## **Onshore and Offshore RMB Response to Recent Tariff Announcements**

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*Synopsis*: Increasing U.S. tariffs on Chinese goods should lead to a depreciation of the Yuan relative to the dollar while decreasing U.S. tariffs on China should have the opposite effect. However, the daily movements of the USD/CNY exchange rate observed in 2018 do not seem to be significantly larger at the time of the tariff announcements. This paper uses the high frequency spot exchange rate at 10-minute intervals for USD/CNY and USD/CNH to identify the causal effects of tariff announcements on both exchange rates. It finds that the offshore USD/CNH exchange rate depreciates when the U.S. imposes (prospective) tariffs and appreciates when trade talks result in the delay of tariffs. The onshore USD/CNY shows ambiguous movements for U.S. tariff announcements that took place overnight for China. Neither show significant response to Chinese tariff news.

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## I. Introduction:

Surging political uncertainty from the U.S. China Trade War creates a rich environment to examine the Dollar-Yuan exchange rate response to tariff announcements. As of April 2019, the United States has imposed a 10% tariff on \$200billion worth of Chinese goods. China has imposed a 5-10% tariff on \$60billion worth of U.S. goods as retaliation. In September 2018 the US administration decided to increase its tariff from 10% to 25%, a measure that was postponed several times, most recently in February 2019. In times of uncertainty, the expectation of future tariff announcements, in addition to actual tariff announcements, can influence exchange rates.

In theory, increasing U.S. tariffs on Chinese goods should lead to a depreciation of the Yuan relative to the dollar while decreasing U.S. tariffs on China should have the opposite effect. However, the daily movements of the USD/CNY exchange rate observed in 2018 do not seem to be significantly larger at the time of the events identified in the trade war timeline of Bowe and

Kolb (2018), as shown by Jeanne (2019). This finding is surprising, especially given the large depreciation of both the onshore and offshore Yuan against the dollar from March to December 2018: over these months, both depreciated from around 6.3 to around 6.9 against 1 U.S. dollar, which represents a depreciation of more than 9.5 percent.

Jeanne (2019) measures daily exchange rate changes using end-of-day quotes. One problem with this approach is that China is known to limit short-term movements of the Yuan, causing daily exchange rate movements to be highly restricted. In addition, the Chinese authorities stabilize the exchange rate with the dollar more than they do for the CNY/EUR or CNY/JPY pairs.

In response to the difficulties caused by China's unique exchange rate regime, this paper uses high frequency intraday exchange rates. It examines the relationship between trade war news (to be defined later) and both the onshore CNY/USD pair and offshore CNH/USD pair from March 1<sup>st</sup>, 2018 to February 24<sup>th</sup>, 2019 using the high frequency spot exchange rate at 10-minute intervals. Shrinking the time interval from daily to intraday (10-minutes) provides a more reliable time frame for causal inference. The probability of another breaking news happening within minutes of any trade war announcements is low, so that any abnormal exchange rate movement is likely to reflect the impact of the trade announcement rather than any other factor.

This paper presents three sets of results. First, I regress the percent change between each 2 consecutive 10-minute quotes of the offshore CNH/USD pair on dummy variables. Even though neither the offshore CNH nor the onshore CNY is traded during weekends and selected holidays<sup>1</sup>, the offshore is traded overnight for China while the onshore CNY merely trades from 9:30am to 11:20pm every day. Due to the 12-hour time difference between China and the U.S., some tariff announcements occurred overnight for China. I can thus directly test the response of offshore CNH at the times of announcement. In addition, the offshore CNH is less insulated from market news by capital controls than its onshore counterpart, making this method more reliable for establishing causality.

<sup>&</sup>lt;sup>1</sup> The Onshore CNY does not trade during Chinese holidays but the offshore CNY trades during Chinese holidays and most U.S. holidays.

Second, I compute the overnight change in the CNY/USD pair and see if tariff news that happened overnight for China lead to significant movements of the exchange rate. By contrast with Jeanne (2019), I measure the exchange rate change as the difference between the last quote of the previous day and the first quote of the current day. Given the lack of trading during the night, this measure is the tightest possible, and the most consistent with the high-frequency news methodology, to assess the impact of overnight news. Finally, to go one step further, I compute weekend changes as the difference between Friday's last quote and Monday's earliest quote to see if weekend events lead to significant changes for both currency pairs.

The differentiation between the managed, discontinuous onshore RMB and the relatively free, continuous offshore RMB can shed light on the private sector's reaction to news in a constrained setting (for the onshore RMB) and unrestrained setting (or the offshore RMB). Overall, I find that the offshore Yuan-Dollar exchange rate reacts significantly to U.S. tariff announcements. The overnight change for the onshore Yuan-Dollar exchange rate does not respond significantly to U.S. announcements to increase tariffs. Interestingly, several weekend events associated with trade talks have seen significant appreciation of the onshore and offshore Yuan-Dollar exchange rate. Given the general trend that both currencies are more sensitive to U.S. announcements than Chinese announcements, I conclude that there might be some asymmetry between the reception of U.S. and Chinese news.

The paper is organized as follows. Section II discusses the theoretical priors on the effect of tariffs on exchange rates. Section III contains a literature review of studies on exchange rate response to news. Section IV presents an overview of the Chinese currency regime and reasons for using both the onshore RMB and offshore RMB for this study. Sections V, VI and VII explain the data, method and results of the three main event studies. Section VIII is a thought experiment that supplements the main results.

## II. Theoretical Priors

Increasing U.S. tariffs on China should lead to a depreciation of the Yuan-Dollar exchange rate for two reasons. First, the Trump administration's imposition of tariffs on Chinese exports to the U.S. challenges existing norms about international free trade. Since China's economy heavily depends on the manufacturing sector and exports, raising tariffs weakens China's economy relative to the U.S. economy, causing the RMB to depreciate against the Dollar. In addition, a depreciation can also occur as China's strategy to offset the tariffs. Depreciating the RMB may lower the prices of Chinese imports to the U.S. and potentially increases the price of U.S. exports to China. Increasing Chinese tariffs on the U.S. should, lead to an appreciation of the Yuan-Dollar exchange rate.

I will first categorize the dummy variables of interest according to basic trade theory. In addition, it is possible that China's actions to impose retaliatory tariffs is risky as it might result in more tariffs from the U.S. I also explore this possibility in a thought experiment at the end of this paper.

#### **III.** Literature Review:

Since the adoption of the floating exchange rate regime post Bretton Woods, exchange rates have been sensitive to global political uncertainty arriving in the form of news. The literature on exchange rates focused news because economists wanted to identify exactly what kind of news caused exchange rate fluctuation. Hardouvelis (1988) found that from 1979 to 1984, four monetary variables (M1, bank reserves, the Fed discount and surcharge rates) carried the most explanatory power for interest and exchange rate movements. Subsequently, Ito and Roley (1987) showed that USD exchange rates responds quickly to news about US money supply and trade balance, but that the JPY/USD pair does not respond to macroeconomic news from Japan, measured at a daily frequency. Almeida, Goodhart and Payne (1998) examined the impact of U.S. and German news on exchange rate changes measured from five minutes to 12 hours post announcement and found these effects to be significant but decreasing over the post announcement measurement interval. They also find that the impact of U.S. macroeconomic news on the DEM/USD is a short run phenomenon. In particularly, in the U.S., the FX market reacts primarily to unexpected shocks from the real economy. More recently, Faust et al (2006) examined 14 years of high frequency exchange rate data for the dollar, UK pound and German Deutschemark/euros. They find that a stronger than expected macro announcement appreciates the dollar.

While these studies affirm the causal relationship between unanticipated U.S. monetary announcements and major U.S. exchange rate pairs such as the euro and the Yen, they are not

informative about the RMB due to its uniqueness as both a managed and floating exchange rate (more on this in the next section).

Furthermore, the few studies that have focused on the high frequency response of the Dollar-Yuan exchange rate to U.S. news announcements have provided evidence that pre-date the current trade war. Ramirez (2011) found that U.S. accusations of Chinese currency manipulation in US media tended to be associated with a slowdown in the rate of the RMB appreciation against the U.S. Liu, Pawels, and Chan (2008) found that the RMB tends to appreciate faster during a Sino-US bilateral meeting week than it does in a week before or after the meetings. In 2011, the same authors did another analysis of the offshore RMB exchange rate and found that U.S. political pressure does not affect the conditional volatility of the offshore rate. However, the exchange rate has changed significantly since 2011. Hence, to understand both the onshore CNY and offshore CNH movements during the trade war, it is necessary to discuss the recent exchange rate regime.

## IV. Overview of the recent RMB experience

#### Onshore RMB

The onshore RMB is a carefully managed floating exchange rate system since 2015 and trades in a very small range compared to other floating currencies. It is pegged to a basket of major currencies and has become a more flexible, liquid and stable currency in 2017. The current exchange rate regime consists of three elements: a central parity rate, a daily band of +/-2 percent around the central parity rate, and FX interventions through buying or selling reserves. Each day, the People's Bank of China (PBOC) announces a central parity between the RMB and the dollar and other currencies.

From June 2005 to June 2015, China allowed the central parity to decrease so that the RMB appreciated by 35.5% against the dollar. It depreciated against the dollar slightly in 2015 to 2016 but rose again in 2017. However, from January 2018 to December 2018, the RMB depreciated by 7.0% against the dollar. I believe that the depreciation reflects the fact that the trade war would further slowdown China's real GDP growth rate (projected to be 6.3% in 2019, from 6.6% in 2018 and 6.8% in 2017<sup>2</sup>).

<sup>&</sup>lt;sup>2</sup> IMF, World Economic Outlook (April 2019).

Despite claims and measures to make the RMB more flexible and market oriented, Chinese policymakers are very concerned with the risk of a large depreciation in the exchange rate. When the PBOC first announced measures to increase flexibility in response to the market sentiment of the RMB being overvalued in 2015, the RMB tumbled and capital outflows accelerated. The central bank had to sell a large amount of FX reserves to stabilize the currency. Learning from this experience, policymakers saw the destructive side of premature financial liberalization and imposed tighter controls on capital flows to mitigate any harm to financial stability that might come from a floating exchange rate regime.

In 2016, in response to another period of RMB depreciation, Chinese authorities began to further backtrack on financial liberalization measures. They imposed new restrictions on FDI by Chinese corporations and began to require Chinese entities to receive official approval before undertaking other cross-border transactions. In addition, the People's Bank of China was pressured to raise interest rates to support the currency, draining liquidity from Chinese financial markets as a result, and caused widespread difficulty to obtain credit in recent years, especially for Small and Medium Size Enterprises (SMEs). Due to these unfavorable domestic situations, the authorities tightened currency controls to prevent capital outflows.

However, these controls increased herding behavior and the sensitivity of the residents' capital outflows to the RMB exchange rate. Any extreme trade war event, such as Trump's sudden announcement to increase tariffs, could potentially trigger a large-scale depreciation and capital flight. Therefore, the monetary authority had imposed several measures in 2017 to 2018 to stabilize the RMB: 1) In early August 2018, the PBOC re-installed a requirement for banks to hold 20% of their FX forwards transactions as reserves. 2) Around the same time, it reactivated the counter-cyclical factor in central parity quotes. The counter-cyclical factor's objective is to reduce irrational depreciation expectations and has been seen as a tool for the PBOC to "lean against" exchange rate changes in the previous day. According to an IMF working paper<sup>3</sup>, the counter

<sup>&</sup>lt;sup>3</sup> Das, Sonali,2019. China's Evolving Exchange Rate Regime. IMF Working Paper

cyclical factor is not defined but each bank calculates it using different parameters for economic fundamentals. In other words, through this measure the PBOC has a greater role in setting the central parity rate, making it less dependent on the US dollar closing rate from the previous date. In addition, there is no evidence that the PBOC used FX intervention, or the buying or selling of reserves to influence the exchange rate post August 2018. Therefore, RMB movements post August 2018 were stabilized only by the above method and stricter capital controls.

## The USD/CNY (onshore) currency pair

In the People's Bank of China's interbank currency market, the China Foreign Exchange Trading System(CFETS), the CNY/USD pair still dominates over 95% of the trade volume. However, it is traded in the narrowest range compared to other currencies. To stabilize this exchange rate pair, China introduced a market making system, FX forwards, swaps and options throughout the 2000s period and extended the trading hours. The market is dominated by large state-owned banks and a limited number of foreign participants. Speculation is relatively low as Chinese firms are below the cross-country average for using hedging instruments.

Below is the graph of the USD/CNY exchange rate pair and the Trade Weighted U.S. Dollar Index from January 2015 to April 2019. When there is the central parity mechanism in place, what then drives the USD/RMB exchange rate? Clark (2017) found that while the central parity rate became predictable and responses to market forces, it does not consistently leads to changes in the CNY/USD rate during the trading day. FX intervention, compared to the central parity trade. In addition, pass-through from the previous day's central parity rate to the current day's central parity rate declined after the countercyclical factor was in place, suggesting that the movements of the rate after August corresponds more to market forces than before. In the interest of this paper, this means that the variation that we observe in the exchange rate (represented by the red line in Graph 2) is not completely guided by the central parity rate.

Graph1. China/US Foreign Exchange Rate vs. Trade Weighted U.S. Dollar(Broad)



Source: Federal Reserve Bank of St Louis Database

# Offshore RMB

China has established several offshore RMB markets in Hong Kong, London, Singapore, and Luxembourg since 2010 in order to create offshore "financial clientele" for the RMB. Beijing encouraged these hubs to trade their currencies directly against the RMB. The Big Four state-owned commercial banks (Bank of China, Industrial and Commercial Bank of China, China Construction Bank, Agricultural Bank of China) act as official clearings banks, and the currency-swap arrangements between PBOC and foreign central banks allow these central banks to be "lenders of last resort" to RMB customers.

Despite its limited significance for trade and international business, the offshore Yuan is considered to be more market-driven and more volatile than the onshore Yuan. Historically, the offshore Yuan is slightly weaker than the onshore Yuan and that the spread between onshore and offshore Yuan widens during periods of Yuan weakness, such in August 2015, shown by graph 2. From August 2015 to May 2017, the offshore RMB movements exceeded those of the onshore exchange rate.

#### Graph2



Source: Nasdaq, "CNH vs CNY: Differences Between the Two Yuan"<sup>4</sup>

However, it possible that the currency interventions by the PBOC stabilized both the onshore RMB and the expectations for the offshore RMB, causing their fluctuation to be relatively synchronized after August 2018. Nevertheless, there are still differences in volatility during the course of the trade war, which makes testing for the high frequency response of offshore RMB to tariff announcements more meaningful.

# V. Event Studies-Data and Method

## Timeline

How to define trade war "news"? In accordance with the literature, "news" would have to be unexpected in order to influence exchange rates. Here, it would be any "breaking news" tariff announcements by the U.S. or China.

<sup>&</sup>lt;sup>4</sup> https://www.nasdaq.com/article/cnh-vs-cny-differences-between-the-two-yuan-cm1022058

I chose the events from the Peterson Institute of International Economics (PIIE) up-to-date Trade War timeline compiled by Chad Brown and Melina Kolb (2018). It contains timelines of several trade wars that President Trump engaged in over the past year such as those about auto and auto parts, aluminum and steel, and intellectual property. For the purpose of this paper, I picked official U.S. or China decisions to consider, impose, reduce, or delay tariffs exclusively in the from March 2<sup>nd</sup>, 2018 to February 24<sup>th</sup>, 2019 in all of the trade war categories that pertain to China. Thus, these events included announcements about steel, aluminum and intellectual property. In Bloomberg news archives, these events are either marked with asterisks or are highlighted by red to signify their breaking news status.

Next, I used Bloomberg News Search to determine the exact time of these announcements, which were usually reported within two minutes after being released by an official source. Since the intraday interval of interest is the 10-minute interval, the slight discrepancy between the official announcement and Bloomberg's breaking news report is not important as there are few events reported at exactly 2 minutes before the threshold.

### Dummy variables

Since theory suggest that an increase in US tariff on China should appreciate the USD and an increase in Chinese tariff should appreciate the CNY/CNH, I defined the following dummy variables from the above events in Table1.

Dummy Variable	Meaning	Expectation for USD/CNY&CNH	Count
D1	ChinaincreasesorsignalsintentiontoincreasetariffsonproductsUS	Appreciation	9
D2	ChinadecreasesorsignalsintentiontodecreasetariffsonproductsUS	Depreciation	5

Table 1. Dummy	y variables
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D3	US increases or signals	Depreciation	17
	intention to increase		
	tariffs on Chinese		
	products		
D4	Weekend Trade Talks	Ambiguous (no change)	3

Note: The US has never decreased tariffs on China. The effect of trade talks (D4) will be in the last section.

# Exchange Rate Data

I use the intraday spot rate at 10-minute intervals for both the onshore USD/CNY rate and offshore USD/CNH rate from the Bloomberg terminal. For the 10-minute intraday interval, this means that each time series data is the final price of the last 10 minutes. Table 1 and Table 2 summarize the trading time and statistical properties of both currency pairs.

The USD/CNH pair trades 24 hours during weekdays, starting from 2:00pm on Sunday U.S. Eastern time, which is 2:00am on Monday in Asia. It stops trading on Friday afternoon at 4:50pm, or 4:50am on Saturday in Asia. The USD/CNY pair does not trade at night during weekdays in China. In other words, the 10-minute quotes from Bloomberg runs from 9:30pm to 11:20(+1)am U.S. Eastern time for every trading day—equivalently, from 9:30am to 11:20pm in China. In addition, it stops trading at 11:20am on Friday U.S. time (11:20pm on Friday in China) and resumes trading at 9:30pm on Sunday U.S. time (9:30am in China). This currency pair also gets more holidays than the offshore exchange rate. For example, it stopped trading on 12/29, 12/30 and 12/31 to observe New Year's and on 4/28, 4/29 and 4/30 to celebrate the Chinese Labor Day on May 1<sup>st</sup>. Therefore, as shown in the summary statistics (Table 2), the sample size for USD/CNY at the 10-minute interval is about half of that of USD/CNH.

	Normal trading hours	Exceptions
USD/CNY	21:30-11:20(+1) US Easter	n Weekends and Chinese holidays
	Time, Monday to Friday	
	20:30-10:20(+1) during Dayligh	t
	Saving	
USD/CNH	Sunday 14:00- Friday16:50	Weekends and selected holidays

Table 2. Trading time of the USD/CNY and USD/CNY

The summary statistics also show interesting properties of these exchange rates. For table 2, I computed the percent change of each exchange rate pair over each 10-minute interval. The USD/CNH is mostly continuous and actually overlaps a portion of the U.S. weekend given the 12-hour time difference between China and the U.S. Only 2 events happened outside of its trading time<sup>5</sup>. Therefore, I can directly test the high frequency response of USD/CNH to trade war breaking news. The summary table shows that the percent change of the 10-minute intraday USD/CNH oscillates between +/-0.03% from 0.00% majority of the time. I will also explain the maximum and minimum change (the largest depreciation and appreciation) in the sample in the regressions that follow this section.

Due to the discontinuous and regulated nature of USD/CNY, I split it into smaller samples to test for response. I find that many events occur overnight or over the weekend when it is not trading. Coincidentally, since the currency pair is highly regulated during the day, there is more variation overnight and over the weekend, as shown by the standard deviation row in table 2. Therefore, I computed the overnight percentage change, calculating the percent difference between the 10:20am (+1) quote and the 20:30pm quote. These quotes are in U.S. Eastern time for 242 overnight changes. What I calculate in fact is the change for the USD/CNY between Chinese time 10:20pm and 8:30am on the next trading day, hence "overnight". Similarly, I computed the weekend percent change using the last quote on Friday and first quote on Monday for China for 63 weekends.

	D%USD/CNY All Data	D%USD/CNY Overnight	D%USD/CNY Weekend	D%USD/CNH All Data
Mean	0.00%	0.00%	-0.02%	0.00%
Standard Error	0.00%	0.01%	0.02%	0.00%

Table 2. Summary Statistics

<sup>&</sup>lt;sup>5</sup> May 19<sup>th</sup>, 2018 and December 1<sup>st</sup>, 2018: they are both instances when China and the US reached agreements over weekend trade talks. Along with another seemingly propitious event on Feb 24<sup>th</sup>, 2019 will be in a separate regression to supplement the main results.

Standard Deviation	0.04%	0.16%	0.19%	0.03%
Skewness	-27.32%	23.63%	15.47%	-6.78%
Minimum Maximum	-0.89% 0.93%	-0.47% 0.64%	-0.46% 0.48%	-0.61% 0.87%
Count	25523	242	63	47845

Note: D%USD/CNY means the percent change of the exchange rate pair over the 10-minute interval. The second and third columns show a selected sample of the USD/CNY exchange rates: overnight and over the weekend. Due to the discontinuous nature of the USD/CNY, it has significantly fewer samples than the USD/CNH pair.

On average for all the intraday USD/CNY data, the percent change per 10-minute interval is 0.00% with a 0.03% standard deviation. For all the intraday USD/CNY data, the percent change per 10-minute interval is 0.00% with a 0.04% standard deviation. The overnight sample has the same mean but larger variance, with the standard deviation being 0.16%. The weekend sample is very interesting. On average, the mean is -0.02%, suggesting that USD/CNY tend to appreciate between Friday and the following Monday. The variation is even larger for this sample, with a standard deviation of 0.19%. The discrepancy of variation in different USD/CNY samples is a good opportunity to test their response to surprise trade war announcements, as I will explain in the following section.

- VI. Event Study- Results
- 1. Offshore CNH response to tariff announcements

Since the USD/CNH pair is continuous except for weekends, it is possible to directly test the high frequency response for tariff announcements<sup>6</sup>. Almost all events in the timeline occurred during the trading time of USD/CNH. I regress the percent change of 10-minute quotes on the three dummy variables defined above. In general, for example, if an event happened at 18:45, then I test

<sup>&</sup>lt;sup>6</sup> The USD/CNH pair stops trading at 17:00 U.S. time on Friday and begins to trade again at 15:30 U.S. time on Sunday. Therefore, any events that happened after 15:30 on Sunday U.S. time would have a corresponding interval in the time series.

for the impact of this piece of news on the change in the exchange rate between 18:40 and 18:50. If an event happened on a Sunday, then it makes sense to test for the exchange rate impact using the change between the first 10-minute quote on Monday and the last 10-minute quote on Friday.

It turns out that when China increases tariffs on the U.S., there is no significant depreciation or appreciation of USD/CNH: the coefficient on D1 is statistically insignificant from 0. In addition, when China reduces tariffs on the U.S., the exchange rate appreciates by 0.01%, although the effect is again not statistically significant, as indicated by the coefficient on D2. However, when the U.S. announces new tariffs or prospective tariffs, USD/CNH depreciates by 0.02%, consistent with the hypothesis.

	D1	D2	D3	<b>D</b> 4
	China +	China-	US+	Weekend
				Trade Talk
D%USD/CNH	0.00%	-0.01%	0.02%**	-0.21***
All Data	(0.76)	(0.65)	(0.015)	(0.00)
D%USD/CNY	/	/	0.00%	/
Overnight			(0.92)	
			For selected events	
D%USD/CNY	/	/	/	-0.31%***
Weekend				(0.01)

Table3. Regressions coefficients

Note: D%USD/CNY(H) is the outcome variable: the percentage change of either Yuan-Dollar exchange rate after the end of one 10-minute interval. Overnight regressions only apply to selected events of D3: US tariff announcements that occur overnight for onshore CNY. Other events (D1, D2 and some of D3) occurred when the CNY is trading during the day and are thus excluded from the overnight regression. P values are reported in the parenthesis. \*represents the result is significant at the 5% level; \*\* represents the result is significant at the 2.5% level, and \*\*\* represents the result is significant at the 1\* level.

These results, whether significant or not, are very close to 0. This can be shown more clearly with a visual representation. In Graph 3, any dot below 0% corresponds to a appreciation of the CNH

against USD and vice versa. Most of the time, the exchange rate change oscillates between a 0.2% depreciation and appreciation as the mean is 0 with a 0.00028 standard deviation.

The dummies D1, D2 and D3 are orange, grey and yellow dots, respectively. From the graph it is clear that the percent change of USD/CNH associated with D1 (China imposing tariffs) and D2(China reducing tariffs) are close to 0 and fairly ambiguous. This could be due to the small sample size. D1 has 9 events and D2 has merely 5 events. It is also possible that China's retaliatory tariffs are viewed as less important for the market as the U.S.'s tariffs on China.

Only one event defined by the dummy variable D3(US increasing tariffs) exceeds the +/-0.2% band that define USD/CNH's normal movements. The one announcement in the PIIE timeline that is associated with the largest USD/CNH depreciation (0.24%) is April 5<sup>th</sup>, 2018 at 18:50, when President Trump announced that he wanted another \$100 billion tariffs on Chinese goods. This is the last breaking news announcement in the first week of April 2018, when tension escalated. On April 3<sup>rd</sup>, 2018 the Trump administration released a list of \$50 billion worth of Chinese products under consideration for a 25% tariff. On April 4<sup>th</sup>, China announced that \$50 billion worth of Chinese imports from the U.S. are under 25% tariff consideration as retaliation. The April 5<sup>th</sup> announcement was to a large extent an attempt by Trump to taunt China. However, out of all the breaking news defined by the dummy variables, this event was associated with the most out of ordinary CNH/USD depreciation, probably due to an anticipation of further escalation.

Graph 3. D%USD/CNH



There are a few outliers that need contextual explanation, even though they do not belong to any dummy variables in this regression. On March 21<sup>st</sup>, 2018, 12:50, the offshore yuan-dollar exchange rate depreciated by 0.87%. Bloomberg Financial News showed that around March 21<sup>st</sup>, 12:10, the White House indicated that it planned to announce tariffs on China over intellectual property violations on the following day. On Thursday, March 22<sup>nd</sup>, 12:10, the Trump administration released a report finding China responsible for conducting unfair trade practices related to technology transfer and indicates forthcoming remedies in the form of tariffs. Since this report was the first official one that accused China of unfair trade practices, the anticipation could have led to the sudden depreciation on Wednesday. However, if anything the pattern on March 21<sup>st</sup>, 2018 shows that there were more cases of appreciation on that day before the 12:10 announcement (see Graph 4 below, in between the two outliers, or 0:00 and 12:50 on 3/21). Following the 12:10 announcement on Wednesday, there is an approximately equal number of appreciations and depreciations at the 10-minute frequency. Thus, the 0.87% appreciation at 12:50 was probably a delayed response and an anticipation for the consequences of Trump's first official stance against China. This event is not included in the regression.



Graph 4 USD/CNH % Change From March 20 to March 23

Overall, the offshore yuan-dollar exchange rate does not respond significantly to Chinese announcements but depreciates significantly when the U.S. imposes tariffs or announce future tariffs on China.

## 2. Onshore CNY Overnight Response to Tariff announcements

As noted in previous sections, China imposed currency controls on the onshore RMB and limits its movements during the day. One problem with applying the high-frequency news methodology to the onshore RMB exchange rate is that it is not quoted during the night (Chinese time), which is when the US-originated news tends to take place. Thus, one must test for the impact of news using the overnight change in the exchange rate.

There are observable differences between the overnight change and the general 10-minute change for this exchange rate pair. For all of the data from January 2018 to April 2019, the 10-minute percent change for the CNY/RMB on average is 0%, with a standard deviation of 0.038% (this includes changes overnight and during the weekends) for a total of 25523 observations. Examining the overnight changes alone, excluding weekends, the average percent change is still 0%, but the standard deviation is 0.16% for 242 overnight observations. Thus, the overnight exchange rate

movements are larger, which is not surprising since they reflect the news that occurred during the entire night rather than a ten-minute time interval.

An overnight event is characterized as follows. During the winter months or Daylight Saving, the event must happen between 11:20am and 9:30pm U.S. time. During months without Daylight Saving, this event must happen between 10:20am and 8:30pm U.S. time. This is because the USD/CNY exchange rate stops trading at 11:20am and begins trading on 9:30 U.S. time, after a night has passed in China. I calculate the absolute value of the percent difference between 9:30pm (8:30pm) and 11:20am (8:30pm) for 242 overnight observations.

All of the dummy variables that fall into this overnight change belong to D3, the scenario which U.S. increases tariffs on Chinese products or signal intention to do so. Out of 17 events that belong to D3, only 8 happened overnight for China. Since D1 and D2 represent China's announcements to increase or decrease tariffs that take place during the day for China, they are not included in this regression.



Graph 6.D%USD/CNY Overnight response

The scatterplot above shows no correlation between D3 and overnight percent changes of the onshore yuan to dollar exchange rate. However, some overnight events of interests are outliers on

the plot, both on the appreciation and depreciation side. On July 10<sup>th</sup>, 2018 around 18:47, the United States Trade Representative (USTR) released a list of \$200 Billion of imports from China to be subjected to a new 10% tariff. When the USD/CNY started trading at 20:30, it depreciated by 0.64%. On September 17<sup>th</sup>, 2018 around 18:37, Trump announced that China tariffs worth roughly \$200 billion would take effect on Sept 24 and that the rate of 10% would rise to 25% in 2019. As a result .the onshore RMB depreciated by 0.25% against the dollar. However, on August 7<sup>th</sup>, 2018 around 16:35, the USTR finalized the second tranche of tariffs on \$16 Billion of Chinese goods while the RMB appreciated by 0.45%. This may have been because the list of goods was shorter than expected.

The regression result also confirms the fact that there is no significant depreciation of the RMB overnight for these events. The coefficient on D3 close to 0<sup>7</sup>. This might be due to the fact the market formed different expectations for each U.S. tariff announcement on the number of tariffs and the gravity of implications. The expectations diverge depending on the month of announcement and the attitude of news reports and other speculation preceding each U.S. announcement, causing the aggregate effect to be ambiguous for each overnight event.

# 3. Onshore RMB-USD weekend response

From the summary statistics in Table2, it is clear that the percent change of USD/CNY over the all the weekends from January 2018 to April 2019 show higher variation than both the overnight and intraday quotes. The standard deviation is 0.19%, compared with 0.16% for the overnight quotes and 0.04% for the intraday quotes, which encourages the conjecture that perhaps more movement is allowed during the weekend for the onshore RMB since intraday movements are restricted.

Coincidentally, US-China trade talks often occurred over the weekend and the results were announced on Saturday or Sunday. Here, I examine three trade talk results. On Saturday, May 19<sup>th</sup>, 2018, China agreed to significantly boost purchase of US Goods and Services. A joint statement by the U.S. and China was released some time later: the two sides agreed to decrease China's deficit

<sup>&</sup>lt;sup>7</sup> -5.939E-05

but did not mention any intention to reduce the tariff on \$200 billion worth of Chinese goods. On December 1<sup>st</sup>, 2018, 19:35, a Chinese media source announced on Twitter that Xi and Trump made a deal to halt the escalation of tariffs that were expected in. If no agreement were reached by March 1st, 2019 then the 10% tariff would be raised to 25 percent. On February 24<sup>th</sup>, 2019, Trump announced via Twitter at 17:50 that the tariff increase would be delayed.

It is open to question whether these announcements would appreciate or depreciate the RMB. Since there are only three trade talks that occurred over the weekend in the time frame of this paper, I created a new dummy variable D4 representing trade talks and regress the weekend USD/CNY percent changes for 63 weekends on this dummy variable assuming that the effect is 0.

Before examining the impact of these events on the onshore exchange rate, it is interesting to point out that the offshore exchange rate on average appreciates when trade talk results are released. The regression coefficient is -0.21% for the dummy of weekend trade talks. However, it is possible that this effect is heavily influenced by one event since there are only three events in the dummy. On May 20<sup>th</sup>, directly following the first weekend announcement, the USD/CNH depreciated by 0.01%. However, it appreciated by 0.61% at the very beginning of the trading day on December 2<sup>nd</sup>, 2019 at 13:00. Thus, it is most likely that this event drove the results. In fact, USD/CNH movement on February 24<sup>th</sup> at the time of Trump's tweet is also negligible. Examining its movements throughout the day, there were depreciations as large as 0.15% several hours before the announcement and appreciations as large as 0.11% several hours after the announcement, meaning the expectations were at best ambiguous at the time.

Graph 8: USD/CNY percent change over 63 weekends vs 3 weekends of trade talk



Glancing at the scatterplot of the weekend changes of the USD/CNY, it seems that the good news events (red dots), especially that of December 1<sup>st</sup> and February 24<sup>th</sup> led to very significant depreciations of the RMB. The regression results confirm this: good news during the weekend is associated with a -0.0031, or 0.31% appreciation of the USD/CNY rate, and it is statistically significant at the 1% confidence level. Compared to the average weekend change (-0.021%), this result is still economically significant. On an individual level, the trade talks on December 2<sup>nd</sup>,2018 and February 24<sup>th</sup>, 2019 largely contributed to the observed average effect. While trade talks in general can have ambiguous signals, those that result in the delay of U.S. tariffs on China appreciates both the onshore and offshore yuan against the dollar.

### VII. Event Study-thought experiment

Given the above results and the observations that expectations are difficult to pinpoint, I conduct a thought experiment and change one assumption from the theoretical model. While theory assumes that the RMB appreciates when China imposes more tariffs on U.S. products, it is possible that such action is political risky for China as it may elicit new tariffs from the U.S. Therefore, China's decision to impose more tariffs on the U.S. can in fact depreciate the yuan-dollar exchange rate. A depreciation of the national currency is not necessarily good news for China because it symbolizes a form of defeat in the trade war. While people living and doing business in China acknowledge that a weaker currency is more advantageous in trade, they view China's retaliatory tariffs against the U.S. as futile and disconcerting. People feared that China would never win a trade war against the U.S., hence their dislike of any escalation of trade war tension is reflected by the depreciation of both the onshore and offshore yuan.

According to this line of thought, I redefined the dummy variables in the following table. Given the assumption that the fear of trade war outweighs the hope of gain from RMB depreciation, I defined Good News and Bad News, two dummy variables. Good News represent all scenarios that signals reconciliation: 1) China reduces tariffs on U.S. products(D2) 2) Both sides have trade talks(D4). Bad News under new assumptions would be any news that signals the continuation of the trade war, namely both sides imposing or threatening tariffs on each other(D1+D3).

Dummy variables	Meaning	Count	ExpectationforUSD/CNYandUSD/CNH
Good News	Both China and US reduce (prospective tariffs) and have trade talks =D2+D4	8	Appreciation
Bad News	Both China and US increase tariffs and perspective tariffs =D1+D3	26	Depreciation

Table4. I	Dummies	according t	to observation	in China
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### Table 5. Regression containing new dummies

	Good News	Bad News	
D%USD/CNH All Data	-0.09%***	0.02%***	
	(0.00)	(0.00)	

Note: The regressors are all dummy variables Good News and Bad News, selected based on the range of outcome variables. There are no Good News that happened overnight for the USD/CNY pair because they all happened during weekends. There are no Bad News that happened on weekends for the USD/CNY pair

because they all happened during weekdays. \*\*\*indicates significant at the 1% level. P-values are reported in the parenthesis.

	D1	D2	D3	D4
	China +	China-	US+	Weekend
				Trade Talk
D%USD/CNH	0.00%	-0.01%	0.02%**	-0.21***
All Data	(0.76)	(0.65)	(0.015)	(0.00)
D%USD/CNY	/	/	0.00%	/
Overnight			(0.92)	
			For selected events	
D%USD/CNY	/	/	/	-0.31%***
Weekend				(0.01)

Table3. Regressions coefficients (included here for comparison)

Note: D%USD/CNY(H) is the outcome variable: the percentage change of either Yuan-Dollar exchange rate after the end of one 10-minute interval. Overnight regressions only apply to selected events of D3: US tariff announcements that occur overnight for onshore CNY. Other events (D1, D2 and some of D3) occurred when the CNY is trading during the day and are thus excluded from the overnight regression. P values are reported in the parenthesis. \*represents the result is significant at the 5% level; \*\* represents the result is significant at the 2.5% level, and \*\*\* represents the result is significant at the 1\* level.

For clarity, I use the offshore exchange rate for this thought experiment because it is the most continuous and has the largest sample size. I also included the original results table for comparison. The results in Table 5 suggest that coming from a Chinese perspective, good news, or reconciliatory news appreciates the offshore CNH exchange rate against the dollar. The appreciation magnitude here is smaller than that for D4 alone. Since the Good News dummy is comprised of D4(Trade talks) and D2(China decreasing tariffs), it might be true that trade talks carried much more positive weight than China's actions to reduce tariffs.

Bad news, or any indication of further tariffs from both U.S. and China, depreciate the offshore CNH against the dollar by 0.02% on average, which is the same magnitude as the effect of U.S. announcements alone(D3). Since Bad News contains both D3 and D1(China increasing tariffs),

these results further confirm that the offshore exchange rate responds more significantly to U.S. announcements than Chinese announcements.

#### VIII. Conclusion

Overall, the evidence from simple linear regressions confirms that the offshore Yuan-Dollar exchange rate responds to U.S. tariff announcements in a way that is consistent theoretical priors. The change of the onshore Yuan-Dollar exchange rate does not show significant depreciation following an overnight announcement to increase US tariffs. Neither exchange rates do not show significant response to Chinese announcements. In addition, the weekend change of the onshore Yuan-Dollar exchange rate appreciates when some kind of agreement to delay tariffs are reached over the weekend.

The thought experiment suggests that there could be an asymmetry of economic strength between the U.S. and China that made exchange rates more sensitive to U.S. announcements than Chinese announcements. Since China cannot match the ability of the U.S. to impose tariffs, any news about tariff delays is in fact beneficial for China. The evidence is strong for the high frequency offshore Yuan- Dollar exchange rate at 10-minute intervals and the onshore Yuan-Dollar exchange rate over weekends. As one news commentator observes, "for officials in Beijing, the worry about Donald Trump's latest tariffs isn't the impact of trade: rather it's the steady march toward a longterm competition that could thwart China's rise."<sup>8</sup>

<sup>&</sup>lt;sup>8</sup> – "In New Trump Tariffs, China Sees Master Plan to Thwart its Rise" Sheng Wu, Bloomberg News (September 18<sup>th</sup>, 2018)

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Time		News
1-Mar-18	17:30:00	Steel and Aluminum Tariffs Announcement, covering \$48 billions of imports from Canada, EU, Mexico and South Korea, only 6% from China
22-Mar-18	12:16:00	Trump admin released report finding China is conducting unfair trade practices related to technology transfer, indicates forthcoming remedies of tariffs on up to \$60 billion of Chinese products: US to levy about %50billion tariffs to offset theft of intellectual property by China, president Trump to sign tariff memo at 12:30pm
1- Apr-18 Sun	13:47:28	China's Customs Tariff Commission issues statement to suspend import tariff reductions for certain imported goods from the US: fruit, vegetable and pork China imposes retaliatory tariffs (\$2.4export value in 2017) against US steel & aluminum tariff
3-Apr-18	16:58:09	Trump admin releases \$50 billion list of 1,333 Chinese products under consideration for 25% tariffs
4-Apr-18 Holiday	3:49:09	China publishes list of 106 products subject to forthcoming 25% tariff as retaliation, covering \$50 billion of China's imports from the US
5-Apr-18 Holiday	18:49:45	US considers additional tariffs on \$100 billion of US imports from China
17-Apr-18	2:31:39	China Imposes Preliminary Tariffs on US Sorghum
18-May-18	0:12:02	China ends tariffs on US Sorghum During Negotiations
	18:10:56	American and Chinese officials made progress toward an agreement that could help avert trade war: China pledges to increase purchase of American goods by at least \$200 billion by 2020
19-May-18 Sat	13:37:45	China to significantly boost purchase of US Goods Services
	13:58:07	Joint statement of US and China trade consultations: to decrease China's deficit but no mention of the \$200billion shrink
29-May-18	8:30:58	White House releases statement: would impose tariffs on \$50 billions of goods from China shortly after announcing the final list on June 15, 2018
30-May-18	8:00:00	China will reduce tariffs on a wide range of consumer goods from July 1, according to a statement by the State Council

15-Jun-18	8:07:59	USTR releases revised list of tariffs on almost \$50 billions of Chinese product starting July 6,2018on even more immediate goods
15-Jun-18	13:31:34	China issues an updated \$50 billion retaliation list of 25 percent tariffs
18-Jun-18	19:37:53	In response to China's retaliatory tariff, Trump directs USTR to identify another \$200 billion worth of Chinese goods for additional tariffs at 10%. Threatens another \$200 billion if China retaliates again.
6-Jul-18	0:01:00	US and China Impose First Phase of June 15 tariff lists: \$34 billion either direction
10-Jul-18	18:47:41	USTR releases a list of \$200 billions of imports from China to be subjected to new 10% tariffs
20-Jul-18	6:15:04	Trump threatens tariffs on all imports (totaling \$504 billion) from China in Interview
1-Aug-18	16:30:00	Trump wants 25 percent tariff, not 10 percent on \$200 billion list of imports released in July
3-Aug-18	10:01:31	China proposes 25% tariff on US liquefied natural gas
3-Aug-18	8:03:50	China threatens adding duties of 5-25% on \$60 billions of US goods following Trump's threat to raise tariff rates
7-Aug-18	16:35:09	USTR finalizes second tranche of Tariffs on \$16billion of Chinese goods
8-Aug-18	8:02:50	China Revises its \$50billion tariff list, removing crude oil. Now the retaliatory tariffs on \$16B of US goods will start on August 23
13-Aug-18	15:21:58	US passes law on trade and national security
23-Aug-18	0:01:00	US and China Each Impose Second Phase of \$50 Billion Tariffs. US. Tariff on \$16Billion worth of imports from China come to effect
17-Sep-18	18:37:31	Trump announces for China tariffs worth roughly \$200B, will take effect on Sept 24, rate is 10% to the end of 2018 but will rise to 25%/ directed USTR to impose new tariffs
18-Sep-18	9:04:20	China Finalizes Tariffs on \$60 billions of imports from US

24-Sep-18	0:00	US tariff on \$200billion of Chinese imports announced on September 17th take effect, along with relatialtory tariffs by China on \$60 billion of US imports announced on Sept 18. The US now has tariffs on 12% of its total imports during 2018
26-Sep-18	6:51:05	China will lower tariffs for 1,585 products including machinery, paper, textiles and construction materials starting from Nov.1
1- Dec-18 Sat	19:35:27	US China Tariff Truce at G20: Xi and Trump announce a deal to halt the escalation of tariffs that were expected in January when they negotiate over trade concerns. If no agreement is reached by March 1st 2019 then the 10% tarifffs wodul be raised to 25 percent
24-Feb-18 Sun	17:50:14	Trump announced via Twitter that he will delay the tariff increase on \$200 billion of imports from China that had been scheduled to go into effect on March 1 2019