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Currency Carry Trade by Trucks: The Curious Case of China's Massive Imports from Itself*

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Abstract

With capital controls, the standard financial market transactions needed for currency carry trade are hard to implement. Using detailed trade data reported by both the mainland Chinese and Hong Kong's governments, we present evidence that indirect currency carry trade likely takes place via round-trip reimports. We also show that greater state control in terms of more state-owned firms does not reduce such "carry trade by trucks."

Keywords: Capital controls, currency arbitrage, state control

JEL Classifications: G15; F3

by Editor Zhiguo He.

1. Introduction

Currency carry trade—a form of risky arbitrage involving borrowing in one currency with a relatively low-interest rate and lending in another currency with a higher interest rate—normally takes place in the financial market. This was the case, for example, for the yen–dollar carry trade in 2018 involving a short position in the Japanese yen and simultaneously a long position in the USD.[1] However, about 40% of the countries in the world have restrictions on cross-border financial transactions, making it hard to engage in currency carry trade this way. In some countries, there are outright bans on cross-border financial

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1 https://www.thebalance.com/yen-carry-trade-explained-pros-cons-how-it-is-today-3305971#:~:text=The%20yen%20carry%20trade%20is,earn%20a%20low%2Drisk%20profit

transactions that are meant to take advantage of the differential between onshore and offshore interest rates. China is one such country. Yet, as the incentive for carry trade is still there, some agents may look for other ways to bypass the restrictions. While such carry trade has implications for understanding both exchange rate movement and international transmission of monetary policies, our understanding about the currency carry trade pursued in a nonstandard way is relatively limited.

This article has two objectives. First, it aims to study how round-trip reimports—for example, Country A exports good X to Country B and then imports it back from Country B—are used to engage in currency carry trade. Second, it aims to study if greater state control of the economy—for example, through more state-owned firms—can help reduce such carry trade. We investigate these two questions using micro-level data from China, where capital controls are extensive, reimports are common (about 8% of China's overall imports during 2002–17 are from itself, according to the country's customs record, making itself the fifth largest source of its imports), and state-owned firms are known to be prominent in the economy. But the basic insight is likely to be generally relevant for understanding currency carry trade in the presence of capital controls.

Capital controls are widely used by many governments, especially those of developing nations. A large literature in international finance has featured a tax on cross-border capital as an optimal tool to address a source of externality associated with overborrowing by private sector agents (see e.g., Jeanne and Korinek, 2010; Bianchi, 2011). These papers typically assume that when a capital control tax is imposed, it can be perfectly enforced. The presence of capital controls makes cross-border arbitrage in the financial market more difficult and intentionally so. But both the externality and the need to impose such a tax are strongest in countries with weak public institutions (see the theory and evidence for this idea in Ma and Wei (2020)). It is precisely in such countries where enforcement of a tax cannot be assured (see Fisman and Wei, 2004; Javorcik and Narciso, 2007, for evidence of tax evasion in developing countries). Such evasive behavior can simultaneously make risky arbitrage (currency carry trade) still profitable and the macro-prudential policies less effective.

This article focuses on a setting in which the standard carry trade transactions in the FX market are blocked by a country's capital controls. We examine the use of goods trade especially reimports—a current account transaction that is not subject to capital controls—as a way to move money across national borders. Specifically, suppose the interest rate differential is such that the agents have an incentive to borrow in USD, move the money into China, invest in assets with a higher interest rate for a period of time before moving the investment out of China again to reap the profits. When an agent in Hong Kong imports a product from China, it has a legitimate reason to take out a loan from a Hong Kong bank to finance the purchase. This loan has a relatively low-interest rate by assumption. The money is then sent to the Chinese exporting firm, ostensibly to pay for the value of the imports. The Chinese firm can then invest the money in a local financial product for a period of time (say 6 months), with a higher interest rate than the original loan in Hong Kong. Once the financial product matures, the firm can convert the final payoff from the RMB to Hong Kong dollar (HKD). This can be done by having the Chinese exporting firm to reimport the same product or slightly processed product back from Hong Kong to China. This process of exports and then reimports allows the agent to short the low-interest HKD and long in the higher interest RMB, mimicking a currency carry trade process.

In principle, the goods used in exports and imports need not be the same for currency carry trade. In other words, regular trade, as opposed to reimports (exporting and reimporting the same goods), can be used in the quasi-financial arbitrage as well. However, the net returns on currency carry trade need to deduct the costs of arbitrage including the physical transportation costs in both exports and imports, as well as the costs of clearing the customs when the goods cross borders. Reimports provide a unique way to save some of the costs. For example, the goods in reimports can stay in the same container throughout the process of the currency carry trade, saving at least some costs in uploading and offloading the content of the container. If the customs tapes sealing the container used in the first border crossing are intact, the customs clearance on the return trip can be expedited.

Moreover, because Hong Kong and Mainland China share a common border, and the free trade agreement between the two (Closer Economic Partnership Agreement) means zero tariff on imports from one place into the other, reimports going through Hong Kong would be more cost-effective than through almost any other location. An extreme version of reimports is "one day round-trip trade"—a container truck leaving Shenzhen for Hong Kong in the morning and coming back to Shenzhen with the same content in the evening. The loan borrowed in Hong Kong for the morning trade need not be paid back right away if the firm on the Hong Kong side gives a grace period for payment to the Chinese firm.

Note that a reimport behavior itself is not illegal and can serve a useful business purpose. For example, many firms have manufacturing facilities in Guangdong and a distribution center in Hong Kong. In this case, all the factory output would be sent first to the Hong Kong distribution center for sorting, bundling, and labeling, and then re-sent to worldwide locations including some places in China. The part that is sent back to China would be classified as "reimports" in the Chinese customs statistics. As another example, many firms in Guangdong are certified "processing exporters," which entitle them to enjoy a tariff exemption on imported inputs but also obligate them to export 100% of their output even if a fraction of the output is ultimately sold to Mainland Chinese customers. The part of the goods sent first from a processing exporter in Guangdong to Hong Kong and then back to China is also classified as "reimports." From the viewpoint of either Mainland Chinese or Hong Kong customs, reimports are part of the legitimate cross-border trade. As such, the customs do not second guess the business purpose of reimports and do not stop them as long as they do not contain illicit content such as drugs or weapons.

Evasion of capital controls is illegal. This raises the question of whether state-owned firms would be more abiding of the law and engage in less currency carry trade by trucks or whether they would profit from their potentially stronger connections with the customs and engage in more carry trade. Making use of the information on the ownership of importing firms, we compute the share of state-owned enterprises (SOEs) at the Harmonized System (HS) eight-digit product level and examine whether "currency carry trade by trucks" is more or less likely for products with a greater representation of SOEs.

As "carry trade by trucks" involves illegal evasion of capital controls, it is hard to observe it directly in the data. Our identification explores the implication of currency carry trade for cross-product heterogeneity in reimports. Specifically, to minimize the transportation costs in reimports, it would be more profitable for currency carry traders to use goods that have a high value-to-weight ratio. We therefore investigate whether the values of reimports in products with a high value to weight ratio rise more than those in other products

when the carry returns (CRs) are higher. This will be in spirit a difference in differences specification.

To ensure that the regressors with CRs are exogenous, we exploit an insight from the monetary economics: A country's interest rate tends to decline as its money supply increases. If Country A's money supply grows faster than that of Country B, A's interest rate tends to decline relative to that of B. This suggests that the relative growth of the money supplies is a plausible instrumental variable (IV) for the change in CRs between two currencies. Because Hong Kong pegs its currency rigidly to the USD, its interest rate moves in lock steps with that of the USA. We use the relative growth of the Chinese and US money supplies as an IV for change in the CRs.

Using annual reimport data from the Chinese Customs, we find a strong correlation between China's reimports and carry trade returns, especially for products with lower trade costs as measured by higher values per kilogram (value/weight). We interpret this as evidence for currency carry trade. The evidence is surprisingly stronger for SOEs than domestic private or foreign firms. We also control for other motives behind reimports, such as the avoidance of value-added taxes. As a further confirmation, when using monthly transaction-level trade data from Hong Kong Customs, we find a strongly positive correlation between Hong Kong's reexports of Chinese products back to mainland China and the interaction between the carry trade return index and the value/weight (V/W) ratio of these products. Finally, we also find that the reporting discrepancy gap, defined as the (log) ratio of the value of reimports reported by China Customs to the value of reexports reported by Hong Kong Customs of the same product, is positively correlated with the interaction term between the CR index and the product differentiation dummy. These results are consistent with "currency carry trade by trucks."

The realized returns are about 10% in nominal annualized terms during the sample period. Note that carry trade is not risk-free. In the absence of capital controls, the nominal exchange rate could move in an unfavorable direction, potentially wiping out the differential in the two interest rates in local currency units or worse. To use reimports to evade capital controls, there is an added risk of being caught, fined, or even jailed. Therefore, a big part of the CRs is a compensation for bearing these risks.

Because the nominal returns from investing in RMB products are higher than those in USD or HKD products in our sample period, the form of carry trade is to use reimports to long in RMB and short in either USD or HKD. However, the exact form of carry trade can change depending on the sign of the interest rate differential. As long as capital controls are in place, and the returns on investment are not equalized between two economies, there is an incentive to engage in currency carry trade, and reimports are likely used as a tool to carry out the carry trade.

The rest of the article is organized as follows. Section 2 describes the mechanism of currency carry trade in detail, reviews the literature, and provides some stylized facts. Section 3 describes our empirical strategy and the data. Section 4 reports the empirical results based on the reimport data reported by mainland China Customs and the monthly trade data recorded by Hong Kong Customs. Section 5 concludes.

2. Currency Carry Trade in China

In this section, we review the Chinese government's policies to regulate cross-border capital flows. We discuss the relevant literature and our contributions. On carry trade through

reimports, we discuss the benefits and costs, and illustrate the ways to use reimports for currency carry trade.

2.1 Capital Controls and Carry Trade: Institutional Background and the Literature

Although China has loosened its restrictions on its current account transactions since 1996 to promote trade in goods and services, it has maintained a firm grip on its capital account transactions. While foreign direct investment and trade finance have been largely liberalized in China, portfolio investment, money market, and financial derivative transactions are still under strict controls (Prasad and Wei, 2007; Zhang, 2014). These capital control measures aim to insulate the country from international financial volatility and risks. Controls on capital inflows can in principle prevent overheating in China's financial markets and economy due to too much inflow of foreign capital, while controls on capital outflows can prevent capital flights. Prasad and Wei (2007) provide a detailed documentation of the evolution of China's capital controls over the period 1980–2005. Ma and McCauley (2008) find that China's capital controls have been binding. They also show that Chinese capital controls have not been watertight.

While capital account transactions are closely monitored by the State Administration of Foreign Exchange (FX) of China, firms still find ways to evade them (Zhang and Balding, 2015). Wei and Zhang (2007) estimate the costs of capital controls for international trade arising from the detection of fake trade related to illicit capital flows. Aizenman (2008) shows that lower trade costs can facilitate illicit financial flows by misreporting trade transactions. Following the approach proposed by Fisman and Wei (2004) to detect tariff evasion, Ferrantino, Liu, and Wang (2012) provide indirect evidence for the avoidance of China's capital controls (i.e., money-laundering) as possible factors underlying either the under-reporting of exports at the Chinese border or the over-reporting of imports at the US border.

Two recent papers also use trade data to infer carry trade in China. Using China's monthly export or import data at HS four-digit level from 2008 to 2014, Lin, Xiao, and Ye (2020) show that trade of cost-efficient products (with higher value-to-weight ratios) responded significantly more to CRs than cost-inefficient products. Liu, Sheng, and Wang (2021) study how firms manipulate trade data to evade capital controls in China. Their model predicts a correlation between the reporting gap of bilateral trade and the exchange rate spread, especially when customs officials are less likely to detect fraudulent transactions.[2] They use the exchange rate spread between the onshore RMB in the mainland and the offshore RMB in Hong Kong to capture the carry trade return, instead of the return differentials between the RMB and the USD as in our paper and Lin, Xiao, and Ye (2020). In addition, their trade data cover only the direct trade between Hong Kong and mainland China but exclude reimports by China.

We make three contributions to the literature. The first one is on identification. While carry trade may be present in China's total trade as shown by Lin, Xiao, and Ye (2020), our analysis suggests that it is mostly China's reimports, especially the reimports through Hong Kong, where most of the currency carry trade is carried out. Because reimports through Hong Kong involve the lowest transaction costs than other types of goods trade,

2 They show that the traded products that violate Benford's law are more likely to be used by arbitrageurs in fake trade.

they are the preferred mechanism for currency carry trade that is disguised in goods trade. We, therefore, coin the term "currency carry trade by trucks" for this type of reimports. In addition, we use relative growth of money supplies in China versus the USA as an instrument for change in the carry trade returns. As money supplies are outside the control of the carry traders, this strengthens a causal interpretation that changes in CRs have led agents to use reimports to perform "carry trade by trucks."

Our second contribution is an explicit investigation into the role of SOEs in currency carry trade. This will provide insights on an important question of whether more state control of the economy through more SOEs can increase the effectiveness of capital controls. While the answer to this question is not clear *ex ante*, we find stronger carry trade activities by the SOEs than other firms. This suggests that a stronger role of the state in the economy in the form of more SOEs does not necessarily translate into a stronger enforcement of capital controls.

Our third contribution is to provide a new explanation for the phenomenon of reimports. As stated earlier, roughly 8% of China's total imports are from itself, making itself the fifth largest source of its imports, right after the USA, but before Germany, France, and the UK during 2002–17. It also accounts for nearly 90% of Mainland China's total imports from Hong Kong. The enormous size of reimports is not well understood in the literature. The existing explanations have to do with the rigidity in the enforcement of processing trade or a fraudulent maneuvering by firms to obtain tax rebate (Liu, 2013). The "currency carry trade" hypothesis provides a new complementary explanation for reimports, including a natural explanation for the outsized role of Hong Kong in reimports.

2.2 Currency Carry Trade through Reimports: An Example

Since the 2008 global financial crisis, the US Federal Reserve and the central banks in other major advanced economies lowered the interest rates to almost zero. We use Libor (Shibor)— London (Shanghai) Inter-bank Offering rate for the USD (RMB)—as a gauge of the returns of low-risk dollar (or RMB) assets, respectively. From Figure 1, we see that the annualized rate of 3-month Libor for the USD during 2010–15 is low and ranges from 0.23% to 0.43%. In comparison, the Shibor-3M annualized rate for the RMB is much higher, between 2.5% and 5.2%. Note that the exchange rate between the RMB and the USD during this period was kept relatively stable by the Chinese central bank. In fact, it is reported that the market expectation then was for the RMB to appreciate, further exacerbating the potential difference in returns. Indeed, the RMB had been appreciating from 8.28 yuan per dollar since 2005 when the RMB was unpegged from the dollar to 6.04 in 2014. In the absence of capital controls, such a difference in the interest rates would have created a classic incentive for some agents to engage in currency carry trade (short the USD and long the RMB).

A report from Bank of America Merrill Lynch provides some examples on carry trade.[3] One method of particular interest is to use reimports via Hong Kong—set up a mainland Chinese company to export a product to a partner in Hong Kong, and then import it back.

3 https://www.philstockworld.com/2013/05/21/how-to-arbitrage-the-peoples-bank-of-china/

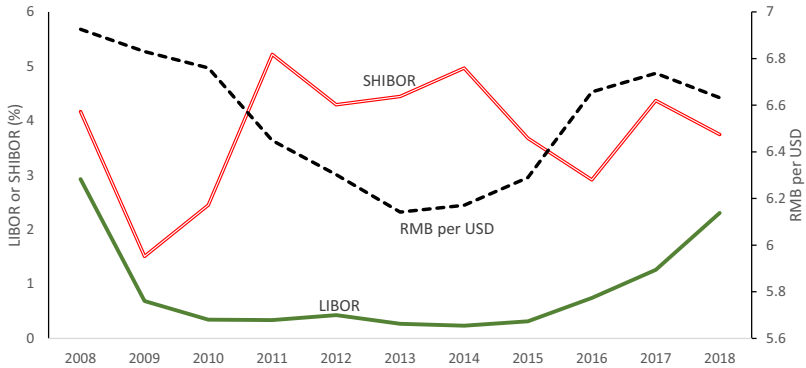

Figure 1. SHIBOR (in RMB), LIBOR (in USD), and CNY/USD exchange rate.
Notes: Both Shibor and Libor refer to returns over a 3-month term. *Data source*: Bloomberg.

Step 1: Citing a need to import something from Mainland China, a Hong Kong partner (typically a firm) applies for a 3-month loan of one million USD at a 1.2% annual interest rate from a Hong Kong bank.[4]

Step 2: The partner in mainland China then exports something with the lowest possible transport cost (e.g., electronic integrated circuits) to Hong Kong, typically from Shenzhen by trucks, while receiving one million USD from the Hong Kong partner, which is exchanged into 6.5 million RMB (based on an exchange rate of USD/CNY = 6.5). The money is then invested in a 3-month wealth management product (WMP) with an annual return in RMB of, say, 5%.[5]

Step 3: Three months later, the WMP is valued at RMB 6.58 million (after interests). If the RMB has appreciated (from USD/CNY = 6.5–6.4, which is the actual change during 2010–13), the payoff from the WMP can now be converted into 1.028 million USD.

Step 4: The same mainland company reimports the same thing, or a slightly processed good back from the Hong Kong partner, again with goods on trucks, paying a slightly higher price of 1.003 million USD (= 1 million*1.003) to cover the Hong Kong partner's principal plus interest payments. The net profit (in 3 months) is 25,000 USD (= $28,000 – $3,000). With US $1 million borrowed money, the annualized return is 10%, higher than most other investment opportunities.

Of course, the transaction is not risk-free. In particular, the exchange rate could move in the opposite direction. This risk is not unique to "carry trade by trucks" but equally

4 In practice, this can be done in several ways. The Hong Kong partner may rely on commodity trade financing or need a letter of credits (L/C) to apply for a loan. The L/C is often provided by the mainland company through its branches in the mainland ("*nei bao wai dai*" in Chinese). The L/C can be based on the mainland company's savings or another short-term loan from a mainland bank. For example, the mainland company may borrow RMB equivalent to one million USD backed by assets for a very short time period such as two weeks, and then invest the money in WMPs for 3 months at a 10% annual rate. With the fund, the company can ask its bank to issue a L/C and then provide the L/C to its Hong Kong partner. Their profit would be lower due to the interests for the 2-week loan.

5 According to WIND, the average return rate of WMPs during our sample period after 2010 is about 5%.

applicable to using only financial tools to do carry trade. Using reimports for carry trade has an added risk for the carry traders of being discovered, fined, and even jailed.

3. Empirical Strategy and Data

3.1 Empirical Strategy

To motivate our empirical strategy, we first illustrate graphically the correlation between CNY–USD CRs and reimports for products with high or low *V/W*, respectively. We define two product groups based on the *V/W* ratio of each HS eight-digit product using the trade data reported by China Customs. High *V/W* products are those with the *V/W* that is greater than \$500/kg at the 2015 constant USD, and low *V/W* products are those with the *V/W* that is less than \$10/kg. As Figure 2 illustrates, reimports of products with a high *V/W* ratio move closely with the CR index, while products with a low *V/W* do not appear to be correlated with the CRs. These patterns support the interpretation that more valuable and lighter products are more likely to be used for currency carry trade due to their lower transportation costs per unit of money moved.

In Appendix 1, based on the data from China Customs Statistics, the average V/W in China's reimports is \$8.14/kg, much higher than that in either China's overall imports (\$0.63/kg) or exports (\$0.95/kg).[6] Since Chinese reimports are mostly through Hong Kong, it is worth noting that regular imports from Hong Kong also have a much lower *V/W* ratio (\$1.72/kg). These differences in the *V/W* ratios are consistent with the interpretation that if reimports are the preferred tool for currency carry trade, it makes sense for carry traders to concentrate on goods with a relatively low transportation cost for a given amount of money moved.

To relate product-level reimports behavior to CRs, we conduct a regression analysis based on the following specification:

$$\begin{aligned} Y_{\mathrm{it}} = {} & \alpha + \beta_1 \log(V/W)_{\mathrm{it}} + \beta_2 CR_t * \log(V/W)_{\mathrm{it}} \\ & + \beta_3 R_{\mathrm{it}} + \beta_4 R_{\mathrm{it}} * \log(V/W)_{\mathrm{it}} + \beta_5 \tau_{\mathrm{it}} + a_i + a_t + e_{\mathrm{it}} \end{aligned}$$

where the dependent variable Y is log(reimport) of HS-eight digit product i in time t, V/W is the product's V/W measured in USD/kg, CR_t stands for the carry returns calculated as the annual changes in the Bloomberg cumulative carry trade index. As control variables, R_{it} refers to export rebate rate, τ_{it} is import duty, a_i and a_t refer to the HS eight-digit product and year-fixed effects, respectively. Product fixed effects are included to capture any heterogeneity in the propensity to reimport across products. The year fixed effects control for all global or economy-wide policy changes such as the global trade slow-down after 2008 and the Chinese government's clampdown on illicit capital flows in 2013. Since CR_t only varies over time, it is absorbed by the year fixed effects. e_{it} is the error term.

While the *V/W* ratio is left-skewed, log (*V/W*) is nearly normally distributed. In the baseline case, we use log (*V/W*) and its interaction with CR as the key regressors [As a robustness check, we will also report results with a dummy variable representing goods whose *V/W* ratios exceed the median value.]. β_2 is the key coefficient of interest: If the currency carry trade hypothesis is correct, then we expect β_2 to be positive. In other words, we

6 We consider only those products with weight information (in kilogram, ton, or gram), which account for more than 75% of the total imports in value over 1995–2017. About 66% of the reimports have weight information.

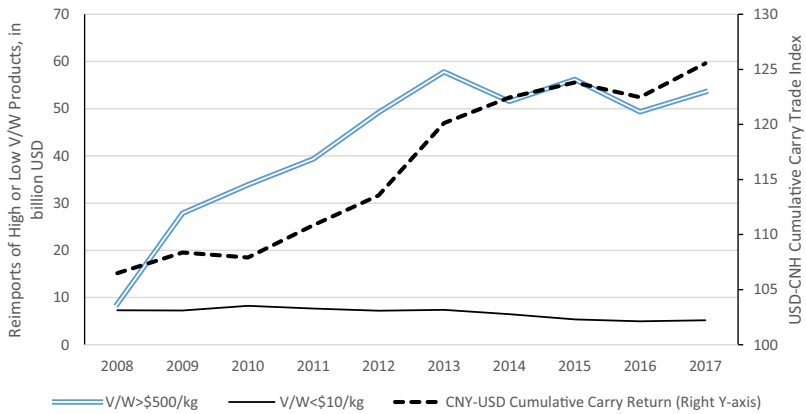

Figure 2. Reimports of high versus low value/weight products and the carry return.
Notes: High value products are those HS eight-digit products with an average value/weight in China's reimports greater than $500/kg in 2015 constant USD (using US GDP deflator from the World Development Indicators); low-value products are those with an average value/weight less than $10/kg in 2015 constant USD. The carry trade index is the Bloomberg cumulative index (averaged over a year).

expect to find higher reimports into China when CR is higher, especially for higher value products. As reimports may be partially driven by export Value Added Tax (VAT) rebates, β_3 and β_4 may bear positive signs as well. β_1 is likely to be positive but it is not a key coefficient of interest. We expect $\beta_5 < 0$ as import duties deter trade.

An important part of the investigation is the role of SOEs in currency carry trade. In an alternative specification, we include triple interactions between $CR_t * \log(V/W)_{it}$ and reimport shares by firm ownership type to examine if certain firm types are more likely to engage in carry trade. In addition, reimports under processing trade were exempted from import duties and were often entitled to VAT rebates compared to domestic sales (Liu, 2013). To control for this type of trade motivated by tax avoidance, we include an interaction term $R_t * \log(V/W)_{it}$ as a regressor, where R_t refers to the VAT export rebate rate.

We do not include the standard gravity variables because they are either at the country level (such as log GDP or log population) or at the bilateral level (such as log distance). Among China's reimports over 1995–2017, 92% were through Hong Kong. In other words, the key data in our case come from a single source and a single destination economy. The standard gravity variables would not have much variations.

Our CR index captures relative changes in interest rates for deposits in CNY and USD, as well as the rate of exchange-rate appreciation. Because our analysis is at the highly disaggregated product level, interest rates and exchange rates, which are both economy-wide variables, can be taken as exogenous from the point of view of each product. Nevertheless, we have investigated a possible endogeneity issue and used the difference between the growth rates of money supply in China and the USA (m2gr_diff) as an IV for the CR. We find that the change in China's interest rate, defined as a 3-month Shibor, is negatively correlated with China's M2 growth (log difference in M2 over a 3-month period) as expected, while the change in the US interest rate (i.e., the US federal fund rate) is not correlated with US M2 growth, probably because the USA has entered an era of "zero lower bound" or

Table I. Summary statistics

The summary statistics are computed from the sample based on data from China Customs, which are used in the regressions in Table II. The summary statistics reported in the last four rows are computed from the sample based on data from Hong Kong Customs at the monthly frequency, which are used in the regressions in Table III.

Variables	Obs	Mean	Std. Dev.	Min	Max
Panel A: Based on China's Customs Data					
log(reimport)	50,898	11.97	3.29	0	23.68
ImpDuty	50,898	26.13	5.88	12	104
Soesh	50,898	0.19	0.30	0	1
Prcsh	50,898	0.55	0.44	0	1
Wbash	50,898	0.13	0.27	0	1
log(*V*/*W*)	50,898	2.04	1.75	−5.42	12.38
CR	50,898	1.64	4.19	−3.32	12.28
CR*log(*V*/*W*)	50,898	4.40	12.96	−35.19	151.97
Rebate	50,898	11.27	5.39	0	17
rebate*log(*V*/*W*)	50,898	25.10	25.93	−69.17	185.65
Panel B: Based on Hong Kong Customs Data					
log(reexport)	269,822	12.92	2.83	0	24.24
log(*V*/*W*_reexp)	269,822	3.96	1.56	−4.61	17.22
CR	269,822	0.12	0.74	−2.73	2.87
CR*log(*V*/*W*_reexp)	269,822	0.54	3.35	−34.78	37.74

"liquidity trap" after the 2008 financial crisis. Nonetheless, the relative money growth is a strong predictor of CR. Because our key explanatory variable is an interaction term, we use m2gr_diff*log(*V*/*W*) as the IV for CR*log(*V*/*W*).

3.2 Data

In the baseline regressions, we use HS eight-digit product level trade data at the annual frequency during 2002–17 from China Customs. As a robustness check, we also use HS six-digit product-level trade data at the monthly frequency during 2002–19 from Hong Kong Customs. Both are at the most disaggregated level available. The summary statistics are reported in Table I.

China's reimports, imports, and exports data from China Customs contain information on value, quantity, units of measurement, trade regimes, and firm ownership types. When creating the shares by trade regime, we consider three major trade regimes: ordinary trade, processing trade, and trade in warehouses and bonded areas. They account for 99.7% of the total reimports during the 1995–2017 period. When creating the shares by firm ownership type, we consider SOEs and non-SOEs (which include domestic private owned firms, wholly foreign-owned firms, and joint ventures). Note that China Customs does not record direct exports to Hong Kong and indirect exports through Hong Kong separately, while it records China's imports from itself.

Trade statistics of Hong Kong Customs report Hong Kong's imports, direct exports (of products produced in Hong Kong), and reexports (of products produced elsewhere).

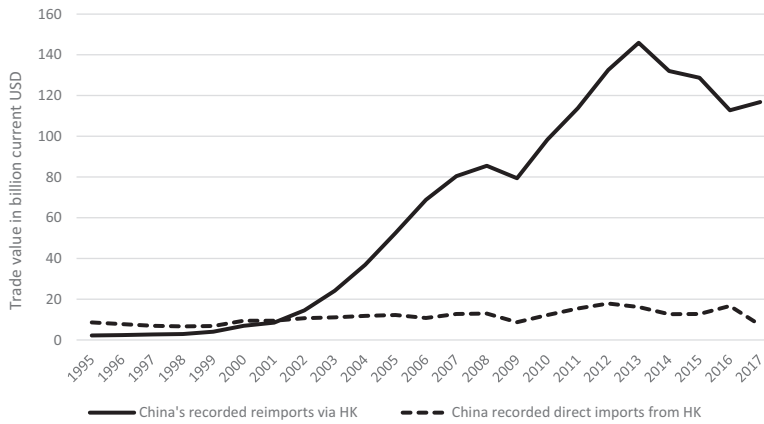

Figure 3. Reimports versus direct imports: from Hong Kong to mainland China.
Data source: China Customs Statistics.

However, Hong Kong's import data cover imports for both domestic consumption and reexport purposes, which means that we cannot distinguish one from the other. Hong Kong reports separately domestic exports and reexports of products produced elsewhere, with reexport value being much larger than direct export value.

In Hong Kong's reexport data, the part that has mainland China as both the country of origin and country of consignment can be considered as China's round-trip reimports (i.e., China → Hong Kong → China). As shown in Figure 3, China reimports through Hong Kong and direct imports from Hong Kong were almost the same in 2001 (at about 9 billion USD), but the reimports were growing much faster; by 2017, the reimports were about sixteen times larger than regular imports.

We measure carry trade returns using the Bloomberg CR index ("CNYUSDCR—long CNY, short USD"). The index considers the carry component based on the interest differential and the FX component based on spot FX return. The daily interest rates of USD and CHY are based on the annualized 3-month deposit rates (Libor3M and Shibor3M, respectively), divided by 260 business day in a year. The original index is an accumulative index, set to 100 on the base date on January 1 1999. In our regressions, we use the annual (monthly) change in this CR index, which is calculated based on the last trading day of a year (month).

The import duty measure (ImpDuty) includes China's applied MFN import tariffs, VAT, and consumption taxes. China's tariff data are from the UNCTAD TRAINS database. Since China's VAT and consumption tax data from China's State Administration of Taxation are available only from 2002 onwards, our sample starts in 2002. The regular lending and shadow banking data, including the amounts of entrusted and trust loans, are from the CEIC. Interest rates (i.e., the Shibor rate and the US federal fund rate), money supply (M2) in China and the USA are obtained from the CEIC and Bloomberg, respectively.

4. Empirical Results

4.1 China's Reimports from Itself Based on the Chinese Customs Data

Table II reports the regression results using log China's reimport value at the HS eight-digit product level as the dependent variable. All regressions include separate HS eight-digit

Table II. China's reimports at the HS8 level and carry returns, 2002–17

This table reports regression results based on data on China's annual reimports. CR is the annual change in the Bloomberg cumulative CNY–USD CR index. *V/W* is the ratio of reimports. The first column reports the OLS regression results. The dependent variable is log(reimport). Column (2) reports the results of the second stage of the 2SLS regression, while Column (3) has the result of the first stage. The instrument (IV) is m2gr_diff*log(*V/W*)= (m2gr_chn-m2gr_usa)*log(*V/W*), where m2gr_chn and m2gr_usa are the annual growth rate in money supply (M2) in China and the USA, respectively. Rebate is the export VAT rebate rate in percentage terms. ImpDuty equals China's applied MFN tariff rate plus consumption tax rate and the VAT rate. SOE share is the share of reimports by SOE firms. Processing Share is the share of reimports by processing firms. Warehouse Share is the share of reimports through warehouse and bonded areas. Year and HS eight-digit product fixed effects are included in all of the regressions. Standard errors in parentheses (clustered by HS6 in Column (1)). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Regressors	(1) OLS	(2) Second stage	(3) First stage
log(*V/W*)	0.117^{***}	0.057^{**}	4.947^{***}
	(0.031)	(0.019)	(0.073)
CR*log(*V/W*)	0.004^{***}	0.023^{***}	–
	(0.001)	(0.004)	–
Rebate	0.036^{***}	0.028^{***}	0.334^{***}
	(0.008)	(0.004)	(0.016)
Rebate*log(*V/W*)	0.009^{***}	0.012^{***}	-0.102^{***}
	(0.002)	(0.001)	(0.005)
ImpDuty	0.001	-0.013^{*}	0.061^{*}
	(0.012)	(0.006)	(0.027)
SOE Share	-0.341^{***}	-0.356^{***}	0.318^{*}
	(0.056)	(0.030)	(0.133)
Processing Share	0.932^{***}	0.911^{***}	0.648^{***}
	(0.062)	(0.031)	(0.138)
Warehouse Share	1.255^{***}	1.260^{***}	−0.179
	(0.066)	(0.038)	(0.167)
IV=m2gr_diff*log(*V/W*)	–	–	-21.815^{***}
	–	–	(0.385)
F-Statistics for excluded IV	–	–	3756.04
Number of observations	50,898	50,187	50,187
R^2	0.813	–	–

product and year fixed effects. Since persistent product-specific shocks can induce correlation over time, we cluster the standard errors by HS eight-digit product category. In the OLS regression reported in Column 1, the coefficient on CR*log(*V/W*) is positive and significant, implying that reimports increase with the CR especially for products with higher *V/W* ratios. This pattern supports the carry trade hypothesis. In Column 2, we implement 2SLS using the relative money supplies in China versus USA interacting with the product level value to weight ratio as the IV. The coefficient on CR*log(*V/W*) is still positive and statistically significant.

As arbitrage responds positively to CR, if we ignore the supply side of capital and other endogenous cost factors, the OLS estimates may be biased toward zero. The increase in the magnitude of the coefficient based on the 2SLS model suggests a downward bias in our OLS estimate, possibly due to some offsetting equilibrium forces that increase the cost of reimports (e.g., higher diesel fuel prices) or lower returns due to the increased supply of capital from abroad. Furthermore, if the raw carry trade return is measured with a large error, the coefficient from the 2SLS can also be larger than the OLS estimate. Column 3 reports the first-stage results. The instrument, m2gr_diff*log(*V*/*W*), is very strong, as indicated by the large *F*-statistic.[7]

In the first two columns of Table II, the coefficient on VAT rebate as well as its interaction with log(*V*/*W*) are always positive and highly significant, supporting the VAT avoidance hypothesis as in Liu (2013), especially for products with a higher *V*/*W* ratio. The overall effect of import duty is either insignificant or marginally significant at the 10% level, probably because much of the reimported products are either duty free under processing trade or subject to the duty-free treatment under the CEPA.[8]

Because the key covariate is an interaction term CR*log(*V*/*W*), we evaluate the economic significance of the effect at the mean value of log(*V*/*W*). The estimated coefficient of CR*log(*V*/*W*) of 0.023 in the baseline regression (2) in Table II indicates that one standard deviation increase in CR (4.19) raises reimports by 21.7%, evaluated at the mean value of log(*V*/*W*) (2.04) as reported in Table I.[9] Given the large volume of reimports, this magnitude is economically sizable.

4.2 Empirical Analysis Using Hong Kong Reported Monthly Reexport Data

A significant advantage of using trade data from Hong Kong Customs is that we can exploit the monthly frequency of the data to identify more precisely the correlation between our key variables, in particular the volatile CR index, and other high-frequency time series variables.[10] In Table III, we include both HS six-digit product fixed effects and year*month dummies to control for product level heterogeneity, time trend, and seasonality in the trade

7 Our finding is robust to the following alternative specifications: (i) using the annual change in carry return index divided by a Bloomberg implied volatility index (Vol) derived from USD-CNY 3-month ATM exchange rate options; (ii) dropping the products covered by the first 24 HS two-digit categories (animal, vegetable and food products). These results are not reported to save space, but are available upon request.

8 The number of observations in 2SLS is slightly smaller than that in the OLS regressions due to singletons (single observations) in a fixed effects regression. We find that excluding the singletons makes no difference to the results.

9 exp(0.023*4.19*2.04)−1 = 21.7%.

10 Hong Kong updates the HS over time. It is a usual practice that the World Customs Organization (WCO) recommends major revisions to the six-digit HS once every 5 years to take into account significant changes in trade patterns, technological progress and international requirements, etc. For instance, the WCO recommended a set of some 240 amendments to HS 2017. Annual review is also conducted by this Department to reflect changes in trade patterns and local needs, but the magnitude of changes to the commodity codes is comparatively minimal, as confirmed by the Census and Statistics Department of Hong Kong SAR. Nevertheless, we have concorded the HS products to HS2002 at the six-digit level to minimize the mismatch over time.

Table III. Monthly Hong Kong reexports to China at the HS6 level and carry returns, 2002–19

This table reports the 2SLS regression results based on data on Hong Kong's monthly reimports. The dependent variable is the log of Hong Kong recorded reexport values to mainland China of the products originated from mainland China from 2002 to 2019, concorded to HS2002. CR is the monthly changes in the Bloomberg CNY–USD cumulative CR index. *V/W* is the ratio based on Hong Kong recorded reexport data. The instrument (IV) in Column (1) is m2gr_diff*log(*V/W*) = (m2gr_chn-m2gr_usa)*log(*V/W*), where m2gr_chn and m2gr_usa are the growth rate in money supply (M2) over a 3-month period in China and the USA, respectively. Column (2) reports the 2SLS results from a regression with an additional triple interaction term between CR*log(*V/W*) and a diesel price index. The instruments are m2gr_diff*log(*V/W*) = (m2gr_chn-m2gr_usa)*log(*V/W*) and its interaction with diesel price index. The two F statistics in Column (2) are for the excluded instruments in the two first-stage regressions with CR*log(*V/W*) and CR*log(*V/W*)*diesel as the dependent variable, respectively. Column (3) reports the OLS results from a regression with lagged dependent variable and lagged_CR*log(*V/W*) as additional regressors. Rebate is the export VAT rebate rate in percentage terms. ImpDuty equals China's applied MFN tariff rate plus consumption tax rate, and VAT rate. Year–month dummies and HS six-digit product fixed effects are included in all of the regressions. Standard errors in parentheses (clustered by HS six-digit category in OLS). $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Regressors	(1)	(2)	(3)
CR*log(*V/W*)	0.252***	0.592**	0.013***
	(0.026)	(0.201)	(0.003)
CR*log(*V/W*)*diesel	–	−0.169**	–
	–	(0.065)	–
log(*V/W*)	0.199***	0.143*	0.221***
	(0.010)	(0.062)	(0.018)
log(*V/W*)*diesel	–	0.028	–
	–	(0.038)	–
ImpDuty	0.002	0.002	−0.003
	(0.003)	(0.003)	(0.007)
Rebate	−0.030***	−0.037***	−0.013**
	(0.003)	(0.003)	(0.006)
Rebate*log(*V/W*)	0.005***	0.006***	0.002*
	(0.001)	(0.001)	(0.001)
Lagged log(reimp)	–	–	0.454***
	–	–	(0.007)
Lagged_CR*log(*V/W*)	–	–	0.005*
			(0.003)
F-Statistics for excluded IV	2697.97	302.03; 635.67	–
Number of observations	269,661	269,661	241,698

data. A Dickey–Fuller test for unit root shows that the original accumulative CNY–USD CR indexes over 1999–2019 are not stationary but its monthly change is stationary.[11] Therefore, we use only the monthly change in the carry trade in the analysis based on Hong Kong's trade data. Since Hong Kong does not provide information on the trade regime or

11 The MacKinnon approximate p-values for Z(t) are 0.75 and 0, respectively. If we assume a time trend, the MacKinnon approximate p-values become 0.91 and 0, respectively.

firm ownership of each transaction, we only include the carry trade index interacted with log(*V*/*W*), China's tariffs, export VAT rebate rates (Rebate), and Rebate*log(*V*/*W*).

The 2SLS regression results, with the dependent variable in the second stage calculated based on Hong Kong's reexports of the mainland Chinese products to China, are reported in Table III.[12] Consistent with our earlier findings, we continue to find strong support for our carry trade hypothesis. Based on the coefficient on CR*log(*V*/*W*_reexp) in the first regression (0.25), we find that a one standard deviation increase in CR, evaluated at the sample mean of log(*V*/*W*_reexp), is associated with a 108% increase in the round-trip trade, ceteris paribus.[13] Because the change in CRs is calculated at monthly frequency, this estimate is not comparable to the earlier one based on the annual trade data from China Customs.

In Column (2) of Table III, we check the robustness of our main results by adding a fuel cost variable, measured by the average diesel price index across Hong Kong and mainland China, to account for the facts that fuel costs may increase with the demand for (carry) trade by trucks across border.[14] The triple interaction term CR*log(*V*/*W*)*diesel has a significant and negative effect on reimports, suggesting that the fuel cost does reduce the incentive of carry trade. Nevertheless, the key interaction term CR*log(*V*/*W*) remains positive and significant at the 5% level.[15]

We also consider the effect of lagged CR. If the decision to engage in carry trade is made when the firms first observe the interest rate differential, reimports could respond to lagged CRs. When we include an interaction term between lagged CRs and log(*V*/*W*) in Column (3) of Table III, the new regressor is indeed positive and significant. The coefficient on the contemporaneous CRs (0.013) is still positive and statistically significant, with a much larger point estimate than the one on lagged CR (0.005). We interpret this as suggesting

12 This regression covers only the products whose quantities are measured in kilogram, gram or ton. We check the robustness of our results to using two different measures of our key V/W variable. First, we use the V/W measure from Colombia (see Lee, Wei, and Xu, 2020), a country that reports the weight for nearly every HS six-digit product in its trade data over 2007–11. It varies only across products, but not over time. If we take V/W as a technical feature of a product, it should be similar across countries. The benefit of using this measure is that we can retain more products in the regression, not limited to those with weight information. Second, we also use the V/W of mainland China's reimport data, similar to what is used in Table II but at the HS six-digit level to obtain a better match with Hong Kong's HS product lists. Therefore, the products covered in this regression are limited to those with weight information in mainland China's reimport data. The simple correlation coefficients among these V/W measures are all around 0.7. Our main finding continues to hold. The results are not reported to save space, but are available upon request.

13 exp(0.25*3.96*0.74)−1 = 108%, where 3.96 is the sample mean of log(*V*/*W*_reexp) and 0.74 is the sample standard deviation of CR, as listed in the Table 1.

14 The original monthly price indexes from the CEIC, set to 100 in January, 2001. The average price index variable (diesel) = (Hong Kong's diesel index + China's diesel index)/200.

15 The lagged carry return should matter when actual trade is a few months later (delayed) after traders observed the carry trade opportunity, especially when carry return was on rise continuously for multiple months. Using the monthly data from Hong Kong, the additional lagged carry return index interacted with log(*V*/*W*) are indeed positive and significant, despite a small coefficient compared to that of contemporary carry return. However, this variable turns insignificant when lagged dependent variable (lagged log(reimport)) is included as a regressor. Therefore, we only include the contemporary CR in our regression.

that carry traders can organize reimports quickly in response to changes in return differentials.

4.3 The Role of SOEs in Carry Trade

The currency carry trade through reimports of goods is a type of arbitrage behavior resulting from China's tighter control on cross-border financial transactions than current account transactions. Being on the commanding heights in the Chinese economy, the SOEs may be obligated to help to carry out government policies, including the control on the capital account. On the other hand, SOEs likely have closer connection with the customs and can also exploit their privileged position and engage in more carry trade.

Exploring ownership information by importer, we compute the share of SOEs for each HS eight-digit product and examine whether higher SOE shares lead to more or less currency carry trade. In Column (1) of Table IV, we run a similar regression as in Column (2) of Table II, with the addition of a triple interaction between CR*log(*V*/*W*) and SOE_share.[16] The coefficient on the new triple interaction is positive and statistically significant at 1%, implying a stronger reimports response to CRs for products with a larger SOE shares. In other words, SOEs likely engage in more currency carry trade than domestic private and foreign firms. This suggests that SOEs in practice are not the exemplary followers of the government order on capital controls. Instead, SOEs seem to take advantage of their potentially better relationship with the customs or capital control officials. More SOEs would not necessarily lead to better enforcement of capital controls.

While we have so far used a continuous measure of the *V*/*W* ratio to identify carry trade behavior, we also check the robustness of our finding by creating a dummy variable, High_*V*/*W*, for the *V*/*W* ratios that are greater than the median value. In Column (2) of Table IV, we use this dummy variable to replace the original log(*V*/*W*). The results are consistent with the baseline results. In particular, when the CRs rise, reimports also rise, especially for products with a high value-to-weight ratio. Products with a higher share of reexports by SOEs respond more strongly to changes in the CRs, indicating that SOEs do more carry trade than non-SOEs.

4.4 Reimports versus Other Types of Trade Flows

In this subsection, we will compare reimports with other types of trade flows to see if reimports, and reimports through Hong Kong in particular, is employed more heavily for carry trade purpose. The results (all based on 2SLS models) are reported in Table V. As before, we use m2gr_diff*log(*V*/*W*) as the instrument for CR*log(*V*/*W*) in all regressions. The *F*-statistics of the first stages are high, suggesting that the instrument is strong.

First, we use China's total exports to the world and total imports from the world as dependent variables. When log(China's total exports) and log(China's total imports) are used as dependent variables in Columns (1) and (2), respectively, we only find weak support for carry trade in Column (2), since reimports account for 8% of China's total imports. When we use log(China's total imports—China's total reimports) as the dependent variable in Column (3), the coefficient on CR*log(*V*/*W*) becomes insignificant. In Figure 4, we

16 We group private firms (individually owned and collectives) with foreign firms (joint venture and wholly foreign owned) together because they are statistically insignificant for each other in the regressions.

Table IV. Prevalence of state-owned enterprises and reimports as carry trade

This table reports the 2SLS regression results based on China's reimport data (2002–17) at HS eight-digit level. The dependent variable is log(reimport). CR is the annual change in the Bloomberg cumulative CNY–USD CR index. VW = log(*V/W*) in Column (1). Column (2) uses the same specification except that we replace log(*V/W*) with a High_*V/W* dummy, which equals one if *V/W* is higher than the medium level of V/W in our sample (about $6.4/kg) and zero otherwise. The instruments (IVs) are m2gr_diff*VW=(m2gr_chn-m2gr_usa)*VW and its interaction with SOE_share, where m2gr_chn and m2gr_usa are the growth rate in money supply (M2) over a 3-month period in China and the USA, respectively. The two F statistics are for the excluded instruments in the two first-stage regressions with CR*VW and CR*VW*SOE_share as the dependent variable, respectively. Rebate is China's export VAT rebate rate. ImpDuty equals China's applied MFN tariff rate plus consumption tax rate, and VAT rate. SOE Share is the share of reimports by SOEs. Processing Share is the share of reimports by processing firms. Warehouse Share is the share of reimports through warehouse and bonded areas. Year and HS eight-digit product fixed effects are included in all regressions. Standard errors are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Dep var = reimports (at HS8 level)	(1) VW = log(*V/W*)	(2) VW = Dummy for High_*V/W* ratios
CR*VW	0.003	−0.006
	(0.006)	(0.020)
CR*VW*SOE_share	0.317***	1.169***
	(0.085)	(0.226)
VW	0.010	−0.178*
	(0.026)	(0.074)
Rebate	0.021***	0.037***
	(0.005)	(0.004)
Rebate*VW	0.015***	0.025***
	(0.002)	(0.005)
ImpDuty	−0.010	−0.013
	(0.007)	(0.007)
SOE share	−0.966***	−0.933***
	(0.167)	(0.108)
Processing share	0.937***	0.892***
	(0.035)	(0.035)
Warehouse share	1.233***	1.200***
	(0.043)	(0.042)
F-statistic for excluded IVs	1,665; 72	1,822; 126
Number of observations	50,187	50,187

compare the changes in *V/W* over time between reimports and total import or exports. It shows that only the changes in *V/W* of reimports have a close correlation with the CR rate.

Second, while China's reimports are mainly through Hong Kong, a few other economies also handle a small portion of them. The second most popular country is Singapore whose share of China's reimports is 1.6% over 1995–2017 (compared to 92% for Hong Kong). The lopsided role of Hong Kong makes sense if reimports are used for carry trade and transportation via Hong Kong is the lowest. In Columns (4)–(6) of Table V, we examine China's reimports through Hong Kong, Singapore, or Japan (the largest economy in

Table V. Which trade flows respond to carry returns?

This table reports only the second-stage results of the 2SLS regressions. Results from the first stage are not reported to save space (available upon request). In Column (1), the dependent variable is log(China's total exports). In Column (2), the dependent variable is log(China's total imports). In Column (3), the dependent variable is log(China's total imports-China's total reimports). The dependent variables in Columns (4)–(6) are China's reimports through Hong Kong, Singapore, or Japan, respectively, all in logarithms. In Column (7), the dependent variable is log(Hong Kong's direct exports to China) or log(China's direct imports from Hong Kong). Column (8) is based on a combined dataset to compare China's reimports via Hong Kong with China's direct imports from Hong Kong, with former being labeled by reimp_dummy as one (and zero otherwise). All of the trade data are from China Customs. In the first seven regressions, m2gr_diff*log(*V/W*), is used as an instrument for the endogenous variable CR*log(*V/W*). In Column (8), we use two instruments, m2gr_diff*log(*V/W*) and m2gr_diff*log(*V/W*)*reimp_dummy, for the two endogenous variables: CR*log(*V/W*) and CR*log(*V/W*)*reimp_dummy. Rebate is China's export VAT rebate rate. ImpDuty equals China's applied MFN tariff rate plus consumption tax rate, and plus VAT rate. SOE Share is the share of reimports by SOEs. Processing Share is the share of reimports by processing firms. Warehouse Share is the share of reimports through warehouse and bonded areas. Year and HS eight-digit product fixed effects are included in all of the regressions. Standard errors in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Dependent variable:	(1) log(tot exp)	(2) log(tot imp)	(3) log(total imp -reimp)	(4) log(reimp via Hong Kong)	(5) log(reimp via Singapore)	(6) log(reimp via Japan)	(7) log(HK's direct exp to China)	(8) log(imp)
CR*log(*V/W*)	−0.003	0.004*	0.004	0.036***	0.016	−0.016*	−0.011*	−0.155***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.009)	(0.007)	(0.005)	(0.006)
CR*log(*V/W*)	–	–	–	–	–	–	–	0.344***
*reimport_dummy	–	–	–	–	–	–	–	(0.007)
log(*V/W*)	0.043***	−0.143***	−0.152***	0.270***	0.120*	0.054	0.254***	0.178***
	(0.012)	(0.010)	(0.010)	(0.021)	(0.049)	(0.035)	(0.019)	(0.024)
Rebate	0.034***	−0.014***	−0.016***	0.045***	0.032	−0.008	0.006	0.012*
	(0.002)	(0.002)	(0.002)	(0.004)	(0.017)	(0.011)	(0.005)	(0.005)
Rebate*log(*V/W*)	0.009***	0.008***	0.008***	0.006***	0.002	0.006**	0.002	0.010***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)	(0.002)	(0.001)	(0.002)

(continued)

Table V. Continued

Dependent variable:	(1) log(tot exp)	(2) log(tot imp)	(3) log(total imp -reimp)	(4) log(reimp via Hong Kong)	(5) log(reimp via Singapore)	(6) log(reimp via Japan)	(7) log(HK's direct exp to China)	(8) log(imp)
ImpDuty	0.004***	−0.000	0.000	−0.026***	0.014	−0.009	−0.009	−0.016
	(0.001)	(0.002)	(0.002)	(0.007)	(0.020)	(0.013)	(0.007)	(0.009)
SOE share	−0.000	0.196***	0.203***	−0.342***	0.118	0.004	−0.089*	−0.198***
	(0.023)	(0.023)	(0.023)	(0.033)	(0.079)	(0.059)	(0.035)	(0.040)
Processing share	0.875***	0.788***	0.820***	0.796***	0.969***	1.195***	0.557***	0.866***
	(0.027)	(0.023)	(0.023)	(0.036)	(0.082)	(0.053)	(0.034)	(0.041)
Warehouse share	0.166***	0.899***	0.861***	1.236***	0.315***	0.496***	0.831***	1.169***
	(0.038)	(0.030)	(0.032)	(0.048)	(0.063)	(0.053)	(0.066)	(0.064)
Number of observations	82,361	81,377	81,111	43,014	9,926	18,202	37,440	81,582

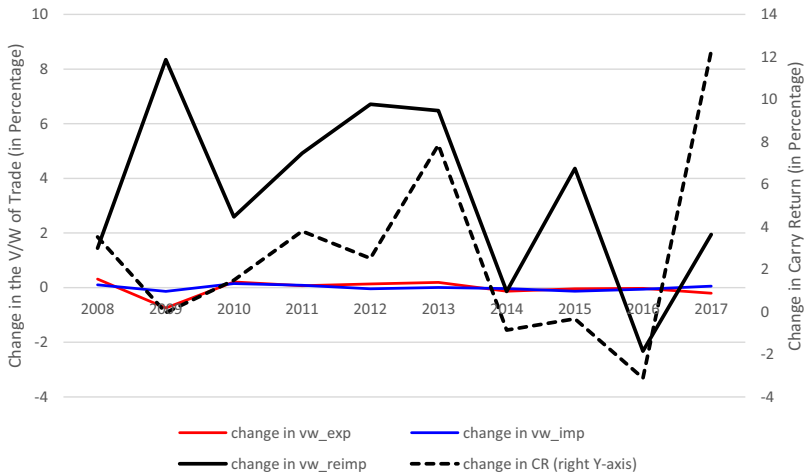

Figure 4. Changes in *V/W* in reimports, total imports, and total exports.
Data source: China customs statistics and Bloomberg.

China's vicinity), respectively. The results suggest that only reimports through Hong Kong respond positively to the CRs (Reimports from Japan are negatively related to the dollar–RMB CRs probably because the market was expecting the Japanese yen to appreciate).

Third, we examine China's direct imports from Hong Kong in Column (7) and find no evidence of a positive correlation with CRs. If anything, direct imports seem to be somewhat negatively correlated with the CRs. As Figure 3 shows, Mainland China's imports from Hong Kong are strongly dominated by reimports in recent years.

Finally, we combine the samples in Columns (4) and (7). The dependent variable is China's imports from Hong Kong (with separate entries for direct imports and reimports). We add an interaction term between a reimport dummy and CR*log(VW) as a regressor of interest. With the new triple interaction term, we use two instruments, m2gr_diff*log(*V/W*) and m2gr_diff*log(*V/W*)*reimport_dummy, for the two endogenous variables: CR*log(*V/W*) and CR*log(*V/W*)*reimport_dummy. Again, we find currency carry trade is likely to employ reimports as a tool but not direct imports. Similarly, Figure 5 shows a positive association between CR and the ratio of reimports to direct imports from Hong Kong.

4.5 Over-Reporting Trade Values by Chinese Importers

Engaging in currency carry trade in the presence of capital controls ultimately involves bypassing government regulations and controls. We now use an alternative approach to show how reimports are used to evade government controls.

With the data reported by both mainland China's and Hong Kong's governments, we can analyze how various policy variables affect the data reporting discrepancy. To maximize the benefits from carry trade, carry traders not only use products with a high *V/W*, but can also over-report the value of their goods. In this subsection, we investigate whether and how CRs induce mis-reporting of trade values. To make proper inference from such an analysis, we assume that the data recorded by Hong Kong Customs is more reliable than those reported by Mainland China Customs. This is a reasonable assumption given the

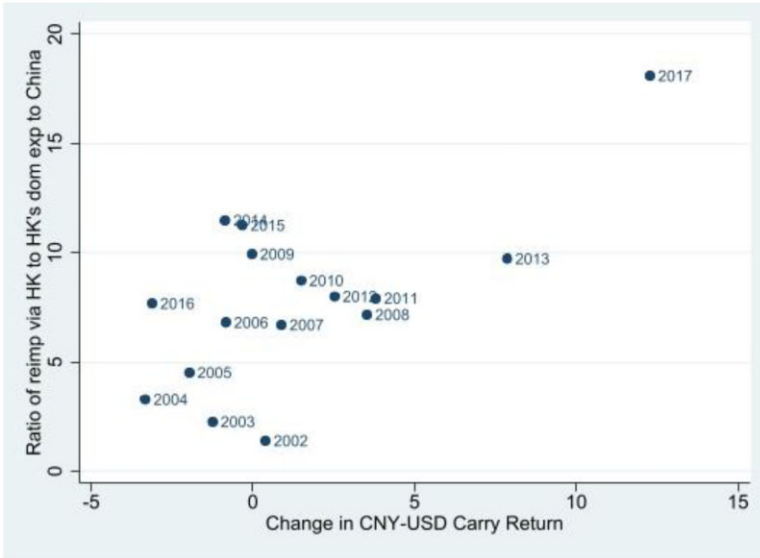

Figure 5. Reimports via HK are higher in years with higher carry returns.
Data source: China customs statistics and Bloomberg.

reputation of Hong Kong government's staff for their stricter enforcement of rules and emphasis on data accuracy.

Following Fisman and Wei (2004), we calculate GAP = log(China reported reimports from Hong Kong/Hong Kong reported reexports to China). Note that the numerator and denominator are meant to measure the exact same trade flow and should be identical in value in the absence of mis-reporting and measurement errors. Because our reimport data from the Mainland Chinese customs are at the annual frequency, we have to aggregate Hong Kong's monthly data to annual frequency. We also have to use HS six-digit product classification as that is the most disaggregated level common to both customs.

A simple calculation shows that the total reimport value recorded by the Mainland Chinese customs is 9% higher than the corresponding reexport value reported by Hong Kong Customs during the 2002–17 period. Since exports are usually quoted in free on board price, while imports are quoted in prices that include insurance and freight costs, some discrepancy is understandable. Careless recording errors can also generate some discrepancy. However, these errors should not be systematically correlated with the carry trade returns.

To misreport the value of trade to Chinese customs, it is helpful if the customs cannot determine the precise unit value of the products. For example, while gold has a high value to weight ratio, it is hard to mis-report the value of gold crossing the border since customs official can easily look up the price of gold, a homogeneous good. One insight from Fisman and Wei (2004) is to look for "differentiated products" in tax evasion such as computer chips or customized machines whose unit values are hard to pin down. We use the definition of "differentiated products" at the HS six-digit level from Rauch (1999), which are essentially products other than commodities and those with a reference price in professional trade publications (or websites).

Table VI. Reporting discrepancy in trade data (HS6 level, annual frequency)

In Column (1), the dependent variable is GAP_value = log(reimp/reexp), where reimp is mainland China's reported reimports through Hong Kong for products originated from Mainland China (in USD), while reexp is Hong Kong's reported reexports to mainland of products originated from mainland (converted into USD using official exchange rate). In Column (2), the dependent variable is GAP_*V/W* = log(*V/W*_reimp/*V/W*_reexp), where *V/W*_reimp and *V/W*_reexp are ratio based on reimport and reexport data, respectively, only for the products with reported weight information from both China and Hong Kong Customs. Hong Kong's trade data are concorded to the 2002 edition of the HS classification. Rebate refers to China's export VAT rebate rate. ImpDuty refers to China's import duty. CR is the annual changes in the Bloomberg CNY–USD cumulative CR index. Diff is a dummy for the differentiated products based on the Rauch's classification. Robust standard errors, clustered by the HS six-digit category, are in parentheses. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

Dep. variable:	(1) GAP_value	(2) GAP_*V/W*
CR*Diff	0.026***	0.014**
	(0.006)	(0.007)
ImpDuty	−0.002	−0.012*
	(0.005)	(0.007)
Rebate	0.051***	0.005
	(0.006)	(0.004)
Year dummies	Yes	Yes
HS6 FEs	Yes	Yes
Number of observations	43,050	24,009
R^2	0.453	0.387

We define a binary variable Diff that equals one for differentiated products and zero otherwise. The empirical results are reported in Table VI. In Column (1), the dependent variable GAP is the reporting discrepancy in trade values. We use the annual change in the CNY–USD carry trade index to measure CR. Import duty and export tax rebate by product are included as control variables. The coefficient on CR*Diff is positive and statistically significant. This means that over-reporting of the trade value is more likely to take place for differentiated products when the CRs are higher. An increase in the CR by one standard deviation would raise over-reporting of the trade value of differentiated products by about 11% on Mainland China's side relative to the value of the same trade flow recorded on Hong Kong's side.

In Column (2) of Table VI, the dependent variable is the log difference in the *V/W* ratios (measured in USD/kg). The average value to weight ratios in the Chinese customs data are more likely to exceed those recorded in Hong Kong's customs data for differentiated products when the CRs are higher. These data patterns suggest that mis-reporting trade value may be employed by currency carry traders as a complementary tactic to reimports.

5. Concluding Remarks

Interest rate differential across countries may create an incentive for agents to engage in currency carry trade, but capital controls can block such trade using financial instruments alone. We study whether agents try to bypass the capital controls by engaging in currency

carry trade by trucks (fake goods trade). In particular, we examine the use of China's round-trip reimports for this purpose, exploiting the data from China Customs and Hong Kong Customs.

Reimports not only waste logistic resources but also adding noises to trade data. The evidence of currency carry trade through fake goods trade shows that the effectiveness of China's capital control is compromised. This is a good example of how market forces can sneak in from the back door. Furthermore, we examine whether the state can increase the effectiveness of capital controls by having more SOEs. Interestingly, we find that SOEs are no less suspicious in the camouflaged carry trade activities than non-SOEs. With better connections with customs officials, and easier access to loans or letters of credits, SOEs are better poised to take advantage of the CRs resulting from capital controls. This means that having more SOEs will unlikely improve the effectiveness of capital controls. Since SOEs are more privileged than local private or foreign firms, it is possible that SOEs prefer a regulatory environment that impose more restrictions on other firms but not on themselves.

The main insight of the article is that capital controls are leaky, especially in countries with a high level of goods trade. In such economies, currency carry trade can be disguised as a part of goods reimports. State-owned firms are not necessarily helpful to capital controls. Rather, they may also respond to financial incentives and may act as an agent of arbitrage.

This article applies an econometric method to uncover camouflaged carry trade activities. The method can be used to identify similar behaviors in other countries or context. Although the benefit from shorting USD and longing RMB will not persist over the long run, the opportunity for arbitraging still exist as long as the capital controls are still in place. Sometimes, traders may benefit from the opposite strategy by shorting RMB and longing USD, and the same logic apply to other currencies as long as a country has capital controls but free movement of goods across border. China recently has plans to relax capital controls (e.g., by allowing the establishment of wholly owned foreign banks), but this will be a gradual process and various types of capital controls and regulations will still be binding in the foreseeable future. Besides, the quantitative easing after the 2008 Great Recession and other events such as the COVID-19 pandemic may still create a similar carry trade opportunity due to recent rounds of stimulus packages from many major economies. In sum, the idea of carry trade by trucks is not specific to just one period or one country.

Finally, our findings are of practical values. For instance, they can help government and customs to detect the evasion or avoidance behaviors, understand better the relationship between trade data and financial flows, and design appropriate countermeasures to address the problem. Our findings also show that liberalizing the exchange rate and interest rate regimes can curb the nonstandard forms of carry trade activities, reduce resource waste, and improve overall economic efficiency.

Data Availability Statement

The data and the codes are posted as the first item on the following webpage: https://users.nber.org/~wei/data.html.

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Appendix 1: The *V/W* (in USD/kg) in China's imports and exports

(Top 20 trading partners ranked by average trading value during 2002–17)

Source countries of China's imports	*V/W* of import by partners	Destination countries of China's exports	*V/W* of exports by partners
Korea	2.55	USA	2.62
Japan	2.95	Hong Kong SAR	0.26
Taiwan China	4.19	Japan	1.64
USA	1.04	Korea	1.01
China	**8.14**	Germany	4.40
Australia	0.13	India	1.19
Germany	5.53	Vietnam	1.58
Brazil	0.20	United Kingdom	3.67
Malaysia	1.44	Taiwan China	0.66
Saudi Arabia	0.59	Netherlands	3.04
Russia	0.39	Malaysia	1.84
Thailand	1.16	Singapore	1.67
Angola	0.56	Russia	2.62
Indonesia	0.17	Australia	1.48
Singapore	1.51	Indonesia	1.20
Iran	0.41	Thailand	1.71
South Africa	0.34	Italy	2.60
Chile	1.13	Canada	1.42
Canada	0.45	United Arab Emirates	1.79
India	0.20	Brazil	1.81
World	0.63	World	0.95

Notes: We list only the top twenty trading partners with China, based on the total trade values of the products with weight information. They account for 77% of China's total imports and 75% of China's total exports, respectively. China's exports to Hong Kong do not include the part that will be reimported back to China. Note that China's reimports have the highest *V/W* ratio (in boldface).