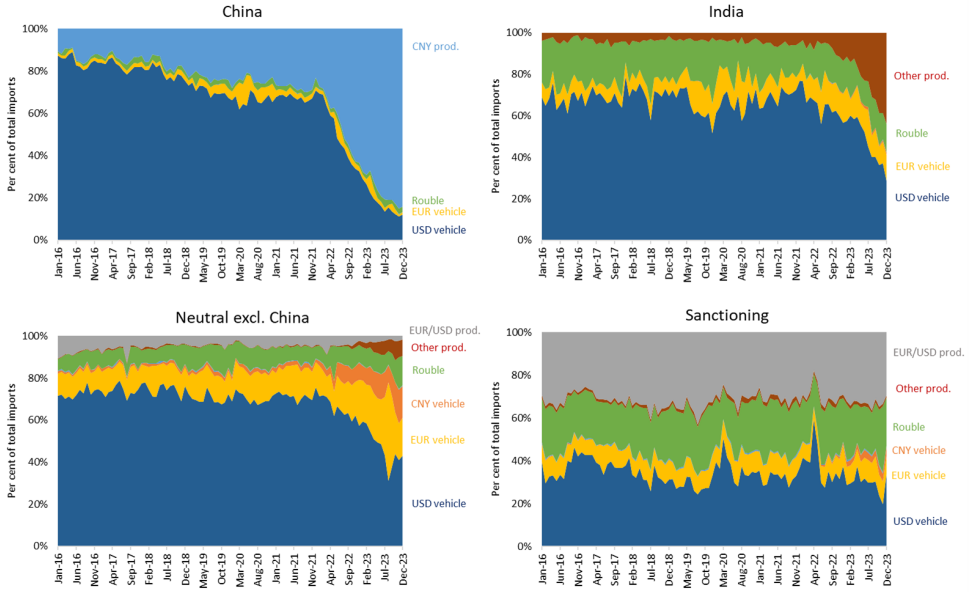
Source: SWIFT RMB tracker.
Note: The figure shows the share of SWIFT messages (by value) accounted for by CNY, for all messages and trade-related messages.

Figure 2: Share and volume of imports, by currency of invoicing



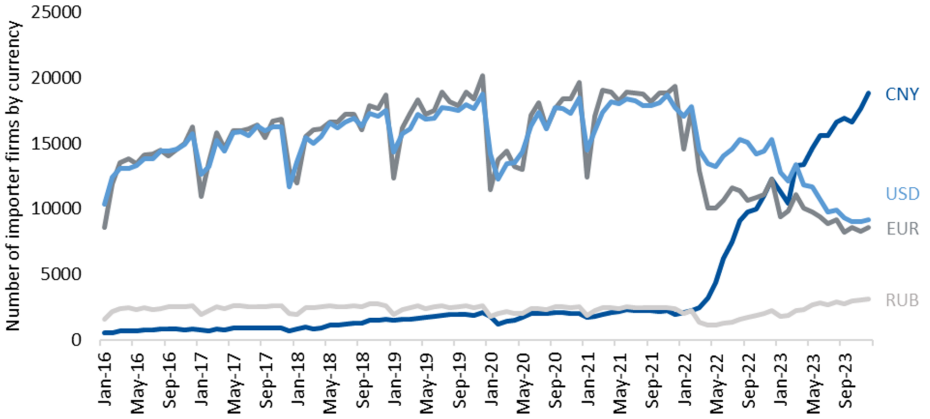
Note: The shares and volumes are calculated by month, by trade volume.

Figure 3: Russia's imports from China, other neutral economies and sanctioning economies, by currency of invoicing



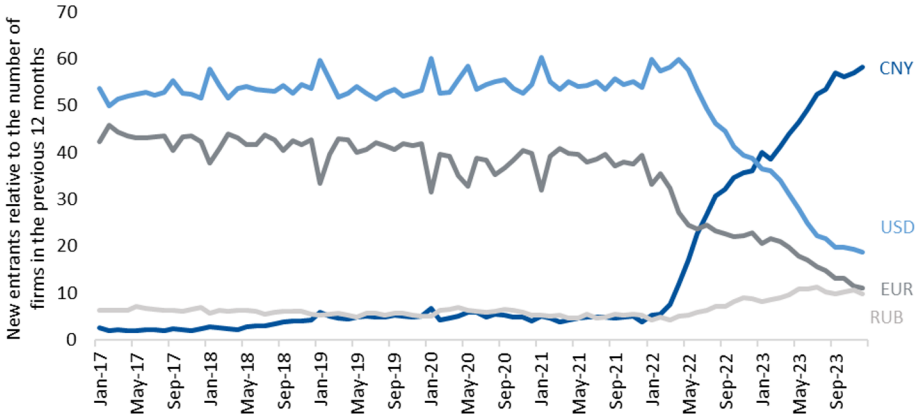
Note: The shares are calculated by month, by trade volume based on Russia customs data.

Figure 4: Number of importers dealing with invoicing in each currency



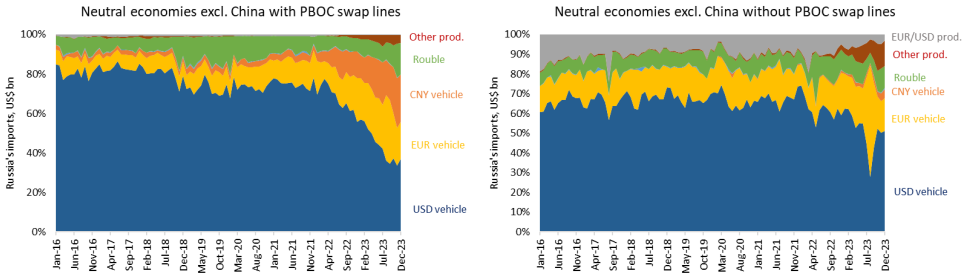
Note: Importers are identified by their unique tax id.

Figure 5: Number of new importers dealing with invoicing in each currency



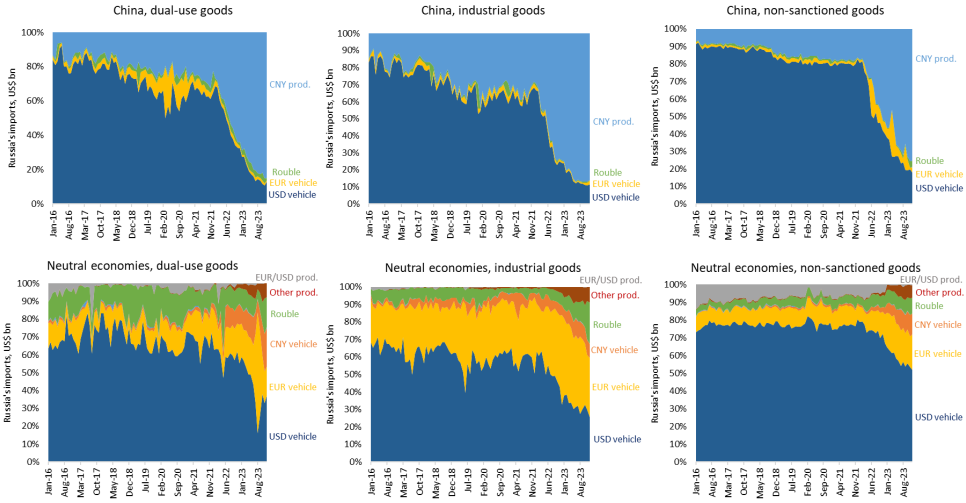
Note: Importers are identified by their unique tax id. A new firm is one that has not conducted import operations in the preceding 12 months.

Figure 6: Share of currencies of invoicing, depending on the existence of PBOC swap lines



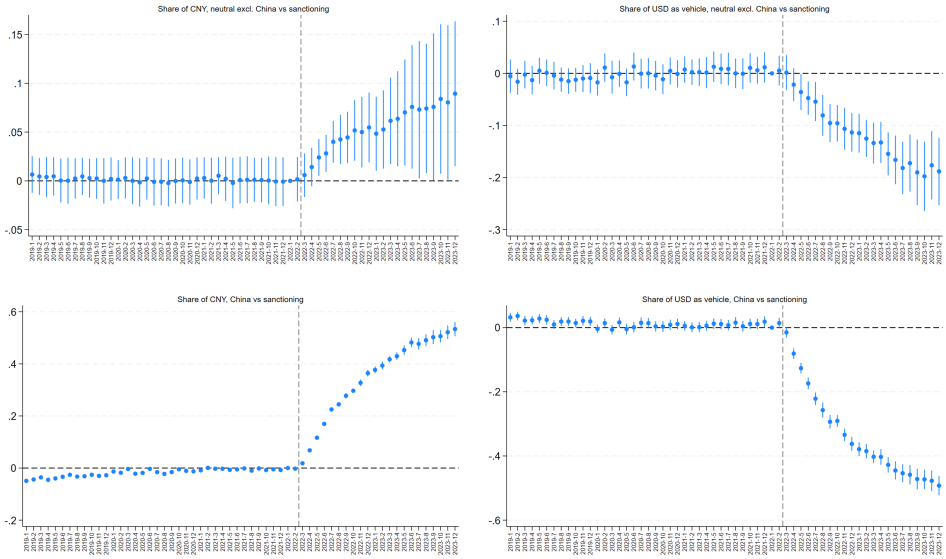
Note: The shares are calculated by month, by trade volume. Shares of currencies of invoicing in a sample of neutral economies excluding China with PBOC swap lines (left) and neutral economies excluding China without PBOC swap lines (right).

Figure 7: Share of currencies of invoicing, by product type



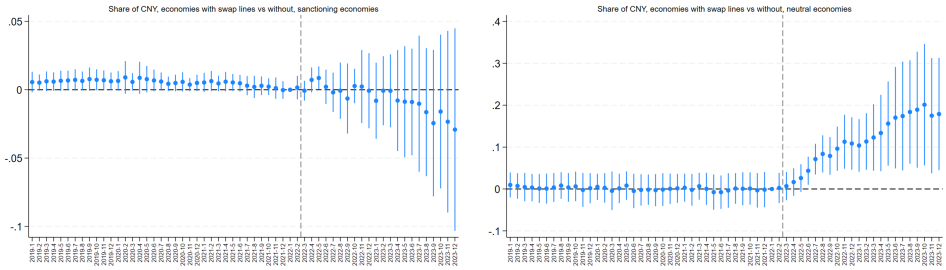
The shares are calculated by month, by trade volume. Top row shows the shares of currencies of invoicing in trade with China. Bottom row shows the shares of currencies of invoicing in a sample of neutral economies excluding China. Sanctioned goods refer to EU sanctions that apply at least partially to a given HS6 code.

Figure 8: Position on sanctions and the choice of currency of invoicing: Event study estimates



The plots show regression coefficients on interaction terms between the dummy variables for neutral economy excluding China (top) or China (bottom) and dummy variables for each month. Linear regressions of the share of Russia's imports in bilateral trade in a given month for a given product denominated in CNY or producer currency (left) or USD (right). Specifications include product-month and product-country fixed effects. 95 percent confidence intervals are based on standard errors clustered on country-month.

Figure 9: Combined effect of PBOC swap lines and trade sanctions: Event study estimates



The plots show regression coefficients on interaction terms between dummy variables for sanctioning (left) or non-sanctioning (right) economy with a PBOC swap line dummy and dummy variables for each month. Linear regressions of the share of Russia's imports in bilateral trade in a given month for a given product denominated in CNY. Specifications include product-month and product-country fixed effects. 95 percent confidence intervals are based on standard errors clustered on country-month.

Table 1: Currency usage over time: Import value, transactions and firms

	CNY producer	CNY vehicle	USD vehicle	EUR vehicle	EUR/USD prod.	RUB	Other
			March-December 2021				
Import value	3.2	0.3	41.1	9.1	24.5	19.6	0.4
Transactions	2.7	0.2	25.1	9.9	30.9	28.7	0.1
Firms	7.1	0.7	54.7	25.9	47.3	7.1	0.4
			March-December 2022				
Import value	13.2	2.2	45.0	9.1	15.2	13.9	0.2
Transactions	13.2	1.6	39.6	12.1	21.5	9.7	0.1
Firms	33.3	5.0	55.7	24.4	33.4	8.6	0.4
			March-December 2023				
Import value	30.1	4.9	28.4	11.4	11.1	11.3	0.2
Transactions	30.7	4.0	27.9	11.9	12.9	8.4	0.1
Firms	53.2	10.5	37.9	21.1	18.4	13.2	0.7

Note: This table reports the breakdown of import value, number of transactions and the number of firms using various currencies in invoicing.

Table 2: Partner countries' position on sanctions and the choice of currency of invoicing

	Firm-level analysis				
	1	2	3	4	5
Dep. var.: Share of trade invoiced	CNY	USD vehicle	EUR vehicle	Producer	RUB
Sample	All	Excl. US	Excl. eurozone	All	All
Post-sanctions x China	0.242***	-0.225***	-0.00983**	0.306***	0.0122***
	(0.0172)	(0.0148)	(0.00463)	(0.0236)	(0.00195)
Post-sanctions x Neutral	0.0430***	-0.0722***	-0.00457	0.0142**	0.0171***
	(0.00657)	(0.00734)	(0.00647)	(0.00611)	(0.00181)
Observations	5,717,583	5,259,520	2,372,163	5,717,583	5,717,583
R^2	0.905	0.955	0.963	0.917	0.964
	Aggregated at the product-country-month level				
	6	7	8	9	10
Dep. var.: Share of trade invoiced	CNY	USD vehicle	EUR vehicle	Producer	RUB
Sample	All	Excl. US	Excl. eurozone	All	All
Post-sanctions x China	0.402***	-0.365***	-0.0614***	0.380***	0.0412***
	(0.0285)	(0.0235)	(0.00430)	(0.0291)	(0.00251)
Post-sanctions x Neutral	0.0536***	-0.100***	-0.0369***	-0.00600	0.0538***
	(0.00746)	(0.00677)	(0.00464)	(0.00524)	(0.00265)
Observations	5,036,774	4,862,357	3,040,937	5,036,774	5,036,774
R^2	0.577	0.712	0.708	0.818	0.684

Note: Standard errors in parentheses are clustered on country-month. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the share of transactions, by volume, in bilateral monthly imports of a given product by a given firm, invoiced in a given currency (top panel). In the bottom panel trade is aggregated across firms by product-country-month. All regressions include firm-product-month and firm-product-country fixed effects (in the bottom panel, product-month and product-country fixed effects). Post-sanctions refers to the time period from March 2022 onwards. The base category are 45 economies that imposed sanctions on Russia.

Table 3: Invoicing in CNY: The role of swap lines

Dep. var: Share of trade invoiced in CNY	Firm-level			Aggregated at the product-country-month		
Sample split	All	Neutral	Sanctioning	All	Neutral	Sanctioning
Post-sanctions x Swap line	0.00892***	0.0458***	-0.00233***	0.0182***	0.121***	-0.00961***
	(0.00152)	(0.00648)	(0.000697)	(0.00403)	(0.0134)	(0.00352)
Swap line	-0.000729***	-0.00574***	-3.22e-05	-0.000264	0.00627***	0.000406
	(0.000181)	(0.00148)	(0.000113)	(0.000870)	(0.00235)	(0.000822)
Observations	4,682,888	292,098	3,708,005	4,755,564	981,654	3,677,114
R^2	0.890	0.916	0.824	0.410	0.523	0.431

Note: Standard errors in parentheses are clustered on country-month. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. Sanctioning refers to 45 economies with sanctions on Russia, neutral are the rest. Post-sanctions refers to the time period March 2022 onwards. Swap line refers to an active swap line with the PBOC. The dependent variable is the share of transactions, by volume, in bilateral monthly imports of a given product by a given firm, invoiced in CNY (columns 1-3). Trade is aggregated across firms at the product-country-month level in columns 4-6. All regressions include firm-product-month and firm-product-country fixed effects. In columns 4-6 all regressions include product-country and product-month fixed effects.

Table 4: Internationally sanctioned goods and the choice of currency of invoicing

	Firm-level analysis					
	1	2	3	4	5	6
Dep. var.: Currency share	CNY producer	CNY vehicle	USD vehicle	EUR vehicle	Other producer	RUB
Sample	*China*	*Ex. China*	*Ex. US*	*Ex. eurozone*	*Ex. US, eurozone, China*	*All*
Post-sanctions * Dual-use	0.00509***	0.000512***	-0.00199***	-0.000192	0.000223	8.12e-05
	(0.00113)	(0.000132)	(0.000450)	(0.000327)	(0.000406)	(0.000186)
Post-sanctions * Industrial	0.00301**	0.000202	-0.00178**	0.00124**	-0.000581	-4.01e-05
	(0.00144)	(0.000220)	(0.000701)	(0.000539)	(0.000539)	(0.000288)
Post-sanctions * Luxury	-0.00425*	-0.000399	0.00251***	0.00202***	-0.00277***	-0.00135***
	(0.00218)	(0.000332)	(0.000862)	(0.000608)	(0.000783)	(0.000341)
Observations	5,279,998	21,351,177	25,750,597	15,808,649	9,648,073	26,631,175
R^2	0.929	0.956	0.971	0.978	0.971	0.984
	Aggregated at the product-country-month level					
	7	8	9	10	11	12
Dep var.: Currency share	CNY producer	CNY vehicle	USD vehicle	EUR vehicle	Other producer	RUB
Sample	*China*	*Ex. China*	*Ex. US*	*Ex. eurozone*	*Ex. US, eurozone, China*	*All*
Post-sanctions x Dual-use	0.0678***	0.00971***	-0.0167***	-0.00381	0.00933***	-0.00245
	(0.00640)	(0.000927)	(0.00221)	(0.00239)	(0.00146)	(0.00183)
Post-sanctions x Industrial	0.0467***	0.00701***	-0.00623*	-0.00986**	0.00234	-0.00312
	(0.00942)	(0.00147)	(0.00352)	(0.00434)	(0.00234)	(0.00301)
Post-sanctions x Luxury	-0.0604***	-0.00583***	0.00799***	0.0201***	-0.00195	-0.0389***
	(0.00849)	(0.00112)	(0.00278)	(0.00383)	(0.00180)	(0.00252)
Observations	278,145	4,803,152	4,907,637	3,099,660	2,647,855	5,081,297
R^2	0.536	0.449	0.702	0.685	0.533	0.670

Note: Standard errors in parentheses are clustered on HS6 products. *, **, *** denote statistical significance at the 10%, 5%, and 1% levels, respectively. The dependent variable is the share of transactions, by volume, invoiced in a given currency in bilateral monthly imports of a given product by a given firm (top panel) or the currency share of invoicing in bilateral monthly imports of a given product (bottom panel). All regressions in the top panel include product-country-firm and firm-country-month fixed effects; all regressions in the bottom panel include product-country and country-month fixed effects. Goods under sanctions are those where EU sanctions apply at least partially. Post-sanctions refers to the period from March 2022 onwards. The three categories shown are mutually exclusive and cover all goods under EU sanctions.

Table 5: Strategic complementarity, sanctions and the choice of currency of invoicing

	Firm-level analysis				
	1	2	3	4	5
Dep. var.: Currency share	CNY producer	CNY vehicle	USD vehicle	EUR vehicle	Other producer
Sample	*China*	*Ex. China*	*Ex. US*	*Ex. eurozone*	*Ex. China, US, eurozone*
Post-sanctions x Medium USD exp.	-0.00266	-8.24e-05	-0.000615	0.00172	0.00111
	(0.00310)	(0.000165)	(0.000841)	(0.00108)	(0.000919)
Post-sanctions x High USD exp.	0.00120	0.000572***	-0.00348***	0.00233**	0.00173*
	(0.00315)	(0.000194)	(0.000890)	(0.00112)	(0.000985)
Post-sanctions x Dual-use	0.00409***	0.000371***	-0.00129***	-0.000376	6.92e-05
	(0.00118)	(0.000134)	(0.000475)	(0.000346)	(0.000431)
Post-sanctions x Industrial	0.00270*	0.000186	-0.00169**	0.00126**	-0.000568
	(0.00149)	(0.000216)	(0.000728)	(0.000540)	(0.000543)
Post-sanctions x Luxury	-0.00437**	-0.000436	0.00267***	0.00197***	-0.00281***
	(0.00219)	(0.000323)	(0.000867)	(0.000616)	(0.000781)
Observations	5,279,814	21,349,730	25,749,048	15,807,465	9,647,155
R^2	0.929	0.956	0.971	0.978	0.971
	Aggregated at the product-country-month level				
	6	7	8	9	10
Dep. var.: Currency share	CNY producer	CNY vehicle	USD vehicle	EUR vehicle	Other producer
Sample	*China*	*Ex. China*	*Ex. US*	*Ex. eurozone*	*Ex. China, US, eurozone*
Post-sanctions x Medium USD exp.	0.00319	0.000836	-0.00284	0.00137	0.00379*
	(0.00824)	(0.00100)	(0.00277)	(0.00355)	(0.00215)
Post-sanctions x High USD exp.	0.00797	0.00402***	-0.0115***	0.000317	0.00884***
	(0.00846)	(0.00110)	(0.00295)	(0.00362)	(0.00220)
Post-sanctions x Dual-use	0.0667***	0.00891***	-0.0145***	-0.00370	0.00781***
	(0.00658)	(0.000967)	(0.00224)	(0.00244)	(0.00148)
Post-sanctions x Industrial	0.0469***	0.00692***	-0.00602*	-0.00983**	0.00207
	(0.00943)	(0.00147)	(0.00355)	(0.00434)	(0.00233)
Post-sanctions x Luxury	-0.0605***	-0.00566***	0.00755***	0.0200***	-0.00178
	(0.00851)	(0.00111)	(0.00279)	(0.00382)	(0.00180)
Observations	277,942	4,801,536	4,905,921	3,098,360	2,646,861
R^2	0.536	0.449	0.702	0.685	0.533

Note: Standard errors in parentheses are clustered on HS6 products. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. In the top panel, the dependent variable is the share of transactions, by volume, in bilateral monthly imports of a given product, invoiced in a given currency. All regressions include firm-product-country and firm-country-month fixed effects. In the bottom panel, trade is aggregated across firms at the level of product-country-month. All regressions include product-country and country-month fixed effects. Goods under sanctions are those where EU sanction apply at least partially. The three categories shown are mutually exclusive and cover all goods under EU sanctions. Post-sanctions refers to the period from March 2022 onwards. Medium and high USD sanctioning exposure refers to the middle and top tercile of products by the share of Russia's imports in 2021 from sanctioning economies and invoiced in USD.

Table 6: Firm characteristics and the choice of currency of invoicing under sanctions

Dep. var.: Share of trade invoiced in the currency shown	1 CNY producer	2 CNY vehicle	3 USD vehicle	4 EUR vehicle	5 Other producer	6 RUB
Sample	*China*	*ex. China*	*Ex. US*	*Ex. eurozone*	*Ex. China, US, eurozone*	*All*
Post-sanctions x Firm size, log	-0.0109**	-0.00168*	0.00920***	0.00118**	-0.00555***	-0.00434***
	(0.00517)	(0.000945)	(0.00233)	(0.000504)	(0.00116)	(0.00131)
Post-sanctions x New firm	0.0253***	0.0103***	-0.0203***	-0.00692***	0.0110	-0.00172
	(0.00963)	(0.00387)	(0.00619)	(0.00243)	(0.00804)	(0.00267)
Post-sanctions x Strategic private	-0.0409	0.00392	0.0127	-0.00473	0.0108**	0.0130
	(0.0432)	(0.00618)	(0.0198)	(0.00508)	(0.00537)	(0.00830)
Post-sanctions x State-owned	-0.0188	-0.00103	0.00227	-0.0262*	0.0340	0.0250**
	(0.101)	(0.00586)	(0.0404)	(0.0140)	(0.0266)	(0.0105)
New firm	0.0138***	0.000697	-0.00139	0.00151	-0.00212	-0.000820
	(0.00518)	(0.000536)	(0.00191)	(0.00137)	(0.00193)	(0.00133)
Observations	5,579,007	20,763,674	25,475,778	15,737,177	9,291,267	26,342,681
R^2	0.788	0.787	0.918	0.945	0.907	0.939

Note: Standard errors in parentheses are clustered on HS6 products. *, **, *** denote statistical significance at the 10%, 5% and 1% levels, respectively. The dependent variable is the share of imports invoiced in a given currency, observation is bilateral monthly imports at the HS6 level by a given firm. All regressions include product-country-month and firm-product-country fixed effects.

A Annex tables and figures

Table A1: Sanctioning economies

European Economic Area		
Austria	Belgium	Bulgaria
Croatia	Cyprus	Czech R.
Denmark	Estonia	Finland
France	Germany	Greece
Hungary	Iceland	Ireland
Italy	Latvia	Liechtenstein
Lithuania	Luxembourg	Malta
Netherlands	Norway	Poland
Portugal	Romania	Slovak R.
Slovenia	Spain	Sweden
Other		
Albania	Australia	Canada
Japan	Monaco	Montenegro
New Zealand	North Macedonia	Singapore
South Korea	Switzerland	Taipei China
Ukraine	United Kingdom	United States

Note: All other economies are classified as neutral in the analysis.

Table A2: Descriptive statistics

Firm-level analysis					
Share of trade invoiced in the currency shown	Mean	Median	St. dev.	Min	Max
CNY producer	0.33	0.00	0.47	0.00	1.00
CNY vehicle	0.01	0.00	0.10	0.00	1.00
USD vehicle	0.35	0.00	0.48	0.00	1.00
EUR vehicle	0.20	0.00	0.40	0.00	1.00
Other producer	0.09	0.00	0.28	0.00	1.00
Aggregated at the product-country-month level					
Share of trade invoiced in the currency shown	Mean	Median	St. dev.	Min	Max
CNY producer	0.26	0.06	0.35	0.00	1.00
CNY vehicle	0.01	0.00	0.09	0.00	1.00
USD vehicle	0.36	0.00	0.45	0.00	1.00
EUR vehicle	0.28	0.00	0.42	0.00	1.00
Other producer	0.06	0.00	0.21	0.00	1.00

Note: Shares are calculated based on bilateral imports in a given month in a given currency of invoicing over the period Jan 2016-Dec 2023.

Table A3: CNY swap lines

Sanctioning economies					
Country	Date	Amount	Country	Date	Amount
South Korea	20.04.2009	180-400	Iceland	9.06.2010	3.5
Singapore	23.07.2010	150-300	New Zealand	18.04.2011	25
United Kingdom	22.06.2013	350	Australia	22.03.2012	200
ECB	08.10.2013	350	Hungary	09.09.2013	10-40
Canada	8.11.2014	200	Albania	12.09.2013	2
Switzerland	21.07.2014-21.07.2020	350	Ukraine	26.06.2012-10.12.2021	15
Japan	26.10.2018	200			

Neutral economies					
Country	Date	Amount	Country	Date	Amount
Hong Kong SAR	20.01.2009	200-500	Malaysia	08.02.2009	80-180
Argentina	02.04.2009	70-130	Belarus	11.03.2009	7-20
Indonesia	23.03.2009	100-250	Mongolia	06.05.2011	5-15
Kazakhstan	13.06.2011	7	Uzbekistan	19.04.2011-19.04.2014	0.7
Pakistan	23.12.2011	10-30	Thailand	22.12.2011	70
UAE	17.01.2012-14.12.2018	35	Turkiye	21.02.2012	10-35
Qatar	03.11.2014	35	Brazil	26.03.2013-26.03.2016	190
Sri Lanka	16.09.2014	10	Armenia	25.03.2015-25.03.2018	1
Chile	25.05.2015	22-50	South Africa	10.04.2015	30
Tajikistan	03.09.2015-03.09.2018	3	Morocco	11.05.2016-11.05.2019	10
Serbia	17.06.2016-17.06.2019	1.5	Egypt	06.12.2016	18
Nigeria	03.05.2018	15	Macau SAR	05.12.2019	30
Laos	20.05.2020	6			

Country	Date	Amount
Russia	13.10.2014	150

Note: As of end-2022; amounts in CNY billion, based on Bahaj and Reis (2020) and People's Bank of China. If end date is not specified, the line is ongoing. In regression analysis ECB swap line is applied to Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, the Slovak Republic, Slovenia and Spain.

Table A4: Share of importing firms, by number of different currencies of invoicing used

Number of currencies	1	2	3	4+	Total
Firm*product*country observations that existed in both periods					
March-December 2021					
Import value	81.1	18.0	0.8	0.1	100
Transaction records	83.4	15.7	0.7	0.2	100
Firm*product*country obs	95.2	4.6	0.2	0.0	100
N of firm*product*country obs	287,810	14,035	551	67	302,463
March-December 2023					
Import value	73.4	24.3	2.0	0.4	100
Transaction records	76.5	20.0	2.7	0.8	100
Firm*product*country obs	89.0	10.3	0.6	0.1	100
N of firm*product*country obs	269,181	31,258	1,838	186	302,463
Firm*product*country observations that appeared after 2021					
March-December 2023					
Import value	80.6	16.4	2.7	0.2	100
Transaction records	78.2	18.0	3.1	0.7	100
Firm*product*country obs	94.0	5.6	0.4	0.0	100
N of firm*product*country obs	950,032	56,491	3,741	265	1,010,529

Note: Each panel shows the share of firms dealing with a certain number of currencies for a combination of HS6 product group and partner country during the period shown. Rows add up to 100% and show shares by the total value of imports, the number of customs transaction records and the number of firms. The share by number of firms is calculated as the firm-weighted average (across all product-country combinations) of the shares of firm-product-country observations corresponding to each number of currencies used.

Table A5: Probability of working with imports in a given currency conditional on previously working with imports in a certain currency

Mar-Dec 2021	March-December 2023						
	CNY producer	CNY vehicle	USD vehicle	EUR vehicle	EUR/USD producer	Other	RUB
CNY producer	98.4	0.0	1.3	0.1	0.0	0.0	0.3
CNY vehicle	0.0	96.2	3.0	0.0	0.1	0.0	0.6
USD vehicle	38.0	5.2	52.2	1.3	0.4	2.1	0.9
EUR vehicle	3.8	1.8	5.3	83.2	0.1	4.0	1.7
EUR/USD producer	0.0	0.2	0.6	0.0	99.0	0.1	0.1
Other	0.9	2.4	5.3	6.2	0.2	84.9	0.1
RUB	6.1	1.1	2.5	3.0	13.7	0.4	73.1

Note: Each column of the table shows probability of having imports invoiced in a certain currency in Mar-Dec 2023 for a given partner country and HS6 product group conditional on having had imports invoiced in a currency shown in the left column during Mar-Dec 2021. Rows correspond to invoicing patterns in 2021 and conditional probabilities in each row add up to 100%. The sample is restricted to firm-product-country-year combinations where firms imported in both years and used a single currency of invoicing.

Table A6: Conditional probability of a firm having imports and / or exports invoiced in CNY

Q3 2023		Q4 2023		
	Export + import	Export	Import	Neither
Export + import	77.3	6.0	15.7	1.0
Export	24.3	51.4	8.1	16.2
Import	5.1	0.3	86.3	8.3
Neither	0.8	2.1	20.0	77.0

Q3 2022		Q4 2022		
	Export + import	Export	Import	Neither
Export + import	73.4	5.6	19.6	1.4
Export	22.3	57.4	10.6	9.6
Import	4.7	0.7	83.1	11.6
Neither	0.5	1.8	14.6	83.0

Q3 2021		Q4 2021		
	Export + import	Export	Import	Neither
Export + import	78.6	2.4	19.0	0.0
Export	2.5	75.0	5.0	17.5
Import	1.4	0.5	85.0	13.1
Neither	0.0	0.2	1.6	98.2

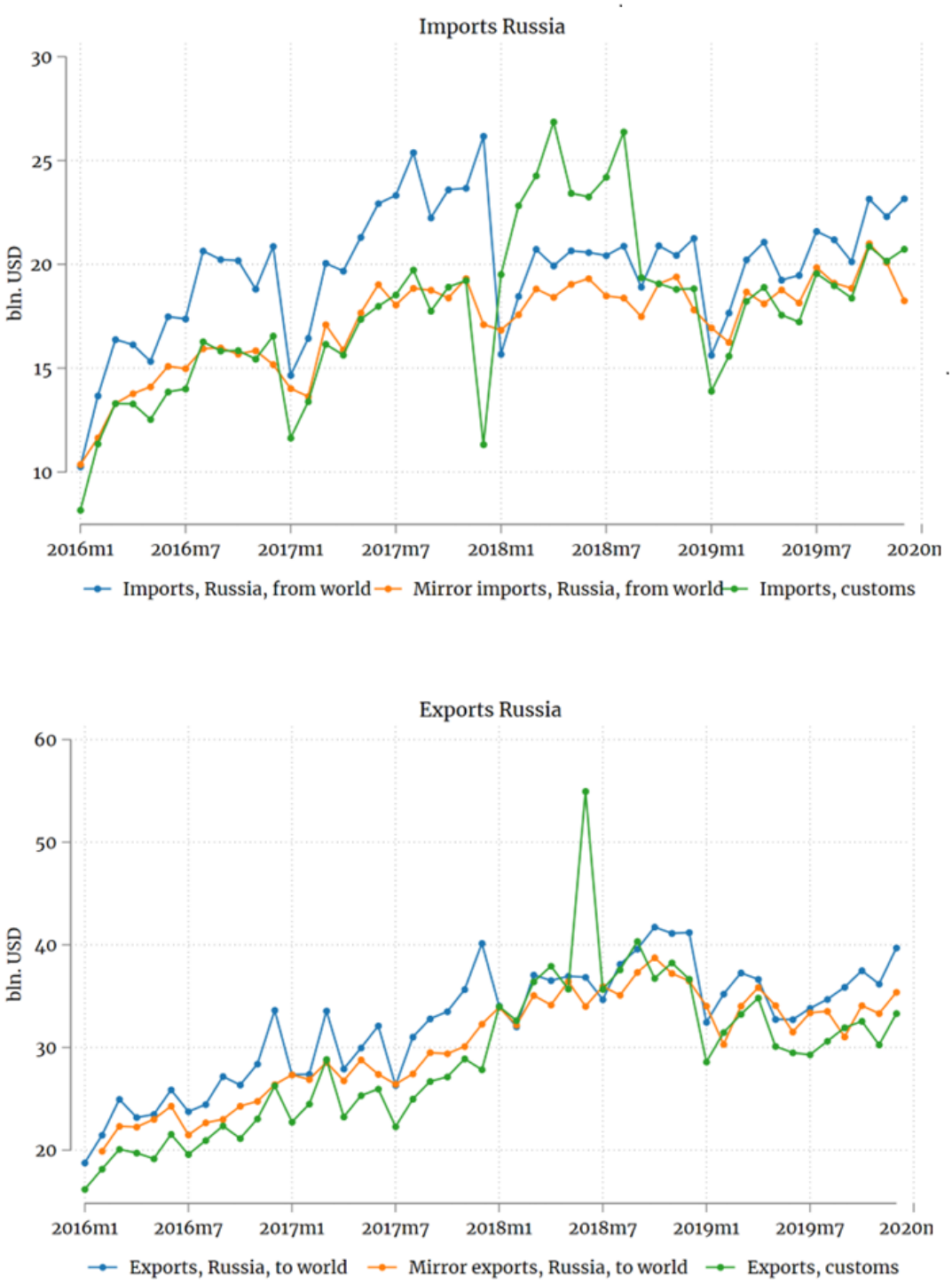
Note: Each column of the table shows probability of a firm having imports and / or exports invoiced in CNY in Q4 of each year for a given partner country and HS6 product group conditional on having had imports only, exports only, both imports and exports or neither invoiced in CNY in the previous quarter. Rows correspond to invoicing patterns in Q3 and conditional probabilities in each row add up to 100%. The sample is restricted to firms that exported and imported in both quarters and used a single currency of invoicing for a combination of product group and country.

Table A7: Decomposition of changes in the shares of currencies of invoicing (percentage points)

	CNY	USD	EUR	RUB	Other
Total change in share	30.0	-12.2	-9.7	-8.6	0.6
Country composition of imports	7.3	13.7	-11.6	-8.2	-1.1
Change within countries	22.7	-25.9	1.9	-0.4	1.7
Of which:					
Change within importing firms	19.6	-18.2	0.5	-2.6	0.6
Change in market shares of existing firms	2.3	-9.0	6.3	0.1	0.3
Entry/exit of firms	0.8	1.3	-4.9	2.1	0.7

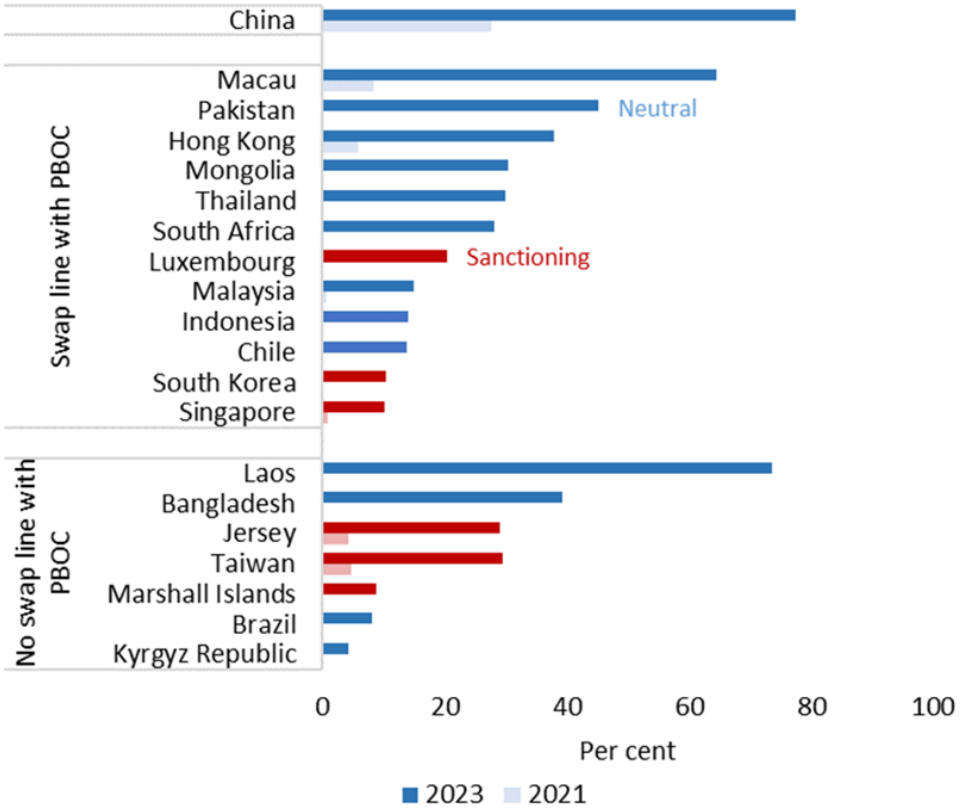
Note: Country composition is a sum of across countries and entry/exit of countries

Figure A1: Russia's imports: Transaction-level data, Russia's aggregate statistics and mirror aggregate statistics



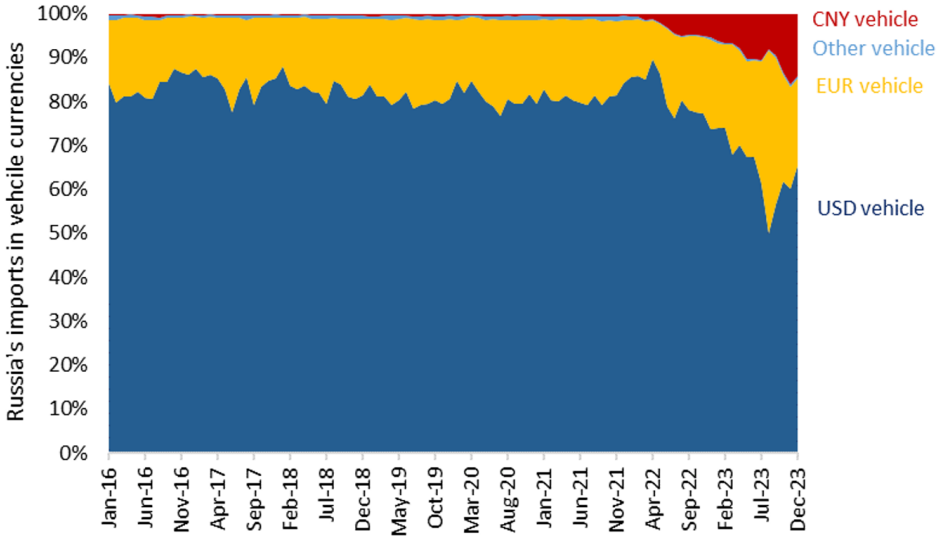
Aggregate imports as reported in the transaction-level dataset and UN Comtrade. Mirror data refers to exports to Russia as reported by trading partners excluding the members of the Eurasian Economic Union. Transaction-level data are aggregated bottom-up from customs dataset.

Figure A2: Top 20 trading partners where Russia's imports were invoiced in CNY in 2022



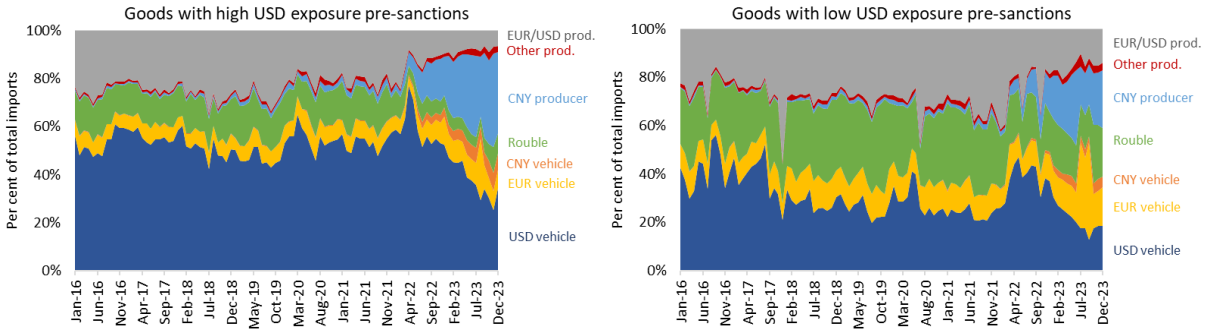
Note: Based on volume of transactions, restricted to the economies with trade invoiced in CNY of at least US$ 1 million equivalent in 2022.

Figure A3: Shares of vehicle currencies in Russia's imports using vehicle currencies



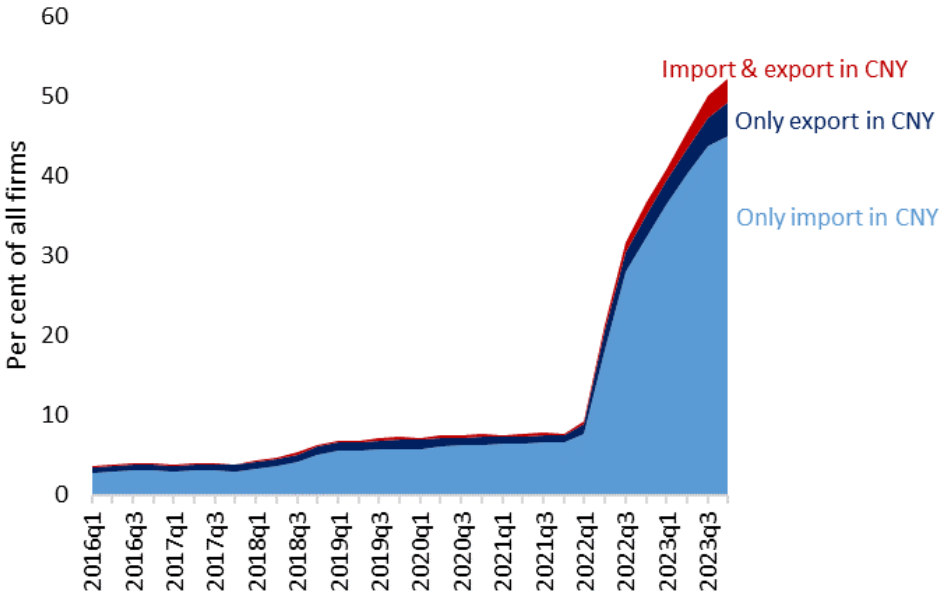
Note: Based on volume of transactions, by month, excluding transactions where local currency or producer currency is used.

Figure A4: Share of currencies of invoicing: Strategic complementarity channel



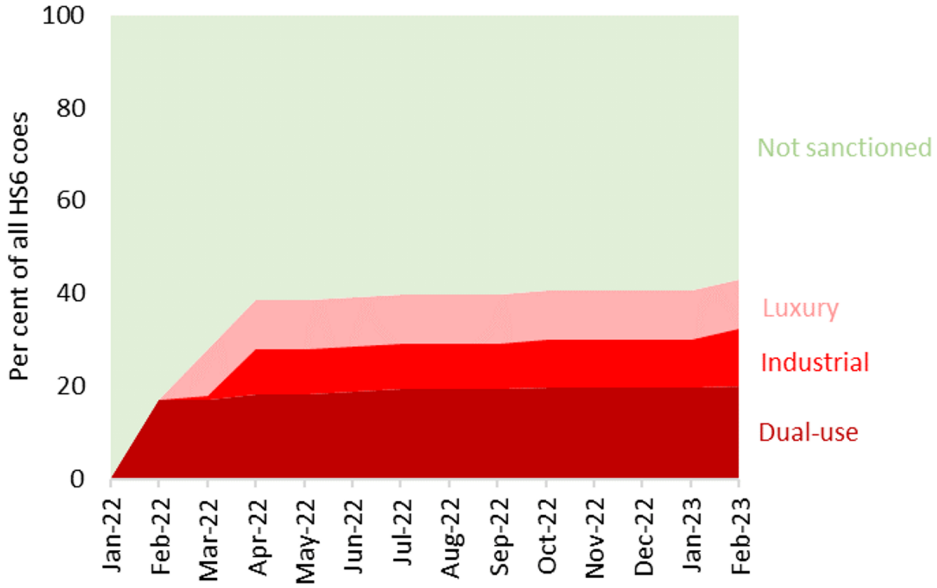
Note: The shares are calculated by month, by trade volume. High (low) USD exposure refers to the top (bottom) tercile of products by the share of Russia's imports in 2021 coming from sanctioning economies and invoiced in USD.

Figure A5: Share of firms that have exports and / or imports invoiced in CNY, by quarter



Note: The figure shows the shares of firms that only have imports invoiced in CNY in a given quarter, only exports invoiced in CNY, both imports and exports invoiced in CNY, or neither, in the total number of firms that operated in that quarter.Based on 34,117 firms that have both imports and exports recorded.

Figure A6: Shares of HS6 product lines subject to sanctions, by type of product



Note: The figure shows the shares of HS6 product lines covering dual-use goods, industrial goods and luxury goods where EU sanctions apply at least partially versus non-sanctioned goods.

B Decomposing changes in the currency shares of invoicing

Total change in the share of invoicing for each currency j (for instance, the US dollar), is given by expression 8, where $t = 0$ denotes the initial period, $t = 1$ denotes the final period; i denotes economies, w_i denotes the share of partner economy i in Russia's imports ($\sum_i w_i^t = 1$) and $s_i j$ denotes shares of invoicing observed for trade with each economy in each period.

$$\sum_i w_i^1 s_{ij}^1 - \sum_i w_i^0 s_{ij}^0 \tag{8}$$

It can be decomposed first decomposed into two components, as follows ((1) = (2) + (3)).

Changes in the structure of imports by country. This calculation (given by expression 9) holds country shares of invoicing constant as of the base period and looks at the differences in country shares of trade. The analysis focuses on economies that traded with Russia both before sanctions and after sanctions. The contribution of entry and exit of trading partners (that is, economies that exported to Russia only before sanctions or only after sanctions) is empirically negligible.

$$\sum_i [w_i^1 - w_i^0] s_{ij}^0 \tag{9}$$

The remaining part is given by expression 10. It can be further decomposed into three components as shown below ((3) = (4) + (5) + (6)).

$$\sum_i [s_{ij}^1 - s_{ij}^0] w_i^1 \tag{10}$$

Changes in invoicing within firms and countries. For each partner economy, the analysis focuses on the market shares of importing firms (indexed f) that operated in both the base period and the final period (w_{if}^t, where $\sum_f w_{if}^t = 1$ for each i and t). The calculation then looks at changes in the shares of currencies of invoicing experienced by each firm, weighed by the shares of those firms in imports from a given economy in the final period. The estimates for each partner economy are, in turn, weighed by country shares of trade in the final period.

$$\sum_i w_i^1 \sum_f [s_{ifj}^1 - s_{ifj}^0] w_{if}^1 \tag{11}$$

Changes in market shares of firms in trade with each partner economy. The calculation is similar to the above except invoicing shares experienced by each firm are held constant and changes in market shares of import within each country are used to calculate the contribution at the level of each trading partner. These are, in turn, weighed by country shares of trade in the final period.

$$\sum_i w_i^1 \sum_f [w_{if}^1 - w_{if}^0] s_{ifj}^0 \tag{12}$$

Entry and exit of firms into the business of trading with a particular country. Expression 13, derived as expression 10 - expression 11 - expression 12, represents the difference between two discrepancy terms weighed by country shares of trade in the final period. The first discrepancy terms is the difference between a currency share of invoicing observed for a given country in the final period and the same share derived by summing up invoicing shares of firms that also traded in the base period. Without entry of firms, this term becomes zero. The second term is the same difference calculated for the base period. By definition, it is nil without exit of firms.

$$\sum_i w_i^1 [[s_{ij}^1 - \sum_f s_{ifj}^1 w_{if}^1] - [s_{ij}^0 - \sum_f s_{ifj}^0 w_{if}^0]] \tag{13}$$