Investigating how fluctuations in the USD/RMB exchange rate affect China's debt assets denominated in US dollars

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Last but by no means least, Vivien Ehle and Charlotte Cooper conclude the 34th Edition of the Student Economic Review with an investigation into how fluctuations in the USD/RMB exchange rate affect China's debt assets which are denominated in US dollars, with a special focus on the value changes that have occurred after the devaluation of the Chinese renminbi. Through the analysis of historic data sets of the exchange rate and US treasuries held by China, the authors find that there is a negative correlation between the net increase in US treasuries held by China and the strength of the Chinese currency. Over the 18-year period examined, China's per-unit external wealth has been reduced a result of currency fluctuations affecting its debt assets denominated in US dollars.

I. Introduction, background and motivation

This research paper addresses how fluctuations in the USD/RMB exchange rate affect China's debt assets denominated in US dollars. Evidently, the real value of China's debt assets denominated in US dollars has a large effect on its external wealth over time. The motivation for this research question stems from the fact that there is little research on this specific topic relative to its significance. Likewise, the ongoing tense relationship between China and the US has been very topical in recent months and years in terms of trade wars, currency wars and exchange rate fluctuations. In the current world economy with all of these aspects coming in to play, the USD/RMB exchange rate is highly volatile.

After the introduction of a fixed exchange rate system from 1994 to 2005, the Chinese Yuan was pegged to the US Dollar and although the nominal exchange rate was fixed, the real exchange rate was significantly devalued. In 2005, China moved to a "managed floating exchange rate system". It was no longer pegged to only the US dollar but to a basket of currencies including the Euro, the US Dollar, the Japanese Yen and Korean Won, with the weight of each currency remaining unknown (Wang, 2018). Since then, China has bought foreign currencies to intentionally keep the value of its currency artificially low. Consequently, Chinese exports are relatively cheaper compared to other countries, such as the United States (Myers, 2018). Recent trends have confirmed that the Chinese currency is indeed under depreciation pressures which sparks speculation that the Chinese government has been manipulating the exchange rate.

II. Literature review

In the paper "The Globalization of United States Debt: The Real Impact of China's Rise as a Creditor State", Michael R. Myers (2018) argues that China has strong bargaining power since it has the ability to sell off its US holdings and thereby collapse the value of the US dollar. At the same time, if China were to reduce its purchase of US assets, the RMB would appreciate relative to the dollar and therefore create significant costs on China's own economy. It is estimated that a ten percent appreciation in the value of the RMB results in a loss of approximately three percent of China's GDP in its foreign reserves (ibid.).

This research paper will examine how China's debt changes

when there is a change in the USD/RMB exchange rate. It will also examine the impacts this has on China's external wealth.

III. Empirical approach and methodology

In order to determine how the USD/RMB exchange rate behaves according to whether the Chinese Yuan is pegged to the US dollar or not, we collect different sets of data provided by the Federal Reserve Economic Data (FRED, 2019) and the US Department of the Treasury (Department of the Treasury, 2019). More specifically, FRED publishes the USD/RMB exchange rate on a monthly basis. Likewise, the US Department of Treasury publishes major foreign holders of treasury securities, including China.

We analyse those data sets using graphs to visualise the effect of exchange rate fluctuations over an 18-year period. Where necessary, we convert data expressed in nominal terms into real terms in order to determine the real effect of a variable. For example, we multiply the USD/RMB exchange rate by the number of US treasuries in order to obtain the true value in RMB of China's foreign debt assets.

IV. Description of data sets and empirical results

To approach this research question, some key data sets were required: the USD/RMB exchange rate history, historical measurements of China's buy/sell activity in US treasuries, which are denominated in US dollars, and the value in local currency (RMB) of China's investment in US treasuries.

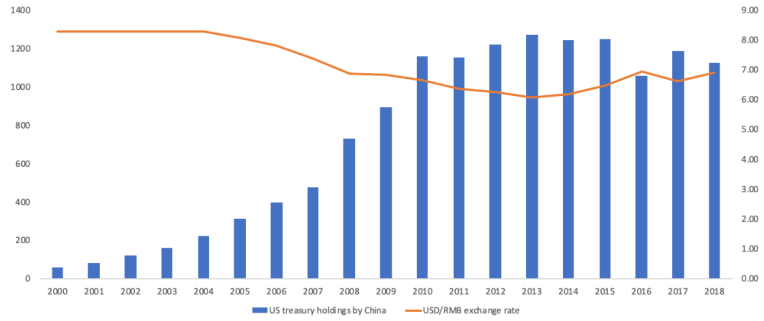

Figure 1: China's holdings of US treasuries (in billions of dollars) against the USD/RMB exchange rate (2000-2018). Source: FRED, US Department of the Treasury.

As depicted in *Figure 1,* there is a negative correlation between the net increase in US treasuries held by China and the strength of the Chinese currency. That is to say that when the Chinese Yuan appreciates relative to the US Dollar, China has more purchasing power with the same amount of local currency than before and therefore can afford to increase their treasury holdings. *Figure 1* reveals significant growth in treasury holdings after the removal of the currency peg in 2005, which led to the appreciation of the Renminbi relative to the US Dollar. Notably, in 2016, a significant drop in holdings was realised in response to the corresponding drop in RMB value, still only relative to the US dollar. This could be resulting from uncertainty in the exchange market due to the slow decrease in RMB value over the three preceding years or just to cash in from the currency value gain from the temporarily weakened exchange rate.

As a country with a largely positive trade balance, China reaps benefits from having a depreciated currency due to the fact that their investment in US treasuries converts to a higher real value in RMB but also due to increased international export demand. This is because Chinese goods are relatively cheaper because of the better exchange rate for US consumers in terms of Chinese imports.

Figure 2 and *Figure 3* attempt to draw closer to the conclusion of the effects that the exchange rate has on China's external wealth, solely focused on US treasuries for the purpose of this paper, by incorporating the real value of the owned US treasuries in local currency, the Chinese Yuan. This curve presents the key data addressing the research question of this paper: examining how exactly China's external wealth is affected by shifts in the relevant currency exchange.

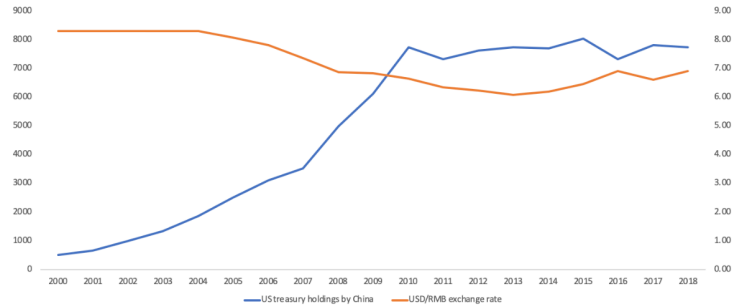

Figure 2: China's holdings of US treasuries (valued in RMB) against the USD/RMB exchange rate (2000-2018). Source: FRED, US Department of the Treasury

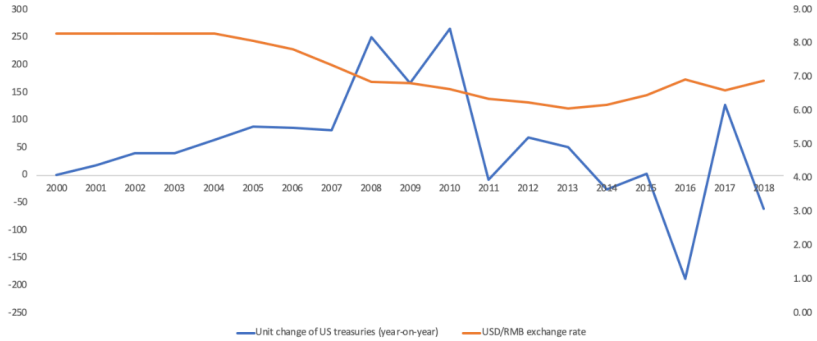

Figure 3: US treasuries bought/sold against the exchange rate (2000-2018). Source: FRED, US Department of the Treasury

As we can see from *Figure 3*, there is a strong inverse correlation between the exchange rate and the buy/sell reaction on US treasuries by China.

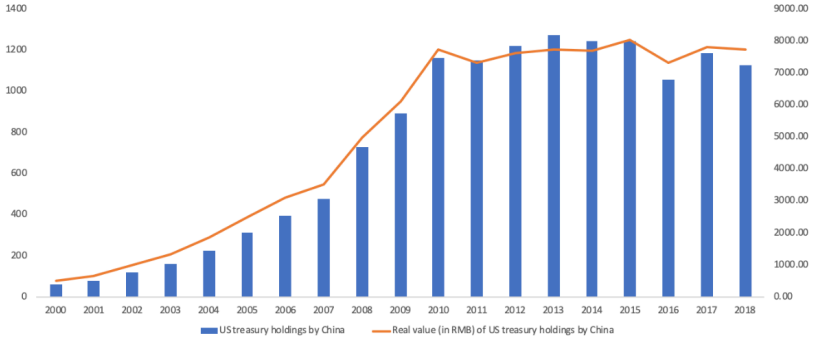

Figure 4: China's holding of US treasuries (in billions of dollars) denominated in USD vs. RMB (2000-2018). Source: FRED, US Department of the Treasury

In *Figure 4* above, the data shows the value of the treasuries in US dollars and renminbi over the time period 2000 to 2018. For the duration of the currency peg, prior to 2005, and until shortly afterwards the treasuries would have converted into local currency (RMB) at a pre-

mium profit because of the false currency trading rate induced by the peg. Shortly after, in 2008, the exchange rate returned to its natural level and, as depicted in *Figure 4*, the treasuries would have converted to RMB at face value. This is consistent with *Figure 1* where we can see the exchange rate abruptly plateau onto its natural rate again in 2008. Conversely, 2012-2014 shows a timeframe where the treasuries would have traded at a loss once exchanged into Renminbi.

Since *Figure 4* reveals the relative valuation of the treasuries in both USD and RMB directly, it acts as a buy/sell chart; ideally treasuries would be sold when the RMB curve is higher than the USD and treasuries would be purchased when the USD curve is equal to or higher than the RMB curve. This is true to the data to a great extent as we can see the purchasing of treasuries explode as soon as the US Dollar equals the Chinese Renminbi in 2008 on the graph in *Figure 2*.

Valuation effects and China's net external wealth

Fluctuations in the USD/RMB exchange rate have affected China's net external wealth. Changes occur because of financial flows and valuation effects as a result of asset trades and capital gains, respectively. Especially after the removal of the Chinese Yuan peg to the US Dollar in 2005, China's external wealth changed.

Theoretically, valuation effects are responsible for the generation of a difference in external wealth comparing two time periods. As a general rule, when the Chinese Yuan appreciates relative to the US dollar, Chinese treasury wealth goes down. In order to determine how China's external wealth has changed by 2018 compared to 2000, we can use a general formula for financial weights while accounting for valuation effects:

$$\frac{\partial VAL_{it}}{\partial E_{ijt}} = \omega_{ijt}^{F} * (A_{it-1} + L_{it-1}) \qquad (1)$$

where ω_{ijt}^{F} is the weight for the Renminbi (*i*) in 2018 in China's (*j*) net foreign assets (*F*) and A and L denote assets and liabilities, respectively. *Equation* (1) tells us what the effect of a change in the exchange rate has on debt (Bénétrix, 2019).

In this case, China's debt assets are denominated in US Dollars. After the Chinese Yuan appreciated in 2005 compared to levels prior to

that year, US treasuries held by China decreased in value, affecting its net external wealth negatively.

Year	USD/RMB exchange rate	US treasuries held by China in billions of dollars
2000	8.2771	-
2018	6.8827	1123.6

$$(6.8827 - 8.2771) \times \$1123.6 = -¥1565.62\text{bn} \qquad (2)$$

Comparing values from 2000 with data from 2018, we can conclude from *equation (2)* that China's net external wealth has decreased by ¥1565.62bn, holding treasuries over the 18-year period constant.

Speculation of changes in the value of US treasuries

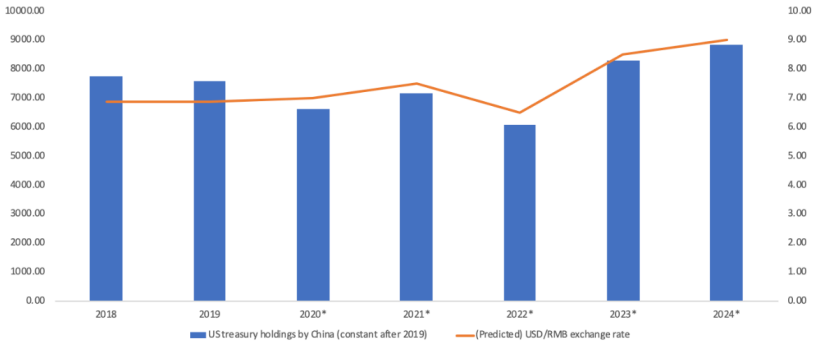

Figure 5: Predicted values of US treasuries' reaction in response to exchange rate fluctuations.

With ongoing tensions between China and the US regarding trade, the USD/RMB exchange rate has been greatly affected. The world's two largest economies officially entered a large-scale trade war in 2018 when they both imposed tariffs on each other's imports. Ever since the first tariffs were imposed by the US and China in July 2018, both countries were observed to be engaging in currency devaluation strategies: for

example, the People's Bank of China set the Dollar's reference rate 0.9 percent lower than prior to the war and thereby weakened it to its lowest level since 2016. After President Trump commented on the move, the dollar index immediately fell by more than one percent (CNBC, 2018). The US has accused China of manipulating its currency in order to benefit from the trade war. As a consequence, Trump has requested that the International Monetary Fund (IMF) intervenes and recognises China as a currency manipulator.

Since the energy recession in 2015-16, China has tightened its capital controls to have greater control over the Chinese Yuan. For instance, the Central Bank fixes the target for its daily exchange rate (Brown, 2019).

That being said, *Figure 5* reveals the predicted values of US treasuries' reaction in response to exchange rate fluctuations and more specifically a general depreciation over the time period, using 2020-2024 as an example. We obtain historical data for the years 2018 and 2019 and predict based upon the ongoing US/China trade war that there is a strong likelihood of an RMB depreciation in the future. We believe that this depreciation is likely to happen due to the fact that it is in China's interest to have a depreciated RMB in order to offset the US tariffs imposed on Chinese exports.

To illustrate this point, we forged a dramatic depreciation to test the reaction of the movement of treasuries. We also included a dramatic hypothetical appreciation in 2022 to show the opposite impact. This, in part, forecasts possible eventualities in light of current affairs. For simplicity, we hold the most recent value (2019) of US treasuries held by China constant.

As expected, *Figure 5* reveals that when the RMB depreciates, the real value of treasuries increases. Likewise, when the RMB appreciates (2022), the real value of treasuries decreases. This confirms our findings of the relationship between the USD/RMB exchange rate and the value of US treasuries.

V. Limitations

This paper has several limitations which impede its accuracy. The lack of data availability on China's behalf and the lack of data on US treasuries held by China prior to 2000 limit the ability to assess the values before the Chinese currency was pegged to the US dollar in 1994.

The availability of this data would add to the accuracy of this paper and be more inclusive of the historical data set.

There is ambiguity in the speculation with respect to the outcome of actual future fluctuations in the exchange rate on the value of US treasuries. The predicted values are solely based on extreme predictions for theory purposes only. In addition to this, there is further ambiguity on the value of treasuries as China has the power to sell treasuries which could result in an increase in the yield of the US treasuries and would hence result in a reduction of the value. Although this is a realistic assumption, China only holds a small percentage of overall US treasuries and would therefore not have a huge impact on the yield.

VI. Conclusion

The aim of this paper was to investigate how fluctuations in the USD/RMB exchange rate affect China's debt assets denominated in US dollars. Our key findings include the negative correlation between the net increase in US treasuries held by China and the strength of the Chinese currency and the negative correlation between the value of the RMB against the USD and the value of US treasuries. In the time period investigated, we showed that China's net external wealth decreased, holding US treasuries constant, resulting from an overall appreciation of the Chinese Yuan between 2000 and 2018.

We also showed that, if the Chinese Yuan were to depreciate over the next few years, the real value of US treasuries denominated in US dollars increases which is consistent with our findings of the relationship between the USD/RMB exchange rate and the value of US treasuries.

Going forward, the ongoing trade war is likely to evolve into a currency war and have a continued impact on the exchange rate and thus the value of US treasuries held by China. However, whether or not the value of US treasuries will increase or decrease over the coming years is ambiguous and highly unpredictable.

VII. References

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