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An Economic Thought about How to Detect Currency Manipulation

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Abstract

Criteria listed in the US Treasury Report to detect currency manipulation of major trading partner countries are necessarily ad hoc. In this paper, a simple economic-thought-based measure has been developed linking Fisher equation and CIRP with keeping implications of the impossible trinity in mind. Results of applying the measure to actual data do not seem to support the suspicion that major trading partner countries of the US might be manipulating their currencies until recently. Although further endeavors should be warranted in the case of China, even its currency practices seem to have been enhancing since 2012.

1   Introduction

The US Treasury has published the Report on Macroeconomic and Foreign Exchange Policies of Major Trading Partners of the United States biannually since 1988. The Report is submitted to Congress pursuant to the Omnibus Trade and Competitiveness Act of 1988. One of the main targets of publishing the Report is to consider whether countries manipulate the rate of exchange between their currency and the US dollar for purposes of preventing effective balance of payments adjustment or gaining unfair competitive advantage in international trade, as stipulated in the Section 3004 of the 1988 Act. In addition, by the Trade Facilitation and Trade Enforcement Act of 2015, the Treasury is required to monitor the macroeconomic and currency policies of major trading partners and engage in enhanced analysis of those partners if they trigger certain objective criteria that provide insight into possibly unfair currency practices.

Based on these laws, the Treasury has established thresholds for the three criteria as follows: (1) a significant bilateral trade surplus with the US is one that is at least \$20 billion; (2) a material current account surplus is one that is at least 2 percent of gross domestic product (GDP); and (3) persistent, one-sided intervention occurs when net purchases of foreign currency are conducted repeatedly and total at least 2 percent of an economy's GDP over a 12-month period.[1] Should any country meet all three criteria, the Treasury would label it a currency manipulator and be required to begin enhanced scrutiny on its currency practices. Should any country meet two of three criteria, the Treasury would put it on monitoring list for further review.

In some sense, these criteria sound reasonable as standards to detect currency manipulation of a certain trading partner country from the US perspective. However, they are necessarily ad hoc lacking enough rational economic reasons why those specific numbers should be picked up. There have been some other approaches like the Economist (2017) [3] to supplement those criteria, yet they cannot be said to be based on enough economic theories either. Needless to say, criteria in determining currency manipulation must be as rigorous as possible so that any other unnecessary problems in different dimensions can be contained efficiently from arising. Nevertheless, there have not been many serious researches to check whether these criteria are able to work efficiently in order to detect possible currency manipulation of trading partner countries from the US perspective.

Therefore, it is quite natural that circumstances here should raise a question: Are there any practical measures reliable, readily accessible and tightly established on economic theories extensively appreciated among economists, with which it can be checked out if and how deeply a certain trading partner country of the US has involved in currency manipulation for boosting its export. If there is such a measure available, it would be really helpful in strengthening fair currency practices around the world as the US Treasury desires. That is because any trading partner country of the US should refrain from getting involved in currency manipulation ex ante since any currency manipulating behaviour for boosting its export will be simply detected by the measure at least ex post.

So far, many academic papers published have focused on the topic of currency manipu-

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[1]The criteria for the monitoring list have gotten much stricter with the newly published Report in May 2019. For example, the previous "a material current account surplus over three percent of gross domestic product (GDP)" was revised to "two percent."

lation at various aspects. For example, Hassan *et al.* (2019) [6] links exchange rate policy to currency risk premia in order to figure out the effects of exchange rate stabilization. Fornaro (2015) [4] investigates the effects of devaluing exchange rate in a small open economy during a financial crisis based on New Keynesian framework. Ilzetzki *et al.* (2019) [7] emphasizes that the exchange arrangements of limited flexibility still remain in the majority since many countries strongly desire to stabilize exchange rates despite significantly increased capital mobility. Staiger and Sykes (2010) [10] studies the theoretical relationship between exchange rate policy and international trade, and understands the concept of 'currency manipulation' as a measure that may impair the commitments made in trade agreements. However, it is really hard to find a paper which provides any numerical measures for the purpose of detecting unfair currency practices and gauging the degree of currency manipulation.

In this regard, a simple economic-thought-based measure has been developed in this paper, which would be practically helpful in identifying unfair currency practices. It is done through linking Fisher equation and covered interest rate parity (CIRP) based on implications suggested by the impossible trinity. The measure has been applied to six major trading partner countries of the US; China, Germany, Switzerland, Japan, Korea and UK. Those countries except UK have been placed on a monitoring list of the late Report, October 2018. UK has been chosen as a benchmark case, which is considered free from currency manipulation. Results of applying the measure to actual data do not seem to support the suspicion that major trading partner countries of the US might be manipulating their currencies until recently. Even Chinese currency practices seem to have been enhancing since 2012 though further endeavors should be warranted.

2 An Economic-Thought-Based Measure to Detect Currency Manipulation

2.1 Whither the level of nominal interest rate in a currency manipulating country?

According to the impossible trinity, it is impossible for a small open economy to have a fixed foreign exchange rate system, free capital movement and an independent monetary policy at the same time. This finding has been strongly supported by academic researches like Obstfeld *et al.* (2005) [8]. Therefore, when free capital movement is given, the central bank of the particular TP (trading partner country) of the US can have only one choice between a fixed FX (foreign exchange) rate system and an independent monetary policy. This means that the central bank will lose its power on controlling interest rate if it wants to keep its currency undervalued around a certain level. In these circumstances, considering the condition of covered interest rate parity in (1), the nominal interest rate of the particular TP should go down when the particular TPC (trading partner country currency) to USD (US dollar) spot FX rate $S_{TPC/USD}$ gets lowered due to currency manipulation.

$$\frac{(1 + i_t^{US})}{(1 + i_t^{TP})} = \frac{F_{TPC/USD}}{S_{TPC/USD}} \tag{1}$$

It might be wondered if the TPC/USD forward FX rate $F_{TPC/USD}$ also gets lowered pari passu. In this case, the nominal interest rate of the particular TP i_t^{TP} will stay unchanged for sure. However, assuming rational expectation is in place, it will be most unlikely especially when the meaning of currency manipulation is taken into consideration. Regarding this, it needs to be stressed that the only case we are interested in is such currency manipulation done for the purpose of boosting export of the particular TP. As a matter of fact, central banks can be required to intervene in FX market with many other different reasons. For example, when FX market shows a lot increased volatility, a central bank may need to intervene just to reduce the volatility. Or, there might be a situation in which a central bank needs to appreciate its currency for the sake of price stability. However, from the perspective of the US Treasury, these cases must be called just currency intervention away from currency manipulation whose purpose is only boosting export of the particular TP.

Based on this perception, it could be argued that $F_{TPC/USD}$ will not be easily lowered no matter how the central bank of the particular TP tries to lower $S_{TPC/USD}$ to a certain level through currency manipulation. After all, if currency manipulation is successful and then trade surplus of the particular TP increases, there will be no economic reasons for $F_{TPC/USD}$ to be lowered when all other things being equal. In fact, it is generally acknowledged that controlling $F_{TPC/USD}$ must be a lot tougher than controlling $S_{TPC/USD}$. This is because $F_{TPC/USD}$ should be developed based on not only supply and demand in spot FX market but expectations for the future while $S_{TPC/USD}$ is mainly formed based on supply and demand in spot FX market. Therefore, although there are various instruments for central banks to intervene in forward FX market as discussed in Domanski *et al.* (2016) [2], controlling $S_{TPC/USD}$ should be much easier since only simeple purchase of US dollar will be sufficient.

In addition, it must be emphasized that the level of long-term market interest rates of the particular TP could be lowered much more easily when currency manipulation is prevailing. This is quite possible because the circumstances in long-term bond markets such as government bond market in the country may not be enough to absorb the burden coming from mismatch in demand for and supply of long-term bonds. When all other things being equal, if $S_{TPC/USD}$ gets lowered by currency manipulation, it is most likely that foreign investors in the government bond market of the particular TP should try to hold more government bonds as far as they want the size of return in US dollar terms to be remained the same as before $S_{TPC/USD}$ gets lowered. In such situations, if the supply of government bonds does not increase enough to absorb increased demand, there is no other way for the level of long-term market interest rates in a currency manipulating country but to go down. Furthermore, as mentioned just above, if some appreciation of currency value is expected in the near future due to increasing trade surplus, foreign investors' demand for the government bonds of the particular TP will be increased much more significantly.

2.2 Deviation from the level of nominal interest rate which would have appeared in steady state and Fisher equation

It is natural to assume that the macroeconomic conditions of the particular TP were in steady state before currency manipulation took place. Once the nominal interest rate, especially long-term market interest rates of the particular TP have got lowered as mentioned before, then this implies that the level of nominal interest rate in the country should be lower than

would have appeared in steady state as shown in (2), where i_t is the realized nominal interest rate of the particular TP and i_t^* is the nominal interest rate of the country which would have appeared in steady state if currency manipulation had not taken place. Considering Fisher equation $i_t^* = r_t^* + E_t(\pi_{t+1})$ where r_t^* is the real interest rate of the country which would have appeared in steady state, it is easy to conjecture that i_t should be lower than the sum of r_t^* and expected inflation $E_t(\pi_{t+1})$ as shown in (3).

$$i_t < i_t^* \tag{2}$$

$$i_t < r_t^* + E_t(\pi_{t+1}) \tag{3}$$

As exposited in Romer (2012) [9], it can be shown that real interest rate in steady state is theoretically the same as real GDP per capita growth rate. This theoretical view is widely supported by various empirical studies like Jonsson & Reslow (2015) [5]. Therefore, the Fisher equations of the US and each TP can be approximated as in following equations (4) and (5), where $rgdp_t$ means real GDP per capita growth rate. Hence, if a certain TP does exercise currency manipulation, its Fisher equation should look like in (6) rather than in (5).

$$i_t^{US} \approx rgdp_t^{US} + E_t(\pi_{t+1})^{US} \tag{4}$$

$$i_t^{TP} \approx rgdp_t^{TP} + E_t(\pi_{t+1})^{TP} \tag{5}$$

$$i_t^{TP} < rgdp_t^{TP} + E_t(\pi_{t+1})^{TP} \tag{6}$$

2.3 An economic-thought-based measure to detect currency manipulation

Now, let us reconsider CIRP which should hold at all times under free capital movement as in (1). The reason CIRP is considered to hold at all times is that it is an arbitrage condition. It holds that the interest rate differential between two currencies in financial markets should be equal to the differential between the forward and spot exchange rates. Otherwise, arbitrageurs could make a seemingly riskless profit. In fact, it is quite easy to understand that the impossible trinity cannot hold without CIRP being presumed to work efficiently. Notice that since CIRP should hold at all times, it should also hold regardless of whether the central bank of the particular TP does exercise currency manipulation.

By combining those approximated Fisher equations and CIRP, a midified CIRP can be built up as in (7). Note that the equality in modified CIRP will not hold if the central bank of the particular TP tries to keep its currency undervalued, and nominal interest rate of the country gets lowered than would have appeared in steady state, and therefore the sum of real GDP per capita growth rate and expected inflation stays higher than its realized nominal interest rate. That is, when a certain TP is in a situation like in (6), its modified CIRP should look like in (8) rather than in (7).

$$\frac{(1 + rgdp_t^{US} + E_t(\pi_{t+1})^{US})}{(1 + rgdp_t^{TP} + E_t(\pi_{t+1})^{TP})} \approx \frac{F_{TPC/USD}}{S_{TPC/USD}} \tag{7}$$

$$\frac{(1 + rgdp_t^{US} + E_t(\pi_{t+1})^{US})}{(1 + rgdp_t^{TP} + E_t(\pi_{t+1})^{TP})} < \frac{F_{TPC/USD}}{S_{TPC/USD}} \tag{8}$$

Figure 1: $CM-ratio$ values with Current GDP Growth Rate (%)

Finally, by putting all the above discussions together, an economic-thought-based measure to detect currency manipulation of a certain TP, $CM-ratio$, can be built up as in (9). Here, the square bracket term is divided by $\left(F_{TPC/USD}/S_{TPC/USD}\right)$ term for the purpose of standardization, so that the degree of currency manimpulation of each country can be compared each other. Note that the value of $CM-ratio$ should be negative under this formation when the central bank of the particular TP does exercise currency manipulation, and its modified CIRP looks like in (8).

$$CM-ratio = \left[\frac{(1+rgdp_t^{US}+E_t(\pi_{t+1})^{US})}{(1+rgdp_t^{TP}+E_t(\pi_{t+1})^{TP})} - \frac{F_{TPC/USD}}{S_{TPC/USD}}\right] \div \left(\frac{F_{TPC/USD}}{S_{TPC/USD}}\right) \quad (9)$$

3   Applying the Measure to Actual Data

The $CM-ratio$ measure developed above has been applied to six major trading partner countries of the US; China, Germany, Switzerland, Japan, Korea and UK. Those trading partner countries except UK have been placed on the monitoring list of the late Report, October 2018. UK has been chosen as a benchmark case, which is considered free from currency manipulation. Here, all the data have been taken from the FRED except forward and spot exchange rate from www.mecklai.com, and real GDP growth rate of China from

Figure 2: $CM-ratio$ values with Real GDP Growth Rate and CPI (%)

OECD. All the quarterly real GDP growth rates and inflation rates are calculated compared to the same period of previous year. For nominal interest rates, monthly average values of 10-year government bond yields and 3-month interbank rates were used. All the quarterly and monthly average values of forward and spot exchange rates are calculated based on daily rates. The maturity of forward exchange rates is set as one year. Analysis period has been set up from 2009:3 to 2019:4 so that the direct effects of financial crisis could be avoided.

Notice that real GDP growth rates and actual inflation rates π_t are used in this application rather than real GDP per capita growth rates and expected inflation rates $E_t(\pi_{t+1})$. This is because, unfortunately, data on real GDP per capita growth rates and expected inflation rates are not available for some countries when based on the above data sources. Specifically, (1) current GDP growth rates, and (2) the sum values of each real GDP growth rate and actual inflation rate based on consumer price index (CPI) are used to calculate the values of $CM-ratio$. The two results of $CM-ratio$ values calculated are shown in Figure 1 and Figure 2, respectively.

There are three points to be noticed. First, Japan should not be blamed with regard to undesirable currency practices against US dollar. In both cases, almost all $CM-ratio$ values of Japan have stayed in positive area, which means that Japan must have stayed far away from currency manipulation. Even when compared to the UK benchmark case, the performance of $CM-ratio$ values of Japan look much more desirable in terms of complying with fair currency practices. In fact, although the $CM-ratio$ of Japan has recorded some negative values from time to time, in general the magnitudes of those negative values look

smaller than those of UK benchmark case. After all, with keeping the UK benchmark case in mind, it does not seem to be a bad idea considering a certain TP's currency practices to be fair if its $CM-ratio$ values are higher than -2%, especially since 2014.

Second, in the cases of China and Korea, it seems that there have been significant structural changes in their currency practices somewhere around in the second half of 2011. As shown in both Figures 1 and 2, the magnitudes of those negative $CM-ratio$ values of the two countries abruptly reduced since 2012. Especially in the case of Korea, the movement of its $CM-ratio$ values with current GDP growth rate has shown similar or even better performance compared to that of the UK benchmark case since 2012. It would be also supported by the movement of its $CM-ratio$ values with real GDP growth rate and CPI. Overall, from the viewpoint of $CM-ratio$ values, it seems that Korea has not involved in undesirable currency practices at least since 2012.

In the case of China, the performance of its $CM-ratio$ values may not seem satisfactory yet from the perspective of the US Treasury since the magnitudes of its negative $CM-ratio$ values are quite large sometimes until recently recording around -5% as shown in both Figures 1 and 2. For example, according to the $CM-ratio$ values with real GDP growth rate and CPI in Figure 2, it still seems likely that China has involved in unfair currency practices until very recently. However, it is true that the magnitudes of its negative $CM-ratio$ values have reduced quite a lot compared to those of previous years. Especially, it seems meaningful that the $CM-ratio$ values with current GDP growth rate reached nearly -2% very recently. Although the very recent movements of the two $CM-ratio$ values are different each other, it is also true that even the magnitudes of negative $CM-ratio$ values with real GDP growth rate and CPI have reduced in a steady fashion until mid-2018. This means, at least, it could be appreciated that China has been trying to correct its currency practices although it may not seem satisfactory yet from the perspective of the US Treasury.

Regarding the cases of China and Korea, it should be strongly emphasized that publishing the Report by the US Treasury must have affected significantly the two countries' currency practices. It is well known that the US Treasury has tried to convince China to maintain fair currency practices for a long time. In fact, the US Treasury has labeled China as a currency manipulator twice in 1994 and 2019.[2] However, since 2011, the Report has hightened its pressure up to a quite different level against not only China but all major trading partner countries for any possibly unfair currency practices. As a matter of fact, the Report began to emphasize the possibility that Korea might have involved in unfair currency practices in Feburary 2011. Other than China, it was the first time for the US Treasury to criticize seriously a certain TP for its possibly unfair currency practices. In this sense, publishing the Report periodically could be considered a powerful tool for the US Treasury in terms of guiding other countries' currency practices.

Third, in the cases of Switzerland and Germany, it looks somewhat suspicious that the two countries might have involved in undesirable currency practices recently. Especially, it is true that Germany has recorded quite big negative $CM-ratio$ values, sometimes recording around -3%, for relatively longer period compared to other european countries between 2016-2018. In the case of Switzerland, while its $CM-ratio$ values with current GDP growth rates

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[2]The US Treasury formally removed China's designation as a currency manipulator in January 2020, which is closely related with a trade agreement between US and China done in the same month.

Figure 3: CIRPs of UK, Switzerland and Germany with 3-month Interbank Rates and 10-year Government Bond Yields calculated by $\left[\frac{(1+i_t^{US})}{(1+i_t^{TP})} - \frac{F_{TPC/USD}}{S_{TPC/USD}}\right]$ (bp)
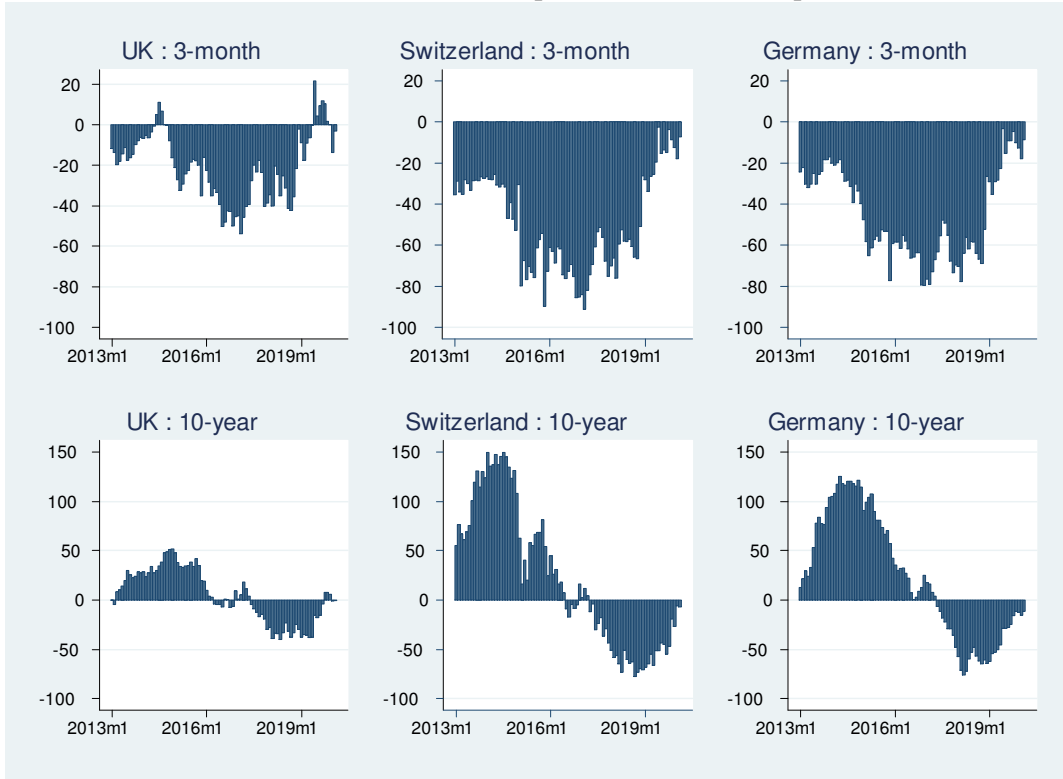

do not look bad, its $CM-ratio$ values with real GDP growth rates and CPI have recorded somewhat bigger negative values around -3% especially in the period of 2017-2018. These suspicious movements of $CM-ratio$ values stand out when compared to the UK benchmark case whose $CM-ratio$ values keep showing relatively stable movement during the period of 2016-2018.

However, it should be cautious to determine whether Switzerland and Germany have really involeved in such currency practices. Regarding this, there is one point which must not be missed. The thing is that CIRPs in european countries have not hold for more than nearly five years since 2014 as shown in Figure 3, which is calculated from the current data using $\left[\frac{(1+i_t^{US})}{(1+i_t^{TP})} - \frac{F_{TPC/USD}}{S_{TPC/USD}}\right]$. In fact, the degree of deviating CIRPs is appeared to be much bigger in Germany and Switzerland compared to UK especially in the period of 2016-2018. Although the shapes of CIRPs in Germany and Switzerland are different depending on the maturities of 3-month and 10-year, they show one common pattern in which the values of $\left[\frac{(1+i_t^{US})}{(1+i_t^{TP})} - \frac{F_{TPC/USD}}{S_{TPC/USD}}\right]$ start to decrease since 2015 and bounce back closing near zero after 2019.

Since the measure of $CM-ratio$ is based on the assumption of always binding CIRP, these CIRPs deviating can be a serious defect threatening the validity of the measure. However, it is natural that any reasons making CIRPs fail temporarily should vanish eventually.

Figure 4: Differences in Interest Rates (3-month Interbank Rates and 10-year Government Bond Yields) between US and Each European Trading Partner Country since 2013 (%p)
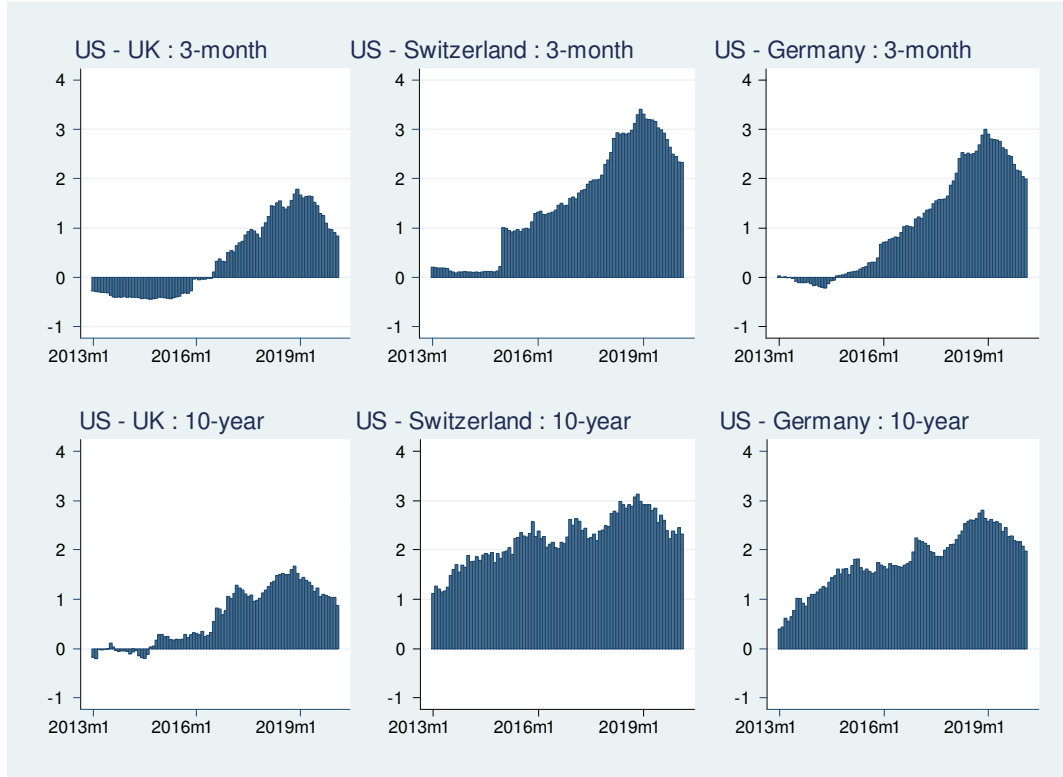

Furthermore, even in a short horizon, if the reason CIRPs fail in many countries can be found out, it should be still possible to discuss about whether a certain TP exercised currency manipulation based on the measure of $CM-ratio$ as long as the influence coming from CIRPs deviating can be taken into consideration. This means that understanding the reason those CIRPs have been deviating during the period would be the key element in determining whether these two countries have really involeved in undesirable currency practices.

In this context, it needs to be stressed that ECB has kept its extremely accommodative monetary policy stance so far, while the Fed has retreated from its Quantitative Easing stance through a gradual exit strategy since 2015. This difference in monetary policy stances among major central banks is well reflected in Figure 4 which shows the movements of interest rate differences between US and each european country. According to the Figure 4, it should be the case that the monetary policy stance of Swiss National Bank (SNB) has been very close to ECB and that of Bank of England (BOE) has stayed in the middle of ECB and the Fed. Regarding this point, it is noteworthy that the whole Euro area shows very similar pattern in terms of recent $CM-ratio$ values since 2015 with that of Germany alone, as shown in Figure 5.

As Borio et al. (2016) [1] explained well, with facing two distinctively different monetary policy stances of the Fed and ECB, it is quite possible that financial market participants should expect the outflows from the euro to the US dollar. This would lead to increased demand for FX swaps or cross-country swaps resulting in higher prices for currency hedges,

Figure 5: Euro Area vs Germany : $CM - ratio$ values with Current GDP Growth Rate (%)
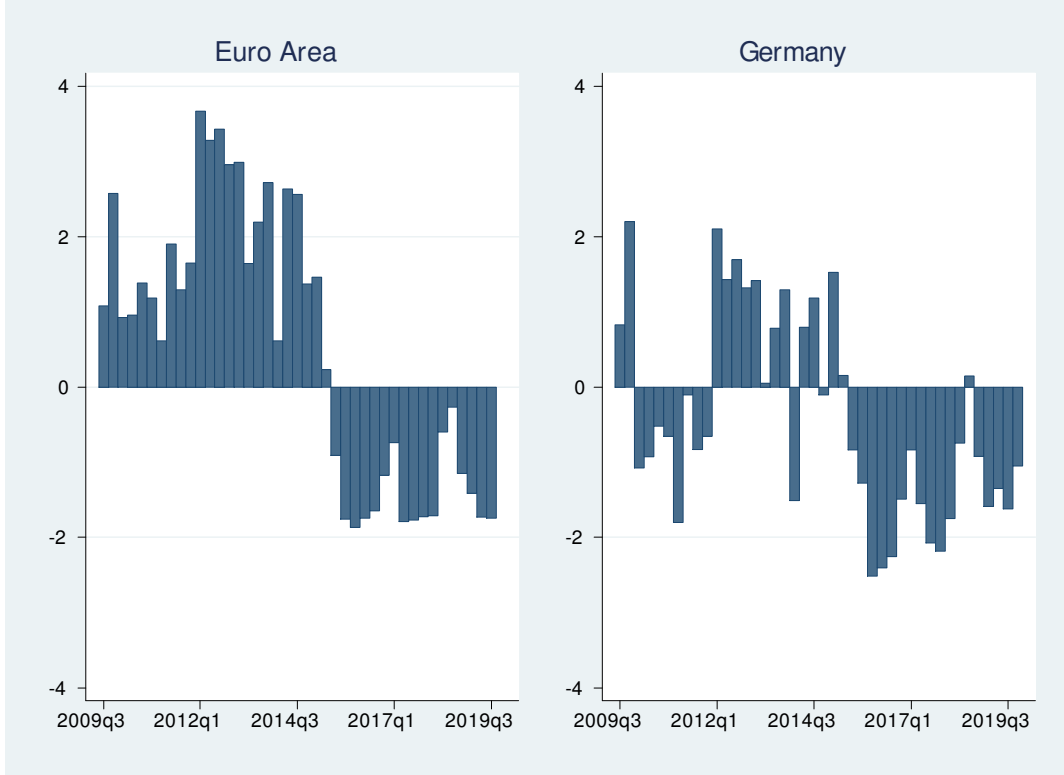

which means that the value of $\left(F_{TPC/USD}/S_{TPC/USD}\right)$ should go up. In this circumstance, it is natural that the values of CIRPs calculated by $\left[\frac{(1+i_t^{US})}{(1+i_t^{TP})} - \frac{F_{TPC/USD}}{S_{TPC/USD}}\right]$ should decrease until interest rate differences get narrowed, as shown in Figure 3. Therefore, $CM - ratio$ values should decrease as well, not because of $i_t^{TP} < rgdp_t^{TP} + \pi_t^{TP}$ but because of increased value of $\left(F_{TPC/USD}/S_{TPC/USD}\right)$.

This implies that those negative $CM - ratio$ values of Germany and Switzerland between 2016-2018 might have appeared because of the different monetary policy stances between the Fed and ECB, not because of undesirable currency practices of those two countries. Interestingly, the CIRP of UK also shows very similar pattern to those of Germany and Switzerland as shown in Figure 3 although the magnitude of decreased value of $\left[\frac{(1+i_t^{US})}{(1+i_t^{TP})} - \frac{F_{TPC/USD}}{S_{TPC/USD}}\right]$ is relatively small reflecting the monetary policy stance of BOE, which would make the possibility more convincing. In fact, when decreasing the actual values of $\left(F_{TPC/USD}/S_{TPC/USD}\right)$ of UK, Japan, Germany and Switzerland by 2% since 2014 as an experiment, negative $CM - ratio$ values with current GDP growth rates of Germany and Switzerland between 2016-2018 are almost vanished out of sight, as shown in Figure 6.

4   Concluding Remarks

Currency manipulation is a serious factor disrupting effective balance of payments adjustment among countries. Maybe rampant suspicion surrounding possibly undesirable currency

Figure 6: $CM-ratio$ values with Current GDP Growth Rate and $\left(F_{TPC/USD}/S_{TPC/USD}\right)$ decreased by 2% since 2014 (%)
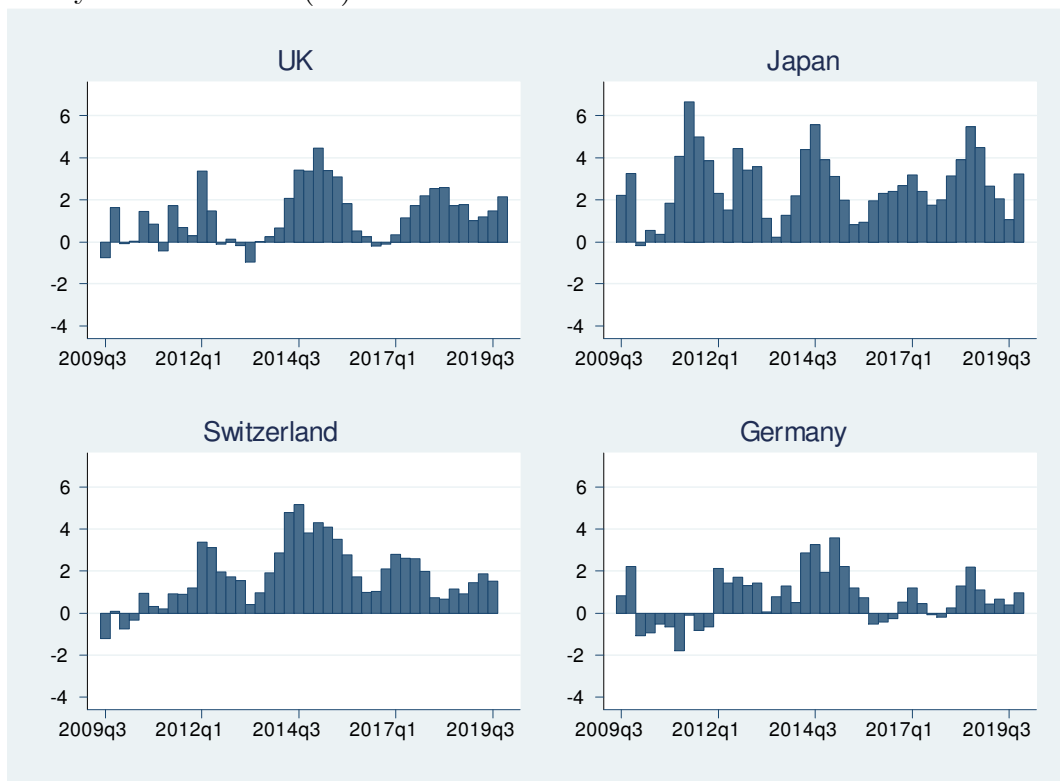
practices played a key role in precipitating the recent global disputes regarding international trade. However, criteria in determining currency manipulation need to be as rigorous as possible. If not enough, they might cause some other problems in different dimensions. Though the criteria listed in the US Treasury Report sound reasonable, they are necessarily ad hoc. Among other things, it might be yet controvercial how those specific numbers in the criteria have been picked up. Nevertheless, it seems that there have not been many serious researches about what kind of criteria would be appropriate in terms of detecting possible currency manipulating behaviour of trading partner countries from the US perspective.

In this regard, a simple economic-thought-based measure to detect currency manipulation of a trading partner country has been developed in this paper. It is done through linking Fisher equation and covered interest rate parity (CIRP) based on an economic thought suggested by the impossible trinity. Results of applying the measure to actual data do not seem to support the suspicion that major trading partner countries of the US might be manipulating their currencies until recently. Although China does not seem to be fully free from the suspicion, it looks quite clear that the currency practices of China have been enhancing steadily at least since 2012. Meanwhile, blaming other trading partner countries than China in terms of currency manipulation seems inappropriate when based on the analysis results with the newly developed measure in this paper, $CM-ratio$.

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