Chinese Yuan (CNY) vs. Hong Kong Dollar (HKD)
Currency Report

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Overview

Forecast outcome

- **HKDCNY exchange rate expected to move to 1.08 in 3-months,1.14 in 6-months 1.145 in 1-yr, 1.07 in 3-yrs, 1.09 in 5-yrs, .**

Introduction

The exchange rate between the Chinese Yuan (CNY) and the Hong Kong Dollar (HKD) has experienced some notable fluctuations in recent months, driven by a combination of economic factors and market sentiment. As of October 9, 2024, the CNY/HKD exchange rate stood at approximately 1.09 HKD per CNY, following a brief period of depreciation. However, strong inflows of global capital into China and targeted interventions by the Chinese authorities have helped to stabilize the currency.

China's central bank policy & Inflation expected to increase

- On September 27, 2024, the People's Bank of China (PBOC) announced an important policy to reduce the proportion of "reserve funds" that banks are required to hold by 0.5 percentage points. As a result of the adjustment, the average reserve requirement ratio for banks was lowered to 6.6%, which makes the money supply increase and inflation expected to rise.
- In addition, the People's Bank of China lowered the interest rate for banks to borrow money on a short-term loan, lowering the seven-day rate from 1.7% to 1.5%. This was done to enable enterprises and individuals to borrow money at lower interest rates to help the economy recover and stabilize more quickly. These measures are all aimed at providing more money to the market and promoting economic stability and growth, which also puts upward pressure on inflation.
- From the above policy, we can also guess that the Chinese government wants a weak Yuan policy.

United States President Election

The U.S. presidential election will indirectly affect the CNY exchange rate. The outcome of the election may lead to fluctuations in the exchange rate of the United States dollar, and the relationship between the United States and China may also be affected. If US-China relations are strained or the market feels uncertain, the CNY may depreciate; conversely, if relations improve or the market stabilizes, the CNY may remain stable or even appreciate. In addition, the economic policies of the new U.S. president will also affect the global market, which in turn will affect the CNY exchange rate. Therefore, the outcome of the U.S. election has a potential impact on the CNY exchange rate.

international reserves stay high

China's foreign exchange reserves can help stabilize the CNY exchange rate. When the yuan depreciates, the central bank can use its international reserves to buy the yuan and reduce its depreciation. In addition, sufficient foreign exchange reserves can also boost market confidence in the yuan and reduce capital outflows. If interest rate cuts lead to capital outflows, international reserves can help cope with these flows and maintain economic stability. Overall, foreign exchange reserves are a "protective shield" to cope with exchange rate fluctuations and maintain the stability of the yuan.

Stock market

With the sharp rise in the shares of Chinese companies in the Hong Kong stock market, investor demand for Hong Kong dollars increased markedly, boosting the active currency market in Hong Kong. In particular, the Hang Seng China Enterprises Index has rebounded by 35% from its September low, attracting large inflows into the Hong Kong stock market. This inflow of funds made the Hong Kong dollar more in demand, leading to a sharp increase in the volume of options trading in the Hong Kong dollar, which reached six times its usual level. At the same time, the supply of Hong Kong dollar became tight due to seasonal factors such as the inflow of funds into the stock market and the need of banks for more funds to maintain liquidity at the end of the quarter. This led to a sustained rise in the interest rate on short-term borrowing and lending between banks (Hibor), reflecting the strong market demand for Hong Kong dollars, and similiar condition happens in china's stock market , therefore the demand for Chinese Yuan also increase significant, however the supply of Chinese Yuan increase due to the central bank's policy therefore we expect CNY depreciate in this regard.

China's trade surplus increased

In 2024, China's trade surplus grew, driven by strong exports, which boosted demand for the Chinese yuan (CNY) in the international market and created upward pressure on its value. Meanwhile, China's foreign exchange reserves increased, providing the government with more tools to stabilize the exchange rate. However, it seems likely that the Chinese government prefers to keep the yuan weak to sustain its trade surplus. This view is supported by recent central bank policies, which indicate a deliberate effort to maintain a weaker currency.

Economic Growth

china's GDP: In 2023, China's GDP grew by 5.2%, reaching 126.06 trillion yuan (about $17.52 trillion), slightly over the government's target of 5%. This growth was supported by various policy efforts, especially in the industrial and service sectors. On the trade side, there is also a growth, with total trade volume up by 0.2%, and exports rising by 0.6%. Looking ahead to 2024, China has set its GDP growth target at 5%, the same as last year.

Foreign capital inflows: If China's economic growth aligns with the government's expectations and fiscal policies remain stable, global investors may stay optimistic about the Chinese market. This optimism, especially during times of uncertainty in other economies, could lead to inflows into Chinese assets, such as the stock market, driving up the value of the Yuan. However, if global growth is uneven or China's economy grows slower than expected, capital could flow out, putting downward pressure on the Yuan's value.

Hongkong gdp: In 2023, Hong Kong's economy achieved a real growth of 3.2%, thanks mainly to a strong recovery in domestic demand and a notable growth in exports of services. However, exports of goods dropped by 10.3% due to weak global demand . Meanwhile, private consumption increased significantly by 7.3% and inflation remained low at 1.7%. GDP per capita stood at HK$396,900 (about US$50,700) and the unemployment rate fell to 2.9%. Looking ahead to 2024, the Hong Kong economy we expected to continue to grow, with real GDP growth ranging from 2.5% to 3.5%. The export situation is expected to improve with the easing of global financial conditions, especially in the second half of the year. Exports of services, especially tourism-related industries, will continue to benefit from the increase in visitor arrivals and various mega events promoted by the Government. Overall, Hong Kong's economic outlook for 2024 is optimistic

Exchange Rate Forecast methods

Based on Figure 2 in Appendix 1, we decided to use UH, RPPP, and our XGBoost regression model to predict exchange rates for both the short term (3 months, 6 months, 1 year) and the long term (3 years, 5 years). Specifically, we will rely on UH for the 3-month and 6-month exchange rate predictions, while also utilizing XGBoost for other short-term forecasts. For long-term predictions, we will use RPPP.

Accurate inflation rate forecasts are crucial for predicting exchange rates using RPPP. As shown in the figure, RPPP performs exceptionally well, with minimal deviation from the actual exchange rate. Given the expected rise in inflation in China, we have adjusted our inflation rate forecasts accordingly.

UH has also proven to be useful for accurate short-term predictions. XGBoost, on the other hand, performs well in the short term by effectively leveraging the available data. However, since long-term predictions involve numerous factors and complexities—and our XGBoost model incorporates around 20 parameters for prediction—we believe that XGBoost is less reliable for long-term exchange rate forecasting. Therefore, we focus its application primarily on short-term predictions.

Forecast results

TABLE I
FORECAST RESULTS FOR HKD/CNY

HKD/CNY Forecast					
	3 month	6 month	1 year	3 years	5 years
UH	1.1111111	1.111111	-	-	-
XGBoost	1.0821372	1.1402628	1.0797268	-	-
RPPP	-	-	1.145	1.07	1.09

Based on our results, we anticipate that the CNY will depreciate in the short term, reaching 1.08 in 3 months and 1.14 in 6 months. However, according to the RPPP model, it is expected to appreciate to 1.145 within one year before gradually depreciating back to its current level (from 1.07 to 1.09) over the next few years. While these predictions are based on current economic conditions, longer-term factors, such as shifts in global policies and inflation trends, may require adjustments.

Our focus is primarily on short-term accuracy, though we recognize that exchange rates are influenced by many variables, such as investor sentiment and central bank policies. As a result, our models will need to be updated as new data becomes available.

In conclusion, we expect the CNY to depreciate in the short term (3 to 6 months), appreciate over the next year, and then gradually return to its current level. These predictions should be revisited regularly as conditions change.

Appendix-1 Observations

observation-1

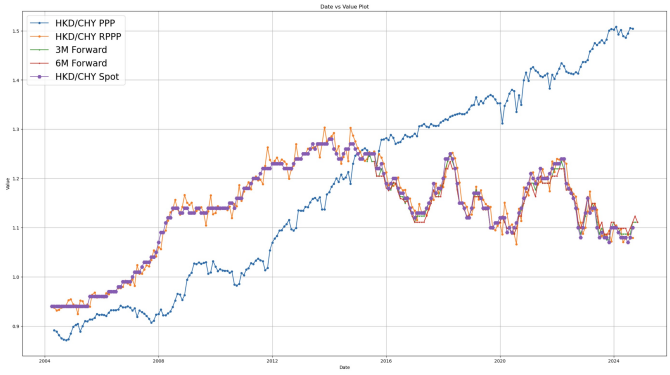

Fig. 1. Plot for the PPP, RPPP, 3M Forward , 6M Forward, spot Exchange rate

From the HKD/CHY PPP line, it demonstrates a gradual and steady upward trend from 2004 to 2024, indicating a rising parity level between the two currencies over time from 0.9 to 1.5, peaking towards 2024. While the Relative Purchasing Power Parity (RPPP) line stays lower than the PPP after 2015 but exhibits a similar trend. From 2004 to 2014, the pattern shows similar trend with HKD/CHY PPP line. There is a period from 2015 onward where the spot rate declines, flattens, and then shows more variability. The values generally fluctuate between 1.0 and 1.1 for most of the timeline, with some mild variation. HKD/CHY Spot lines shows similar trend with HKD/CHY RPPP line.

The 3-Month Forward line moves somewhat closely with the 6-Month Forward line and the spot exchange rate. This alignment can be seen as an indication that UH may perform well in the short term, which we have incorporated into our predictions.

Overall, the graph highlights the trends of PPP, RPPP, Forward Rates, and Spot Rates, with PPP showing a clear upward trend over the years. The forward rates and spot rates closely follow each other. Given these patterns, we decided to use UH and RPPP for our predictions, as these models appear to better align with the actual exchange rate trends shown in the graph.

observation-2

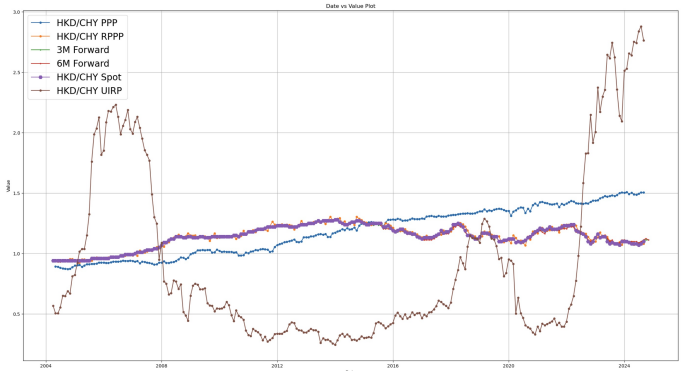

Fig. 2. Plot for the Plot for the PPP, RPPP, UIRP, 3M Forward , 6M Forward, spot Exchange rate

Compare the currency exchange rate more about Uncovered Interest Rate Parity (UIRP), HKD/CHY UIRP is the most striking feature in this graph, showing extreme volatility. It rises significantly around 2004-2005, then crashes towards 2008 before another sharp decline leading to 2012. After a period of relative stability, it climbs again drastically post-2020, marking a steep rise toward 2024. HKD/CHY PPP line follows a more stable upward trend. In contrast to the UIRP, the PPP remains much more stable, showing a slow and steady climb over the years. HKD/CHY RPPP moves closely with HKD/CHY PPP line but shows a little more stable, staying about 1.0 – 1.1. HKD/CHY Spot line is close to the forward rates, showing some minor volatility around 2016 and a slight decline post-2020. It shows more fluctuation over these years.

3-Month Forward line is largely horizontal, with minor fluctuations compared to the UIRP, which is closely to the 6-Month Forward line. They both show similar trend, while 6-Month exchange rate line indicates a smoother movement. Both forward curves remain clustered around 1.0-1.05 with limited sharp movements, implying short-term predictability or stability.

Overall, the graph highlights UIRP as a significant variable, in addition to the measures from the first graph. UIRP shows much greater volatility and reacts strongly to macroeconomic changes, particularly in recent years, diverging significantly from the other metrics. As a result, we decided not to rely on UIRP for accurate predictions due to its volatility. However, it can still serve as an indicator of general trends in appreciation or depreciation.

Appendix-2 Methodology

To forecast exchange rate we do following steps

- we collect the data relevant to exchange rate (ex:CPI, Exchange Rate, Forword Exchange Rate, Interest Rate ...) and some macroeconomic data for china and hongkong
- Next we calculate the inflation Rate, ppp ,Rppp, and combine other data using those theories (Rppp, UH) to observe the outcome, and decide which one perform better
- Finally, we also use XGboost Regression to forecast exchange rate

Unbiasedness Hypothesis (UH)

This theory is obtained from combining the result from UIRP and CIRP ,which tell us that the Expected future exchange rate is equal to the forword rate, since it is just the Expected value , therefore it is hard to forecast exact exchange rate by this theory , but we do see the trend of the exchange rate from this theory

$$\mathbb{E}[S_{t+1,DC/FC}] = F_{t,t+1,DC/FC} \tag{1}$$

Relative Purchasing Power Parity (RPPP)

From this theory , we can get there is a relationship between Exchange Rate Change and Relative Inflation Rates,the conclusion this theory tells us is that Currencies of countries with relatively high inflation tend to depreciate ,therefore if we can somehow forecast the inflation rate then we can forecast the exchange rate (if this theory holds)

$$\mathbb{E}[S_{t+1,DC/FC}] = S_{t,DC/FC} \cdot \frac{(1 + \mathbb{E}[\pi^{DC}_{t,t+1}])}{(1 + \mathbb{E}[\pi^{FC}_{t,t+1}])} \tag{2}$$

Uncovered Interest Rate Parity (UIRP)

From this theory , we can get there is a relationship between Exchange Rate Change and Relative Interest Rates,the conclusion this theory tells us is that High-interest rate currencies are expected to depreciate relative to low-interest rate currencies ,therefore if we can somehow forecast the interest rate then we can forecast the exchange rate (if this theory holds),However we all know that the exchange rate move frequently,In contrast that the interest rate barely move , so this theory is also hard to forecast the exact exchange rate accurately.

$$\mathbb{E}[S_{t+1,DC/FC}] = S_{t,DC/FC} \cdot \frac{(1 + i^{DC}_{t,t+1}])}{(1 + i^{FC}_{t,t+1}])} \tag{3}$$

XGBoost Regression

It is an ensemble method that builds decision trees iteratively and combines their predictions. The general form of the model can be expressed mathematically as follows:

$$\hat{y}_i = \sum_{k=1}^{K} f_k(x_i)$$

Where:

- $\hat{y}_i$ is the predicted value (in this case, the exchange rate),
- x_i represents the feature vector for the i-th instance (such as macroeconomic variables),
- $f_k(x_i)$ is the output of the k-th decision tree in the model,
- K is the number of trees in the ensemble.

Each tree f_k is optimized to minimize the loss function. In the case of XGBoost regression with squared error loss, the loss function is:

$$L(\hat{y}_i, y_i) = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

Where:

- $-y_i$ is the actual observed value (actual exchange rate),
- $-\hat{y}_i$ is the predicted exchange rate from the model,
- $-n$ is the number of data points.

Additionally, XGBoost includes regularization to control overfitting. The objective function being minimized is:

$$\text{Objective} = \sum_{i=1}^{n} L(\hat{y}_i, y_i) + \sum_{k=1}^{K} \Omega(f_k)$$

Where: $\Omega(f_k)$ is a regularization term for the complexity of each tree, often expressed as:

$$\Omega(f_k) = \gamma T + \frac{1}{2}\lambda \sum_{j=1}^{T} w_j^2$$

Where:

- $-T$ is the number of leaves in the tree,
- $-w_j$ is the weight assigned to the j-th leaf,
- $-\gamma$ and λ are regularization hyperparameters to penalize model complexity.

This approach effectively balances prediction accuracy and model complexity, helping to avoid overfitting.

Appendix-3 plots & tables

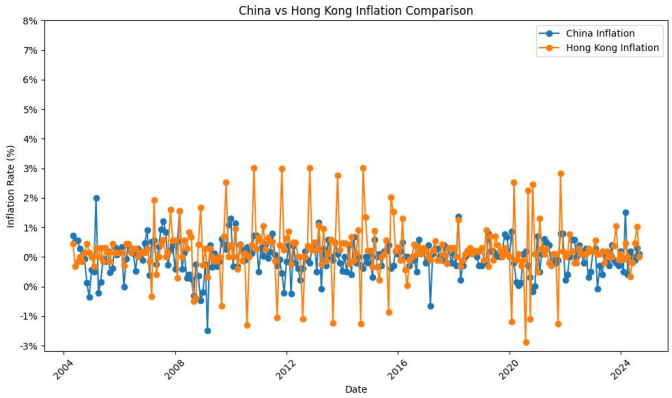

Figure 1: China & Hong Kong Inflation Comparison

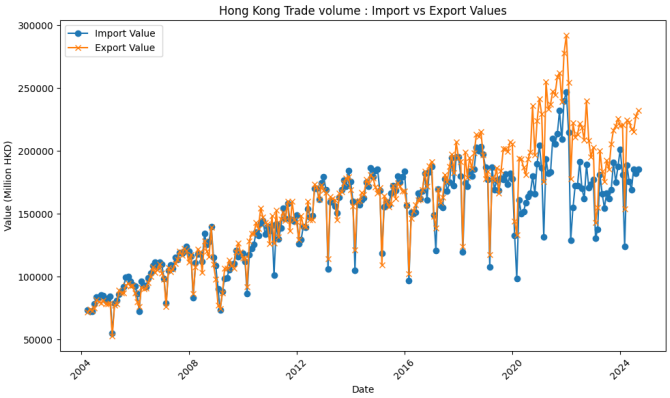

Figure 2: Trading volume for Hongkong(Import vs Export

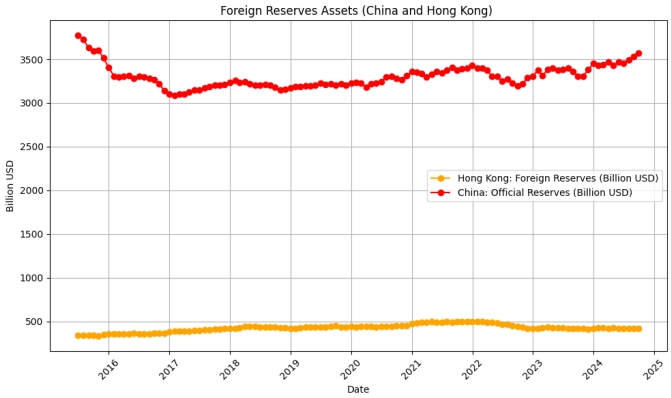

Figure 3: International Reserves comparison

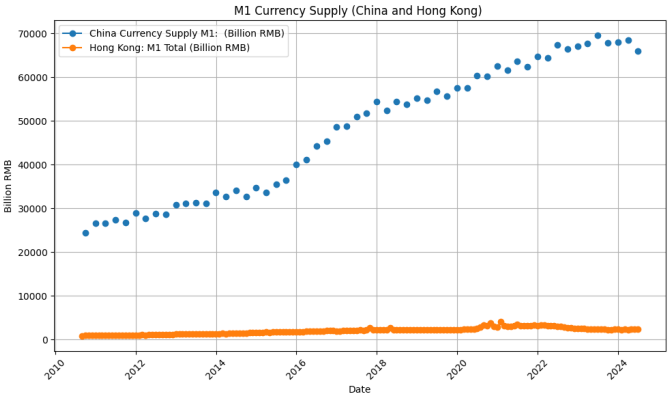

Figure 4: M1 Money Supply comparison

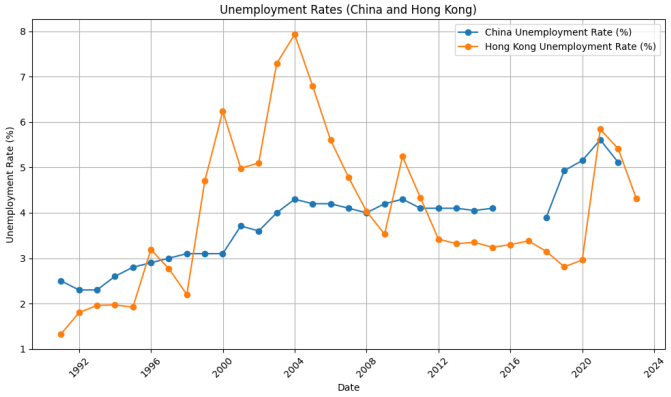

Figure 5: Unemployment Rates comparison

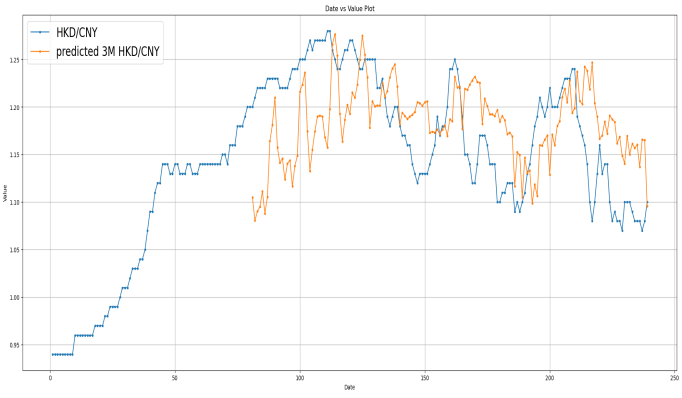

Figure 6: XGboost prediction for 3 month (actual vs predict)

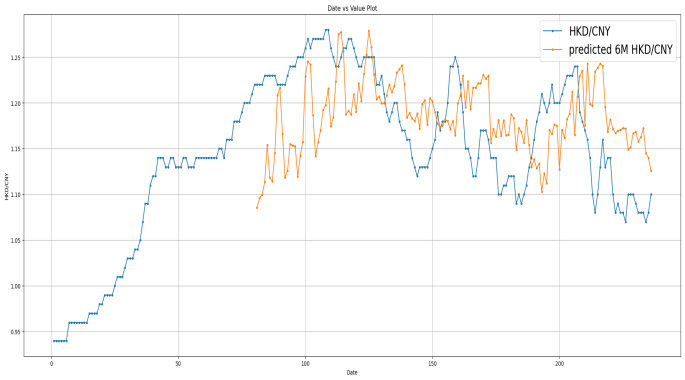

Figure 7: XGboost prediction for 6 month (actual vs predict)

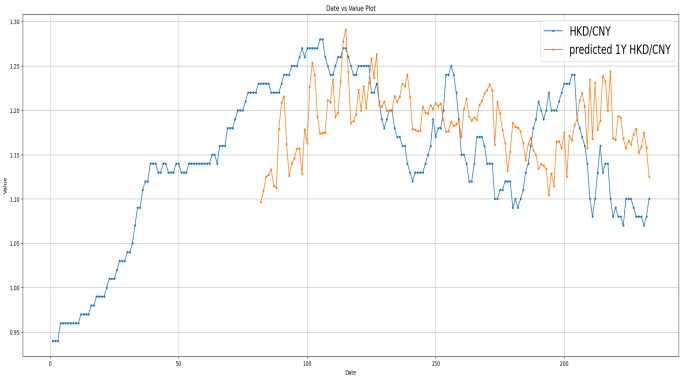

Figure 8: XGboost prediction for 1 year (actual vs predict)

Table 1: Economic Data for China and Hongkong (2015-2024)

china Data										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Interest rate (%)	3.5	2.8	3.4	3.9	3.1	2.75	3.2	2.75	2.9	2.5
GDP (US$ billion)	11100	11200	12300	13900	14300	14700	17800	17900	17800	
CPI	100.8	101.8	102.5	101.5	101.7	105.4	99.7	100.09	102.1	100.7
Inflation	0.8	1.8	2.5	1.5	1.7	5.4	-0.3	0.9	2.1	-0.8
Unemployment Rate (%)	4.05	4.02	3.9	4.93	5.15	5.61	5.11	5.5	5.2	
FX Reserves (US$ billion)	3771.347	3303.172	3150.384	3206.123	3225.235	3243.325	3345.897	3246.595	3384.853	3453.853

hongkong Data										
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Interest rate (%)	0.5	0.75	1	1.75	2.75	2	0.5	0.5	4.75	5.75
GDP (US$ billion)	309.39	320.86	341.27	361.73	363.07	344.94	368.95	358.7	382.05	
CPI	90.4	92.7	93.9	95.5	97.8	98.5	101.1	102.3	104.8	106.6
Inflation	4.1	2.5	1.3	2.4	2.4	2.2	2.6	1.2	2.4	1.7
Unemployment Rate (%)	3.3	3.38	3.15	2.81	2.96	5.84	5.41	4.32	3.96	
FX Reserves (US$ billion)	343.21	360.78	400.07	434.50	436.41	441.32	490.58	465.701	427.41	416.35