

Estimating Round-Tripping FDI from Firm-Level Data in China *

Zeyi Qian Junfu Zhang Qiangyuan Chen

Abstract

When capital leaves a country and then flows back as foreign direct investment (FDI), we call it round-tripping FDI. It is widely suspected that China's official FDI statistics contain a substantial amount of round-tripping FDI. However, it is difficult to quantify the round-tripping FDI due to the lack of data. In this paper, we propose two methods to identify round-tripping FDI. The first one tracks capital flows at the firm level. If a firm in China invests in a foreign firm and this foreign firm makes an investment back to China shortly after, then we consider this investment to China as round-tripping FDI. Our second measure of round-tripping FDI adds to the first measure by including investments in China made by Chinese investors registered in tax havens. The first estimate of round-tripping FDI accounts for up to 3% of China's total FDI from 1999 to 2015, whereas the second estimate accounts for up to 70% in the period. Our firm-level analysis shows that industrial firms facing higher tax burdens are more likely to make round-tripping FDI. We also show that at the city level, adjusted FDI statistics by subtracting the estimated round-tripping FDI are better predictors of imports and exports. Finally, we show that provinces receiving higher shares of

*Qian: Department of Economics, Clark University; Zhang: Department of Economics, Clark University; Chen: National Academy of Development and Strategy, Renmin University of China. We thank participants at the 2023 North America Conference of the Chinese Economists Society at the University of Oklahoma, the Graduate Student Seminar of the Department of Economics at Clark University, and the Camphor Economist Circle Seminar for their helpful comments and constructive suggestions. We also extend our gratitude to the reviewers and editors for their valuable feedback. Any remaining errors are ours.

Correspondence: Zeyi Qian, Department of Economics, Clark University, Worcester, MA 01610, USA, Email: zeqian@clarku.edu, ORCID: 0009-0000-6632-1411.

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round-tripping FDI are more likely to be punished for illegal financial activities. Taken together, these findings suggest that our measures of round-tripping FDI, although noisy, are indicative of real transactions.

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JEL classification: F21, F23, C81, K20

1 Introduction

According to data from the World Bank, China experienced a significant increase in foreign direct investment (FDI), surging from 4.04 billion U.S. dollars in 1999 to 174.39 billion U.S. dollars in 2015. However, debates surrounding the accuracy of these figures have persisted due to the potential inflation by round-tripping FDI, a phenomenon in which capital leaves a country and then flows back as FDI, artificially amplifying FDI statistics. Over the years, there have been a few attempts to assess the true magnitude of China's FDI. Yet research on round-tripping FDI is limited primarily due to challenges associated with data quality, data availability, and the lack of transparency in China's FDI reporting (Cuddington 1986, Gunter 1996).

Existing literature on round-tripping FDI focuses on two challenging issues. The first one pertains to estimating the share of round-tripping FDI, a task complicated by constraints in both data and methodology. Exploiting both official and unofficial data sources, some researchers have categorized FDI from Hong Kong, Macao, and a specific list of tax havens as round-tripping FDI.¹ Clearly, this approach runs the risk of overstating the figures by including an abundance of tax haven investments. An alternative method calculates the discrepancy between FDI statistics reported by China and those reported by source countries, interpreting the difference as round-tripping FDI.² This approach suffers from inconsistent statistical standards across countries and can lead to incomprehensible negative values of round-tripping FDI. Both of these methods rely on national-level data, producing rather crude estimates.

¹See Harrold and Lall (1993), Lardy (1995), and the report by the United Nations Conference on Trade and Development (UNCTAD, 1995).

²See the reports by the Organization for Economic Cooperation and Development (OECD, 2003), Asian Development Bank (ADB, 2004), and Xiao (2004).

The second strand of existing research is concerned with the motivations behind round-tripping FDI. Some researchers posit that round-tripping FDI is a way to pursue favorable business conditions and conceal illicit assets, but they are mostly speculative and do not provide much empirical evidence (Lessard and Williamson 1987, Dooley and Kletzer 1994, Fung et al. 2011, Hanlon et al. 2015). Only two studies attempt to elucidate the motivations behind round-tripping FDI using firm-level data (Sutherland et al. 2009, Karhunen et al. 2022). Studies on firms in tax havens reveal significant patterns of round-tripping and tax avoidance in various countries. For example, in Russia and Ukraine, a substantial portion of FDI flowing through offshore financial centers (OFCs) is linked to regional corruption, where capital is laundered and reinvested domestically (Ledyeva et al. 2015, Repousis et al. 2019). In India, Mauritius has been a major source of round-tripped FDI due to a 1983 Double Taxation Avoidance Agreement, with estimates suggesting around 10% of inflows are round-tripped, resulting in significant tax revenue losses (Aykut et al. 2017). Similarly, one-third of Brazil's outward FDI is directed to Caribbean OFCs, and about 30% of inward FDI is suspected to be round-tripped. In Italy, the complexity of multinational enterprises' financing structures highlights the extensive use of OFCs for pass-through capital and round-tripping (Accoto and Oddo 2023). However, their sample was restricted to FDI from specific regions and offshore financial centers, highlighting the necessity for a more comprehensive study.

Our research contributes to the understanding of China's round-tripping FDI in three key aspects. First, we improve upon the methods to identify China's round-tripping FDI. Utilizing firm-level outward foreign direct investment (OFDI) data and FDI data, we try to accurately track the firms involved in capital outflows and subsequent inflows, thereby painting a complete picture of the round-tripping process (when it is initiated by an OFDI). Recognizing that capital may leave China through many different channels, we also try the method of categorizing FDI from certain origins as possible round-tripping FDI. However, instead of treating all of them the same, we only count investments from foreign businesses or business owners with a Chinese name as round-tripping FDI. We believe our method produces more accurate estimates. Second, we assess and validate our estimates of round-tripping FDI. We demonstrate that net

FDI, once adjusted for round-tripping FDI, serves as a superior predictor of imports and exports. In addition, our analysis reveals that provinces exhibiting higher instances of round-tripping FDI are more prone to financial irregularities. Third, we utilize firm-level data to verify tax considerations as a potential driver of round-tripping FDI. We find that foreign firms involved in round-tripping FDI contribute less to exports. All these results are discussed in the context of China's unique legal framework.

The remainder of the paper is structured as follows: Section 2 introduces our data and methodology; Section 3 examines the differences between official FDI and net FDI; Section 4 presents empirical results exploring the cause of round-tripping FDI and Section 5 concludes.

2 Estimation of round-tripping FDI

2.1 Firm-level data

2.1.1 FDI and OFDI

A rather narrow notion of round-tripping FDI involving Chinese firms making investments abroad and these investments subsequently circulating back into China as FDI. To identify such instances, we match overseas investee firms of China-based OFDI with overseas investors of China-acquired FDI, using two comprehensive datasets.³

The first dataset is *China's FDI Database*, obtained from China's State Administration for Market Regulation. Covering FDI received by Chinese firms from 1978 to 2018, this database allows us to observe foreign firms investing in China. It provides detailed information on around 2 million Chinese firms and their approximately 3 million investors. Our primary focus is on aspects such as the timing and amount of foreign investments, as well as the names and locations of the firms involved. The second dataset is *China's OFDI Database*, obtained from China's Ministry of Commerce and covering OFDI from Chinese firms to other countries from 1983 to 2015. This database allows us to observe domestic Chinese firms investing abroad. It provides detailed information about the parent companies in China and their overseas subsidiaries.

By merging these two datasets, we can observe domestic Chinese firms investing

³In subsection 2.2, we will discuss such matching methods in detail.

abroad and their foreign investees investing back in China, which is the entire route of round-tripping FDI at the firm level. This allows us to calculate the scale and share of China's round-tripping FDI precisely.

For empirical analysis, we restrict our sample period to 1999-2015. Prior to 1999, the aggregate statistics from *China's FDI Database* show discrepancies when compared to alternative data sources, suggesting that the earlier data may not be reliable.⁴ We end the sample period in 2015 mainly because *China's OFDI Database* stopped reporting the date of each investment after 2015, which is needed for determining round-tripping FDI.

2.1.2 Industrial enterprises

To test the motivations behind round-tripping FDI, we use the *Chinese Industrial Enterprises Database* from 1998-2008. This dataset covers an average of 180 thousand industrial firms per year in mainland China with sales exceeding 5 million Chinese yuan. Given that large firms are more operationally viable and capable of round-tripping FDI and that the manufacturing sector is the primary sector where overseas investments are made, we believe that this dataset is the most appropriate choice. In the following section, we will match Chinese firms that engage in OFDI from those previously mentioned datasets with the *Chinese Industrial Enterprises Database*, to examine whether tax burden is a likely determinant of round-tripping FDI. The taxation variables and a number of control variables, including the quantity of labor, capital, and operational status of the firm, are all available in the *Chinese Industrial Enterprises Database*.

2.2 Methodology for estimating round-tripping FDI

In this section, we discuss how we utilize firm-level data to estimate the scale of round-tripping FDI through two different methods.

2.2.1 Strict definition

Our first, and strict, definition of round-tripping FDI is defined in a way illustrated in Figure 1. Three firms are involved in a round-tripping FDI: Firm A denotes a firm

⁴A detailed explanation of this issue can be found in the Appendix of this study.

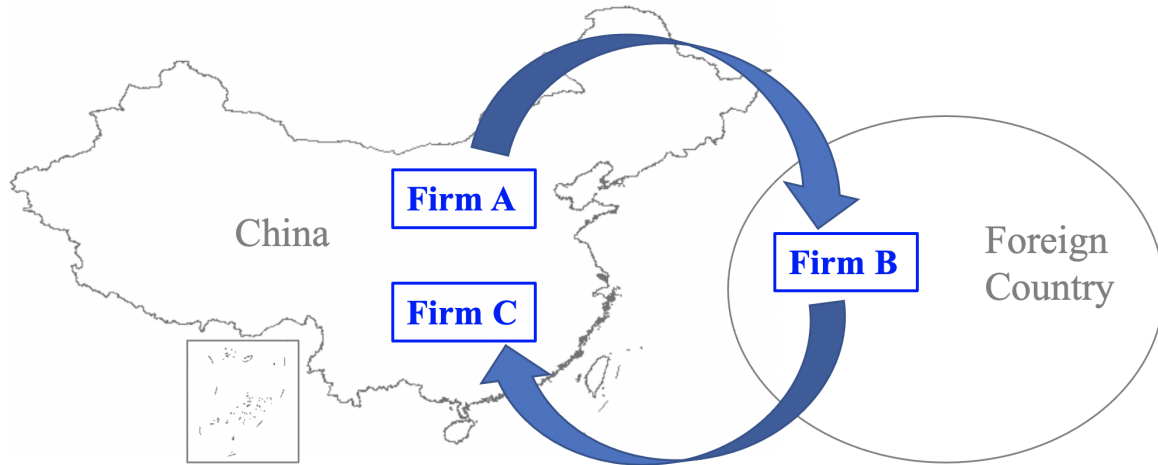


Figure 1: Routes of round-tripping FDI

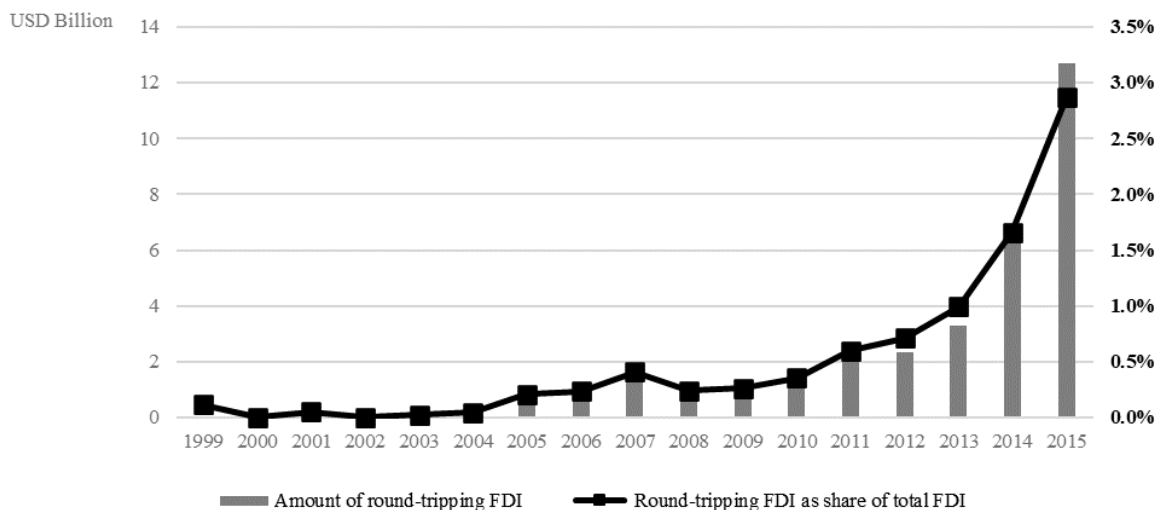
Note: China refers to mainland China in the diagram. Foreign country refers to all countries or regions outside mainland China.

registered in mainland China by a Chinese citizen; firm B denotes an overseas firm that received investment from firm A; and firm C denotes a firm in mainland China that received investment from the overseas firm B. The arrows in Figure 1 indicate capital flows: An OFDI from China first goes from firm A to B, and a FDI to China then goes from firm B to C, thus forming a round trip. We can observe Firm A and B in *China's OFDI Database*, while *China's FDI Database* captures firms B and C.

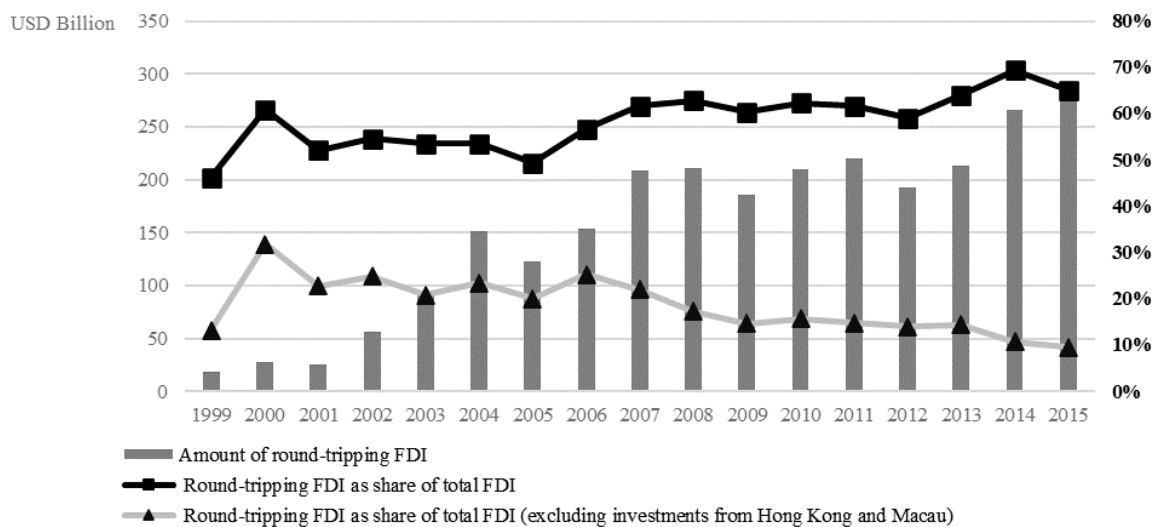
Thus the key to identifying this type of round-tripping FDI is to find a common foreign firm B in both databases, as an investee in the OFDI data and then an investor in the FDI data. Given that the same firm may appear under slightly different names in the two databases, we try to identify firm B by first performing an exact match, followed by a fuzzy match based on the firm's name and location.⁵ Finally, for each matched link of firms A, B, and C, we consider it a round-tripping FDI if the FDI (from firm B to C) occurs in the same year as or one year after the OFDI (from firm A to B).

By this rule, a total of 29,597 A-type firms are identified in *China's OFDI Database*, with 1,893 of them present in the matched round-tripping FDI data. This implies that approximately 6.4% of the firms in *China's OFDI Database* are engaged in round-tripping FDI.

⁵For example, we assume "British Zhongsan Limited Liability Company" and "British Zhongsan Company" are the same firm. So we match by using "British" and "Zhongsan" in two databases.



(a) Round-tripping FDI by strict definition



(b) Round-tripping FDI by loose definition

Figure 2: Estimating round-tripping FDI by different approach

Note: We present two measures of round-tripping FDI based on the strict and loose definitions, represented by 2(a) and 2(b) in the figure 2. We aggregate firm-level data to the country level over the years, and we also calculate the proportion of round-tripping FDI relative to total FDI using the same methodology. The strict definition captures the most rigorous form of round-tripping FDI identification, while the loose definition accounts for a broader range of investment relationships.

2.2.2 Loose definition

Our strict definition above may not capture all forms of round-tripping FDI. For example, an individual Chinese citizen (instead of a firm A) may establish a firm abroad and subsequently invest back into China as FDI. To capture this kind of activity, we propose a loose definition where, in addition to the round-tripping FDI by the three types of firms, we also treat a subset of investments from tax havens to China as round-tripping FDI. Tax havens, also known as “offshore financial centers,” are small countries and territories that offer low business tax rates and favorable regulatory policies to foreign investors. Following the list compiled by Hines (2010), we consider a total of 52 countries and territories to be tax havens (see Table A5 in the Appendix for the whole list). We extract all investors in *China’s FDI Database* located in tax havens with Chinese business names or Chinese owner’s names, and treat their investments in China as round-tripping FDI.⁶ By including these additional data, we aim to present a more complete representation of the true scope of round-tripping FDI in China. While the strict definition above will likely underestimate the total amount of round-tripping FDI, this loose definition may overestimate it. This is because an investor at a tax haven with a Chinese name may be a true foreigner of Chinese origin. In that case, the investment to China should be considered as true FDI but will be mistakenly captured as round-tripping FDI by our loose definition here.⁷ While it is hard to know to what extent our loose definition over-estimate round-tripping FDI to China, we find it reassuring that many FDI investors from tax havens do have Chinese passport numbers.⁸

⁶We consider an owner’s name to be a Chinese name if the surname is Chinese and the whole name consists of fewer than nine characters. Korean and Japanese owners may have the same surnames as Chinese, but Japanese names usually have more than four characters, and Korean surnames are concentrated on a few surnames.

⁷Indeed, Chen et al. (2022) studied diaspora direct investment to mainland China, using a method similar to ours to identify such investors.

⁸There’s no way to calculate the exact share of individual investors with Chinese passports, because for most people (94%) the ID information is missing. In the whole analysis sample, we have 66,693 investments that involve individual investors, among which only 4,058 have ID information and all are Chinese citizens. For the rest, it is impossible to tell whether they are Chinese citizens or foreigners of Chinese descent. More statistical results are presented in the Appendix.

2.2.3 Amount and trend of round-tripping FDI

Our calculations reveal that the amount of round-tripping FDI has been increasing based on both definitions. Perhaps because strictly defined round-tripping FDI incurs significant costs and time, only a small portion of firms choose this approach. We see in Figure 2(a) that the total volume of strictly defined round-tripping FDI is relatively small. Even at its highest level in 2015, this form of round-tripping FDI only constitutes about 3% of the total FDI in China; before that, the share is even lower.

In contrast, when using the loose definition, the share of round-tripping FDI is much higher. It increases from approximately 50% in 1999 to a staggering 70% by 2014, shown in Figure 2(b) by the dark black line.⁹ While this share is strikingly high, it is in line with what some other researchers have reported (e.g., ADB 2004, Xiao 2004). The list of tax havens used to calculate the loosely defined round-tripping FDI includes Hong Kong and Macau, two highly autonomous territories under the sovereignty of China. We tried to recalculate the round-tripping FDI by excluding investments from these two territories, the share of which in China's total FDI is the grey line in Figure 2(b). This share is much lower, ranging from 31% in 2000 to 9% in 2015. Note that this share continuously declines after 2006. This implies that of China's total FDI, a significant portion comes from Chinese investors based in Hong Kong and Macau. The share of this kind of round-tripping FDI (coming from Hong Kong and Macau) grew continuously during the later years of our sample period, peaking at 59% in 2014. Clearly, these two regions' geographic and cultural proximity to mainland China has given them a great advantage over other tax havens to invest in China.¹⁰

Figure 2(b) also indicates that whether excluding Hong Kong and Macau or not, the share of the loosely defined round-tripping FDI increased sharply around 2000. This reflects the macroeconomic environment in China at that time. In April 1998, China's central government issued the directive *Several Opinions on Further Expanding Opening Up and Improving the Utilization of Foreign Investment*, and shortly after there was a round of "development zone fever" — local governments all over the country opened thousands of economic development zones to attract FDI (Zhang 2011). These seem to

⁹Obviously, these two round-tripping FDI statistics (based on the strict and loose definitions) are related. The correlation between the two measures is 0.373.

¹⁰See Zhang (2005), Fung et al. (2011), Luo et al. (2022), and Xiao et al. (2022).

have spurred round-tripping FDI from tax havens.

3 Validation of estimated round-tripping FDI

In this section, we provide evidence that our estimates of round-tripping FDI are reasonable and contain useful information. We show that the estimated round-tripping FDI plays a less important role in promoting international trade than other FDI. We also find that provinces receiving a disproportionately high amount of round-tripping FDI are more likely to be caught for fraudulent financial activities, presumably because they have more businesses involved in deceptive, misleading, or other illegal practices to facilitate round-tripping FDI.¹¹ It is important to note that in all regressions presented in this subsection, the key independent variable (round-tripping FDI or total FDI) contains measurement errors, which may result in a bias against finding significant correlations.

3.1 FDI, round-tripping FDI and international trade

As a key form of multinational corporate activity, FDI has long been a central focus in the field of international trade. A substantial body of the early literature suggests a substitution effect between FDI and international trade (e.g., Mundell 1957, Vernon 1966, Buckley and Casson 1981, Rugman 1980). For example, if Intel establishes a factory in China to produce computer chips primarily to serve the local market, then China would not need to import these chips from foreign countries and at the same time would not need to export for the purpose of obtaining the foreign currencies needed to buy those chips. As a result, the FDI from Intel would reduce China's imports and exports. However, another perspective posits that FDI and international trade should exhibit a complementary relationship (e.g., Markusen 1995, Helpman and Krugman 1989, Helpman et al. 2004, Keller and Yeaple 2009, Ramondo and Rodríguez-Clare 2013). For example, if Apple Computers takes advantage of the relatively low labor cost in China and builds a plant there to produce its products for the world market,

¹¹We also tried to use Panel Vector Autoregression (PVAR) to examine the impact of net FDI and round-tripping FDI on province-level GDP from 2002 to 2015. Results show that while net FDI positively influences GDP with a gradual decline over time, round-tripping FDI exhibits minimal and often noisy effects on GDP. However, impulse responses are not significant.

we would see China exporting more (Apple’s final products) to foreign countries and at the same time import more intermediate goods (used by Apple) from foreign countries. In this case, Apple’s FDI leads to an increase in China’s total volume of international trade. As China has increasingly become the “World’s Factory” in our sample period, the complementarity argument seems to be more consistent with casual observations. We therefore postulate that FDI is positively associated with international trade in China and that round-tripping FDI, entering China with different purposes, will show a weaker correlation with international trade.

We first verify these predictions at the city level. To calculate the volume of international trade, we use the *China Customs Database* from China’s Administration of Customs for the period from 2000 to 2013. This dataset provides information on the import and export activities of Chinese firms, which are aggregated to obtain the annual value of international trade (imports plus exports) for each city in China. We also aggregate FDI, round-tripping FDI, and FDI net of round-tripping FDI at the city level. We estimate the following equation:

$$\text{Trade}_{ct} = \alpha + \beta_1 \text{Net FDI}_{ct} + \beta_2 \text{Round-tripping FDI}_{ct} + \mu_c + \lambda_t + \varepsilon_{ct} \quad (1)$$

The dependent variable Trade_{ct} represents the total value of imports and exports (in ten thousand USD) for city c in year t . The independent variables are the amount of net FDI (total FDI net of round-tripping FDI) and the amount of round-tripping FDI, which will be measured in different ways in different empirical specifications. We included city-fixed effects (μ_c) and year-fixed effects (λ_t) to control for the time-invariant effect of city characteristics and yearly changes of the overall economy that affect all the cities in the same way.

The regression results are in Table 1. For comparison purposes, in column (1), we impose the restriction $\beta_1 = \beta_2$ and use the total FDI statistics released by the Chinese government as the independent variable. As expected, the coefficient is positive and highly statistically significant, implying that more FDI is associated with more international trade at the city level. In column (2), the independent variable is split into two—net FDI and round-tripping FDI, calculated using our strict definition. Given the

Table 1: FDI and international trade, city-level analysis

	(1)	(2)	(3)
	Official	Strict	Loose
Dependent variable	Import & Export (USD 10 thousand)		
Total FDI	7.5668*** (0.2496)		
Net FDI		7.9960*** (0.2586)	14.0148*** (0.6009)
Round-tripping FDI		2.3882*** (0.9044)	2.6091*** (0.4879)
City FE	Y	Y	Y
Year FE	Y	Y	Y
F	87.9184	85.2380	94.5147
Adj. R-square	0.1990	0.2069	0.2295
Observations	3760	3760	3760

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Total FDI is the official FDI statistic. Net FDI represents the official FDI minus the estimated round-tripping FDI under our two definitions. Separating dependent variables in exports and imports yields similar results.

relatively minor share of the strictly defined round-tripping FDI, the net FDI variable in column (2) is only slightly different from the total FDI variable in column (1). Thus it is not surprising that they have coefficients of similar magnitude. What is striking is that the coefficient of round-tripping FDI is much smaller, suggesting that the strictly defined round-tripping FDI has a much weaker relationship with the volume of international trade. In column (3), the independent variables, net FDI and round-tripping FDI, are calculated using the loose definition. Here we see the same pattern as in column (2): round-tripping FDI has a much smaller coefficient than net FDI. It is interesting to see that the round-tripping FDI calculated in two different ways have rather similar coefficients in columns (2) and (3), suggesting that at least in terms of promoting international trade, the two types of round-tripping FDI play a similarly smaller role. Also, a comparison of the R-square across Table 1 suggests that allowing net FDI and round-tripping FDI to have different coefficients yields a better fit with the data. This is especially true in column (3), where both the R-square and the F statistic for overall significance indicate a much better fit.

Next, we examine the relationship between FDI and international trade at the firm level, again with the expectation that round-tripping FDI (if measured properly) will have a weaker effect on international trade. Our sample comprises all foreign-

invested firms within the manufacturing sector from the *Chinese Industrial Enterprises Database*. The data contains information on the exact amount of investment a firm receives from foreign countries, its revenue from exporting products to foreign countries, as well as many other firm characteristics and activities. Unfortunately, it does not provide information on the value of the firm's imports. Thus we examine the relationship between exports and FDI by estimating the following equation:

$$\begin{aligned} \text{Exports}_{it} = & \alpha + \phi \text{Foreign_capital}_{it} \\ & + \nu \text{Foreign_capital}_{it} * \text{Round-tripping_FDI_firm_dummy}_{it} \\ & + \delta X_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{aligned} \quad (2)$$

where Exports_{it} denotes the value of exports by firm i in year t ; $\text{Foreign_capital}_{it}$ represents the amount of foreign capital invested in firm i in year t ; the dummy variable equals 1 if the firm received round-tripping FDI, which is interacted with foreign investment to allow round-tripping FDI to have a different effect on exports. X_{it} is a set of control variables including firm age, capital, labor, and debt-asset ratio. We also control for firm-fixed effects (μ_i) and year-fixed effects (λ_t).

Table 2: FDI and exports, firm-level analysis

	(1)	(2)	(3)
	Total	Strict	Loose
Dependent variable	Export value (thousand CNY)		
Foreign capital	1.2217*** (0.3996)	1.2838*** (0.4356)	1.2868*** (0.4371)
Foreign capital × Round-tripping capital		-0.8393* (0.4555)	-0.8463* (0.4559)
Controls	Y	Y	Y
Firm FE	Y	Y	Y
Year FE	Y	Y	Y
Adj. R-square	0.0272	0.0278	0.0278
Observations	580156	580156	580156

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Both the dependent and independent variables are measured in thousands of CNY.

The regression results are in Table 2. In column (1), we shut down the interaction term, forcing all FDI to have the same coefficient. $\text{Foreign_capital}_{it}$ has a positive and highly statistically significant coefficient, implying that at the firm level, foreign direct investment leads to exports. Columns (2) and (3) include the interaction term, allowing

strictly and loosely defined round-tripping FDI to have a different effect than other FDI. Both columns show similar results: Round-tripping FDI has a much smaller coefficient. The coefficients in column (3) imply that while one thousand CNY of other FDI is associated with a 1,287 CNY increase in exports, one thousand CNY of round-tripping FDI is associated with only a 441 CNY increase in exports (846 CNY less). Thus these results, like those in Table 1, also imply that round-tripping FDI has a smaller effect on international trade. Both suggest that our methods produce reasonable estimates of round-tripping FDI.

3.2 Round-tripping FDI and administrative penalties

Our last exercise in this section examines whether round-tripping FDI is positively correlated with financial penalties. Since round-tripping FDI is domestic capital circling back as foreign investment, it often involves operating in grey areas, exploiting loopholes, or even conducting illegal transactions. As discussed in Karhunen et al. (2022), round-tripping FDI tends to have detrimental consequences for host countries, primarily due to the lack of transparency in many offshore financial institutions that handle such investments. These institutions, by withholding information on corporate shareholders and asset sources, enable residents to transfer illicit proceeds from activities such as tax evasion, drug trafficking, and bribery. This process allows for the concealment of funds and the legitimization of financial identities, facilitating money laundering.

A greater incidence of illicit activities leads to a higher likelihood of sanctions, hence behaviors like round-tripping FDI may exhibit some correlation with penalties. To explore this correlation, we use the *China Administrative Penalty Database* from the China Banking and Insurance Regulatory Commission for the period from 2005 to 2015, which includes almost 20 thousand penalties at the province level.

Given that more economic activities will naturally lead to more penalties, a correlation between round-tripping FDI and penalty levels is not informative. To purge this

size effect, we compute the location quotient (LQ) for each province, defined as:

$$\text{LQ of penalty}_{pt} = \frac{\frac{\text{Penalty}_{pt}}{\sum_p \text{Penalty}_{pt}}}{\frac{\text{GDP}_{pt}}{\sum_p \text{GDP}_{pt}}} \quad (3)$$

$$\text{LQ of round-tripping FDI}_{pt} = \frac{\frac{\text{Round-tripping FDI}_{pt}}{\sum_p \text{Round-tripping FDI}_{pt}}}{\frac{\text{FDI}_{pt}}{\sum_p \text{FDI}_{pt}}} \quad (4)$$

The LQ of penalty_{pt} is computed by dividing province p 's share of total penalties in year t by the province's share of national GDP in the same year. Similarly, the LQ of round-tripping FDI_{pt} is calculated by dividing the province's share of round-tripping FDI in year t by its share of total FDI in that year. We then estimate the following regression model to check the relationship between the LQ of administrative penalties and the LQ of round-tripping FDI at the provincial level from 2005 to 2015:

$$\text{LQ of penalty}_{pt} = \alpha + \gamma \text{LQ of round-tripping FDI}_{pt} + \mu_p + \lambda_t + \varepsilon_{pt} \quad (5)$$

Note that we have controlled for province and year-fixed effects.

Table 3: LQ of round-tripping FDI and LQ of penalty

	(1)	(2)	(3)	(4)
	Strict		Loose	
Dependent variable	LQ of penalty			
LQ of round-tripping FDI	0.7177* (0.3741)	0.8999* (0.5070)	0.2832*** (0.0273)	0.2177*** (0.0332)
Province FE	N	Y	N	Y
Year FE	N	Y	N	Y
Adj. R-square	0.0112	-0.0271	0.3112	0.1460
Observations	237	237	237	237

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

As shown in Table 3, there is indeed a positive correlation between administrative penalties and round-tripping FDI at the province level. The correlation is much more statistically significant when using the loose definition of round-tripping FDI (in columns (3) and (4)). Whether to control for province and year-fixed effects does not significantly affect the results. Therefore, when a province receives a larger share of

round-tripping FDI in a year, it also receives a larger share of penalties in the finance sector, suggesting that our estimates of round-tripping FDI are indeed indicative of corrupt and unlawful activities in finance.¹²

Additionally, the loose definition of round-tripping FDI, which includes more individual-level transactions, results in a stronger correlation with financial penalties as shown in Table 3. This may be because the cost of illegal activities is generally lower for individuals than for firms, leading to a higher likelihood of problematic round-tripping FDI made by individual investors.

4 Tax payment and round-tripping FDI

In this section, we examine the tax-driven motives behind round-tripping FDI at the firm level. Additionally, we conduct a heterogeneous analysis, categorizing firms based on region, trading status, and ownership structure.

4.1 Empirical specification

The literature primarily attributes round-tripping FDI to two reasons: Legitimate financial activities such as pursuing preferential treatment and currency speculation, and illegal financial activities such as concealing illicit assets. In the context of China, foreign-invested firms receive a wide range of favorable treatments, including lowered or exempted corporate income tax, value-added tax, and miscellaneous fees; expedited bureaucratic procedures; better access to infrastructure; government-sponsored financing and subsidies; more freedom in hiring and firing practices; more freedom in transferring income across the state border; etc. These together provide significant incentives for domestic firms to export capital and subsequently reinvest it as foreign investors (Dooley and Kletzer 1994, Mansfield and Mundial 1994, Knack and Keefer 1995, Xiao 2004, Zhang 2005, Sutherland et al. 2009, Jiang and Fan 2010).

Given that it is rather difficult to quantify the effects of most of the differential treatments, we here focus on one particular factor: the impact of tax disparities on round-tripping FDI at the firm level. The earlier version of China's tax law, effective

¹²We also run a horse race between round-tripping FDI and net FDI by including them in the same regression. We find that while the LQ of round-tripping FDI is positively correlated with the LQ of penalties, the LQ of net FDI has no explanatory power.

from 1991 to 2007, imposed a corporate income tax rate of 15% to 24% on foreign-invested firms and foreign firms, while domestic firms were subject to a higher tax rate of 33%. Starting in 2008, a new tax law unified the tax rate at 25% for all firms. However, local governments can still provide a variety of tax incentives to attract foreign direct investment. To detect the relationship between tax incentives and round-tripping FDI, we estimate the following model:

$$\text{Round-tripping FDI}_{i,t+1} = \alpha + \psi \text{Tax}_{it} + \delta X_{it} + \mu_i + \lambda_t + \varepsilon_{i,t+1}, \quad (6)$$

where Round-tripping $\text{FDI}_{i,t+1}$ represents the amount of round-tripping FDI from firm i 's overseas subsidiary back to mainland China in period $t+1$. We added 1 to it and took the logarithm. Tax_{it} represents the corporate income tax paid by firm i in period t , while X_{it} denotes a set of control variables, including log number of employees, log fixed assets, log firm age, and the debt-to-asset ratio. This choice of control variables follows Fan et al. (2023), who examined the impact of corporate taxation on OFDI. μ_i and λ_t represents firm and year fixed effects respectively, and $\varepsilon_{i,t+1}$ is the random error term.

Firm characteristics and tax data are drawn from the *Chinese Industrial Enterprises Database* for the years 1998-2008, which are then matched with our round-tripping FDI data by firm names. It is important to note that, as we are conducting this analysis at the firm level, only the strict definition can be used to measure round-tripping FDI. After matching, the resulting database includes an average of 183,495 industrial firms per year, with an average of 3,420 firms making outward FDI each year. Of these, 346 firms (or 10.33%) were engaged in round-tripping FDI.¹³ Since the overwhelming majority of the firms in the *Chinese Industrial Enterprises Database* never invested in foreign countries, they will never be engaged in round-tripping FDI. We will drop these firms from our analysis sample. That is, in our analysis below, we will only consider those firms that have made some investment in foreign countries. Among these firms, we will examine whether and how much of their capital has circled back to China as round-tripping FDI. The descriptive statistics of these firms are shown in Table 4. Note that tax values can be negative, because a firm experiencing losses would report the

¹³More matching results can be found in the Appendix.

deferred tax assets, resulting in a negative income tax expense. For this reason, we cannot take the logarithm of this variable.

Table 4: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Tax _t (1 million CNY)	37,465	0.0838	1.2001	-2.0634	127.8893
ln(Amount+1) _{t+1}	37,624	0.0169	0.2802	0	7.1413
ln(Age+1) _t	37,597	2.1350	0.9331	0	7.6014
ln(Labor+1) _t	37,622	5.4453	1.5383	0	12.5774
ln(Capital+1) _t	37,612	10.8454	2.1135	0	20.1521
Debt-asset-ratio _t	37,423	0.5955	0.6795	-1.4371	120.5854

Since about 90% of the firms in our analysis sample have never been engaged in round-tripping FDI, we are concerned that a simple OLS regression of equation (6) may be biased due to the excessive zeros in the dependent variable. Thus we estimate a Tobit model for the investment amount.¹⁴ To mitigate the risk of omitted variable bias, we lag the independent variables by one year.

4.2 Baseline results

The baseline results are in Table 5. Column (1) presents the results for firms that have engaged in OFDI. We then restrict the sample to only those firms that have made round-tripping FDI in column (2), which considerably reduces the sample size.

In column (1), the coefficient of tax_t is positive and statistically significant at the 5% level. In column (2), the coefficient of Tax_t is even more significant at the 1% level compared to the results in column (1). In both regressions, the coefficient is quite similar (around 0.5), suggesting that for every additional 0.1 million CNY in income tax expense, a firm's round-tripping FDI increases by about 5% ($e^{0.5 \times 0.1} - 1$). (Note in Table 4 that the mean corporate income tax is only 0.08 million CNY, so an increase of 0.1 million CNY represents a substantial change.) By engaging in round-tripping FDI, domestic firms can establish ownership of foreign entities in China. This strategy enables them to take advantage of tax incentives designed for foreign firms, ultimately

¹⁴When using Pantob, clustering is not feasible. Addressing the reviewer's concerns, we performed all regressions using OLS and found that the results (positive or negative correlations) were consistent with those from Tobit. However, there were significant differences in coefficients, as OLS cannot address the issue of many zeros as effectively as Pantob, leading to greater bias in OLS compared to Pantob.

Table 5: Baseline results

Dependent variable	(1)	(2)
	Sample of OFDI firm	Sample of round-tripping FDI firm
	$\ln(\text{Amount} + 1)_{t+1}$	
Tax _t	0.5288** (0.2070)	0.4956*** (0.1499)
$\ln(\text{Age}+1)_t$	-2.2135*** (0.3666)	-2.0823*** (0.3716)
$\ln(\text{Labor}+1)_t$	1.6717*** (0.6151)	1.3797** (0.5746)
$\ln(\text{Capital}+1)_t$	-0.4611 (0.4867)	-0.6748 (0.5025)
Debt-asset-ratio _t	1.4824 (1.5087)	1.7052 (1.4702)
Firm FE	Y	Y
Year FE	Y	Y
Observations	37248	3723

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. The Tobit fixed effect model is based on the theoretical model constructed by Honor, Bo E. (1992), and the Pantob (version 0.6) Stata code released in 2009. Our coefficients represent the average marginal effect of expected income tax expense on round-tripping FDI.

reducing their overall tax burden.

Meanwhile, the control variables indicate that longer-surviving firms are less likely to engage in round-tripping FDI, perhaps due to their inherent advantages in production capacity and their strong ability to manage income tax expenses. Additionally, firms with a larger workforce might seek ways to reduce taxes and mitigate rising costs, potentially offsetting wage expenses. However, the influence of capital and the debt-to-assets ratio is not clearly evident. Overall, our findings support the notion that when firms face tax pressure, engaging in round-tripping FDI becomes an advantageous strategy.

4.3 Heterogeneity analysis

4.3.1 Eastern versus non-eastern regions

To analyze the effect of firm heterogeneity on motivation of firms' round-tripping FDI, we first categorize firms according to their locations: eastern and non-eastern, which are shown in columns (1) and (2) of Table 6.¹⁵ The results show that round-tripping FDI is

¹⁵The eastern regions encompass Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, Hainan, Liaoning, Jilin, and Heilongjiang. The other provinces include Shanxi,

Table 6: Heterogeneous results

	(1)	(2)
Panel A:	Eastern region	Non-eastern region
Dependent variable	$\ln(\text{Amount} + 1)_{t+1}$	
Tax_t	0.2947*** (0.0754)	3.6420*** (0.9464)
Controls	Y	Y
Firm FE	Y	Y
Year FE	Y	Y
Observations	28337	8911
	(3)	(4)
Panel B:	Trading firm	Non-trading firm
Dependent variable	$\ln(\text{Amount} + 1)_{t+1}$	
Tax_t	0.2887 (0.2366)	3.2961 (2.4459)
Controls	Y	Y
Firm FE	Y	Y
Year FE	Y	Y
Observations	24625	12623
	(5)	(6)
Panel C:	State-owned firm	Non-state-owned firm
Dependent variable	$\ln(\text{Amount} + 1)_{t+1}$	
Tax_t	-0.3166 (0.3690)	2.0486** (0.8444)
Controls	Y	Y
Firm FE	Y	Y
Year FE	Y	Y
Observations	9862	27386

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

positively associated with tax burden in both eastern and non-eastern regions. However, in non-eastern regions (Column (2)), the tax burden has a much larger coefficient. This likely stems from the fact that local governments in non-eastern regions often implement more aggressive policies to attract foreign investment and favor foreign-invested firms. These policies, intended to offset relative geographical disadvantages, may have provided firms with strong incentives to engage in round-tripping FDI and capitalize on the favorable treatment for foreign investments.

Anhui, Jiangxi, Henan, Hubei, and Hunan, Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang are non-eastern regions.

4.3.2 Trading versus non-trading firms

In columns (3) and (4), we divide our analysis sample into trading and non-trading firms. Export values are obtained from the *Chinese Industrial Enterprises Database*. For import data, we merge the *China Customs Database* and *Chinese Industrial Enterprises Database* using firm names to identify firms that import goods from other countries. Firms with either export or import records are classified as trading firms, while those without such records are classified as non-trading firms.

Interestingly, the coefficient for Tax_t is statistically insignificant for both subsamples. In terms of magnitude, the coefficient for trading firms is similar to that for firms in eastern regions, while the coefficient for non-trading firms is similar to that for firms in non-eastern regions. This overlap is expected, as most trading firms are likely located in eastern regions. The small and statistically insignificant coefficient for trading firms suggests that firms involved in international trade are not inclined to engage in round-tripping FDI. This observation is consistent with the tendency of such firms to focus on securing subsidies or reducing trade barriers to enhance their financial performance. For these firms, obtaining foreign investment status through round-tripping FDI may be a less attractive strategy for tax avoidance.

4.3.3 State-owned versus non-state-owned firms

In columns (5) and (6), we examine the differences between state-owned and non-state-owned firms. The ownership structure of a firm is directly observed from the *Chinese Industrial Enterprises Database*. The coefficient of Tax_t for state-owned firms (column (5)) is negative and statistically insignificant, whereas the coefficients for non-state-owned firms (column (6)) are positive and statistically significant. This suggests that non-state-owned firms exhibit greater flexibility and efficiency in tax avoidance, possibly due to their market orientation, competitive mechanisms, and profit motives. In contrast, state-owned firms are driven more by political and social objectives, which may limit their capacity to engage in tax avoidance strategies that fall within gray areas.

In summary, the most significant heterogeneity arises from differences in the geographical locations of firms and their ownership structures. This heterogeneity likely

results from variations in government regulatory intensity, levels of intervention, and legal distinctions. Firms facing greater constraints are less likely to engage in round-tripping FDI for tax avoidance.

5 Conclusion

We propose two methods that leverage China's FDI Database and OFDI Database to quantify the magnitude of round-tripping FDI in China. The first approach is based on tracking capital flows, which reveals a relatively low scale of round-tripping FDI. This is due to the requirement for firms to register three distinct types of entities both domestically and internationally to carry out round-tripping FDI. The second approach further considers FDI in China by Chinese investors who have established firms in tax havens. This method yields a much higher estimate, suggesting that round-tripping FDI could account for up to 70% of China's official FDI figures.

To verify that our estimation methodologies are reasonable and informative, we use a diverse array of data and conduct correlation analysis from different perspectives. Our analysis indicates that estimated round-tripping FDI plays a less significant role in promoting international trade. Additionally, we find that provinces with a higher proportion of round-tripping FDI are more likely to face penalties for illicit financial activities.

Finally, we employ the *Chinese Industrial Enterprises Database* to examine the tax avoidance motives behind round-tripping FDI. Our findings suggest that firms facing higher income taxes may resort to round-tripping FDI. Additionally, firms located in non-eastern regions and non-state-owned firms exhibit a higher propensity to engage in round-tripping FDI for tax avoidance purposes.

Although we have improved upon existing studies in estimating round-tripping FDI in China, our approach remains somewhat crude and produces noisy measures. We hope that more and better data will become available in the future, enabling more accurate estimates that can better inform scientific research and policymaking.

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Appendix

A Comparing FDI data from different sources

To demonstrate the validity of our firm-level FDI data sourced from China's State Administration for Market Regulation, we compare it with data from China's National Bureau of Statistics and the World Bank, as shown in Figure A1. The blue lines represent data from China's State Administration for Market Regulation, the yellow lines represent data from the National Bureau of Statistics of China, and the grey lines represent data from the World Bank.

In Figure 1(a), the number of newly established foreign-funded firms from the National Bureau of Statistics closely aligns with the data we used. The period from 1999 to 2015 shows the most similar trend, matching the period covered in our paper. In Figure 1(b), the FDI trends from different databases are similar. However, the total amount of FDI reported by the World Bank is generally lower, suggesting a statistical discrepancy with China's reported FDI due to differences in statistical methodologies.

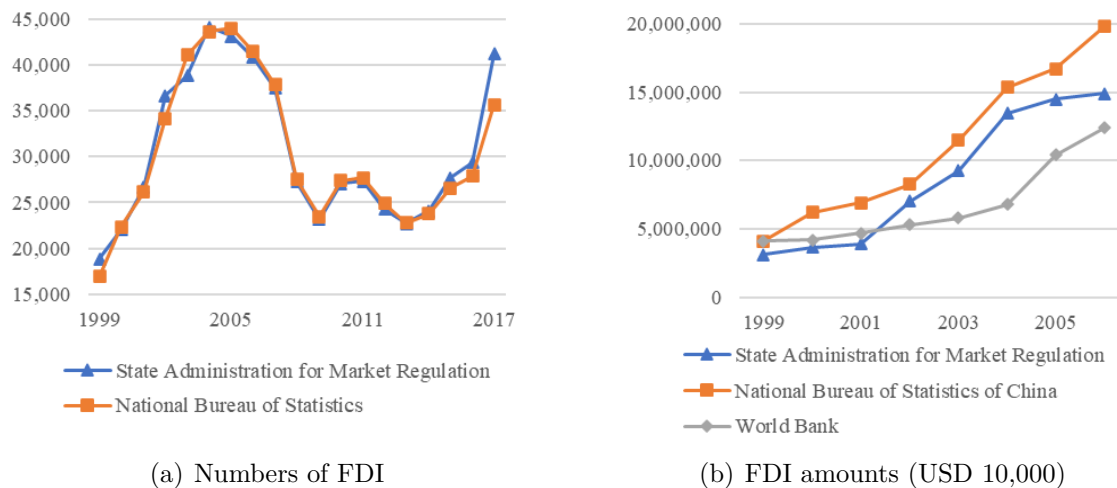


Figure A1: Comparison of FDI from different sources

B Matching procedures

To refine our estimation of the scale of round-tripping FDI using two different methods and to empirically examine the impact of tax disparities on firm-level round-tripping FDI, we need to conduct multiple rounds of data matching.

B.1 Matching China's FDI Data and OFDI Data

We match the *China FDI Database* with the *China OFDI Database* to construct a round-tripping FDI dataset to estimate the share of round-tripping FDI under the strict definition. This matching corresponds to the results in Section 2.2.1.

We utilize names of foreign-funded firms from the *China FDI Database* (including firms B and C) and match them with overseas subsidiary names from the *China's OFDI Database* (including firm A and B). The process, being referred to as firm B's name matching, can be divided into four steps.

First, we precisely match firm B from both databases based using their names. Second, for firm B that was not matched in the previous step, we extract keywords by removing terms such as "Limited Liability Company," "Ltd.," "Corporation," "Inc.," and "Company" from both databases. We then retain the keywords from the firm names and match firm B from both datasets using these keywords. For example, we assume "British Zhangsan Limited Liability Company" and "British Zhangsan Company" represent the same firm, and retain "British" and "Zhangsan" in both databases.

Third, to improve accuracy after extraction, we use the "matchit" command in Stata. In this string-matching technique, a similarity score of 1 indicates perfect similarity. We retain matching pairs with a similarity score of 0.9 or higher among distinct text strings in both databases.

Finally, to account for potential errors in the previous matching steps, we perform manual verification to ensure accuracy. We define FDI investments occurring 0-1 years after OFDI as round-tripping FDI and aggregate this annually to determine the total amount of round-tripping FDI for each year under the strict definition. In addition to aggregating the amounts, we also summarize the frequencies.

After aggregating the annual statistical results under strict definition from 1999 to 2015, we differentiate them based on factors such as cities, provinces, source countries, and regions (see Tables A1, A2, A3, and A4). Tables A1 and A2 show that round-tripping FDI occurs in both eastern and non-eastern regions. Table A3 indicates that round-tripping FDI mainly originates from tax havens. Table A4 highlights significant differences in the number of FDI and OFDI in some tax havens, suggesting the presence of round-tripping FDI. Notably, the British Virgin Islands, with a population of just

over 30,000, is one of the top five FDI sources for China. The data also show that Hong Kong is the preferred transit point for round-tripping FDI due to its geographic proximity to mainland China.

B.2 Identifying Chinese investors from China FDI Database

We also identify FDI from Chinese investors in the *China FDI Database* to calculate the share of round-tripping FDI using a loose definition. This matching corresponds to the results presented in Section 2.2.2.

First, we extract firm B with Chinese names from Tax Havens (as shown in Table A5). Second, we extracted FDI from tax havens where the investors have Chinese surnames and names with fewer than 3 characters (or less than 9 characters in Stata). It's worth noting that some investors have identifiable ID card numbers and passport numbers in data that can be easily classified. But Japanese citizens may have Chinese surnames with four characters, which we exclude. Additionally, excluding Chinese surnames for Korean citizens is challenging. We exclude investors with surnames like "Kim," "Lee," or "Park." Finally, we aggregate the FDI amounts invested by Chinese investors annually, as described above, and combine them with the annual aggregation of round-tripping FDI using the strict definition.

B.3 Matching Chinese Industrial Enterprises Database and round-tripping FDI data

We merge the round-tripping FDI data with the *Chinese Industrial Enterprises Database* to investigate the tax-driven motives behind round-tripping FDI at the firm level. This primarily involves matching firm A.

First, we perform precise name matching between firm A in the round-tripping FDI data and firm A in the *Chinese Industrial Enterprises Database*, retaining firms with exact matches. Second, we extract keywords from the names of firms in both the round-tripping FDI data and the *Chinese Industrial Enterprises Database* (using the same methods as before) and match these datasets based on the keywords. Third, we use the "matchit" command to calibrate the matches. Firm pairs with a similarity score below 0.9 and located in different cities or provinces in the two databases are excluded.

Table A6 presents the final matching results and it shows that firms engage in OFDI relatively infrequently, and even fewer engage in round-tripping FDI. When we divide the number of firms involved in round-tripping FDI by the number of firms engaging in OFDI each year, we find that almost 10% of these OFDI-involved firms participated in round-tripping FDI.

Table A1: City-level round-tripping FDI (top 20)

City	Total amount (USD 10,000)	Total number
Shenzhen	375,803	252
Shanghai	761,242	252
Ningbo	155,507	177
Beijing	2,218,541	129
Suzhou	102,226	107
Guangzhou	98,164	90
Wuxi	101,319	72
Tianjin	111,298	72
Hangzhou	93,436	70
Qingdao	94,845	66
Nantong	80,310	63
Xiamen	70,642	59
Dalian	59,362	48
Jiaxing	39,771	46
Zhuhai	27,200	44
Dongguan	27,918	43
Shaoxing	33,054	41
Luoyang	132,910	39
Yantai	42,257	38
Chongqing	32,453	37

Table A2: Province-level round-tripping FDI

Province	Total amount (USD 10,000)	Total number
Guangdong	638,973	598
Jiangsu	553,883	467
Zhejiang	354,759	371
Shanghai	761,242	252
Shandong	376,039	221
Beijing	2,218,541	129
Fujian	99,609	115
Liaoning	150,989	115
Henan	190,694	74
Tianjin	111,298	72
Jiangxi	24,535	49
Hunan	55,963	43
Hebei	57,150	42
Chongqing	32,453	37
Sichuan	17,969	29
Hubei	14,675	28
Anhui	16,537	26
Shaanxi	13,236	25
Guangxi	5,832	24
Yunnan	53,389	22
Gansu	8,828	11
Inner Mongolia	9,763	10
Jilin	3,049	9
Shanxi	26,015	9
Hainan	332	6
Xinjiang	4,617	6
Guizhou	8,388	6
Heilongjiang	1,013	4
Qinghai	8,861	4
Ningxia	3,505	3
Tibet	50	1

Table A3: Source of round-tripping FDI

Country / Region	Total amount (USD 10,000)	Total number
Hong Kong	5,248,420	2310
British Virgin Islands	93,098	121
Japan	29,683	56
United States	19,764	50
Singapore	58,437	42
Cayman Islands	204,037	26
Macau	28,682	23
Samoa	2,899	16
Taiwan	8,368	14
Korea	570	12
Bahamas	5,735	11
United Kingdom	1,721	10
Russian Federation	5,324	10
Malaysia	11,673	10
Australia	5,160	9
Germany	5,942	8
Seychelles	10,788	8
Sweden	21,313	8
Canada	4,622	7
Bermuda	23,954	7
Indonesia	12,535	6
United Arab Emirates	498	5
Mauritius	1,632	3
France	2,293	3
Philippines	3,000	3
Thailand	3,746	3
Uganda	6,960	3
Spain	181	2
Denmark	359	2
Italy	613	2
Angola	700	2
Mongolia	830	2
Egypt	843	2
India	920	2
Romania	1,000	2
Brunei	2,424	2
Ireland	100	1
New Zealand	139	1
Netherlands	500	1
Luxembourg	818	1
Nigeria	1,000	1

Table A4: Destinations and origins of Chinese foreign investments (top 7)

Country / Region	Number of round-tripping FDI	Number of FDI to China	Number of OFDI from China
Hong Kong	3,601	574,219	12,538
British Virgin Islands	152	57,931	651
Singapore	60	40,320	894
Cayman Islands	39	9,446	315
Macau	35	21,416	105
Samoa	19	19,203	17
Bermuda	15	1,310	23

Table A5: List of tax havens

Andorra	Cyprus	Liechtenstein	Panama
Anguilla	Djibouti	Luxembourg	Samoa
Antigua and Barbuda	Dominica	Macao	San Marino
Aruba	Gibraltar	Maldives	Seychelles
Bahamas	Grenada	Malta	Singapore
Bahrain	Guernsey	Marshall Islands	St. Kitts and Nevis
Barbados	Hong Kong	Mauritius	St. Lucia
Belize	Ireland	Micronesia	St. Martin
Bermuda	Isle of Man	Monaco	St. Vincent and the Grenadines
British Virgin Islands	Jersey	Montserrat	Switzerland
Cayman Islands	Jordan	Nauru	Tonga
Cook Islands	Lebanon	Netherlands & Antilles	Turks and Caicos
Costa Rica	Liberia	Niue	Vanuatu

Table A6: Matching results of industrial firms and round-tripping FDI

Year	Total observations	Firms made OFDI	Firms made round-tripping FDI	Ratio of round-tripping FDI to OFDI among firms
1998	132,026	1,641	200	12.19%
1999	127,724	1,685	198	11.75%
2000	126,492	1,918	217	11.31%
2001	131,308	2,368	236	9.97%
2002	138,126	2,660	251	9.44%
2003	148,297	3,083	285	9.24%
2004	209,110	4,387	449	10.23%
2005	206,676	4,325	416	9.62%
2006	232,424	4,749	462	9.73%
2007	261,747	5,136	507	9.87%
2008	304,513	5,672	583	10.28%