Risk Factors in Currency Markets

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Asset Management – November 5th 2019

Outline

Value Strategy in Foreign Exchange

= buy high-yield bonds & sell low-yield bonds

- Value in essence buys assets with high yields (or low prices) and sells assets with low yields (or high prices).
- In equities, the strategy is called value-growth investing.

Note: The same strategy of buying high-yielding assets and selling low-yielding assets works in many other asset classes, but goes by different names.

Carry

In foreign exchange, the value strategy is called carry. This strategy goes long currencies with high interest rates and shorts currencies with low interest rates.

nominal

Currency Portfolios

- Focus on investments in forward and spot currency markets.

Note: Forward currency markets exist for only a limited set of currencies and for short time periods.

- Forward currency markets, however, offer two distinct advantages:
  1. Carry trade is easy to implement in these markets and data on bid-ask spreads for forward currency markets are readily available.
  2. Forward contracts are subject to minimal default and counter-party risk. compared to foreign fixed-income
- Consider monthly foreign currency excess returns from the perspective of a U.S. investor.
- Consider currency portfolios that include developed and emerging market countries for which forward contracts are traded.

Expectation Hypothesis: $f_t = E_t s_{t+1}$

$\log(RX_{t+1}) = E_t s_{t+1} - s_{t+1}$

$\Rightarrow E[\log(RX_{t+1})] = E(s_{t+1}) - E(s_{t+1}) = 0$

$\Rightarrow$ Expected rate of return = 0

But actually they're quite large!

$\Rightarrow$ Expectation Hypothesis not true

$f_t \neq E_t s_{t+1}$

risk-free risky

F_t known at time t

But we don't know s_{t+1}

Notation

Shortcoming: Ignore risk.

- s denotes the log of the spot exchange rate, in units of foreign currency per U.S. dollar. s_t $s_t = \log S_t$
- f denotes the log of the forward exchange rate, in units of foreign currency per U.S. dollar. F_t (future transaction determined at current time t) $f_t = \log F_t$
- $\Rightarrow$ an increase in s means an appreciation of the home currency.
- The log excess return on buying a foreign currency in the forward market and then selling it in the spot market after one month is

$$rx_{t+1} = f_t - s_{t+1}$$

uncertainty

$$\text{risk-premium} = \underbrace{f_t - s_t}_{\text{log forward discount}} - \underbrace{\Delta s_{t+1}}_{\text{change in spot rate}} = (s_{t+1} - s_t)$$

rate of depreciation of foreign currency

Usually, the magnitude of $f_t - s_t$ is larger than Δs_{t+1}.

current time t

$t+1$: \$1 $\rightarrow F_t$; $s_{t+1} \rightarrow$ \$1

$RX_{t+1} = \frac{F_t}{S_{t+1}}$ excess return (don't have to pay anything to enter the forward market)

To can buy foreign at lower price

$\Rightarrow$ expect spot rate to increase in the future

$\Rightarrow$ expect foreign to depreciate

Covered Interest Rate Parity (CIP)

NO Arbitrage

- In normal conditions, forward rates satisfy the covered interest rate parity condition.
- ⇒ the forward discount is equal to the interest rate differential (i_t^* and i denote the foreign and domestic nominal risk-free rates over the maturity of the contract)

$$f_t - s_t \approx i_t^* - i_t$$

- The CIP holds at daily and lower frequencies (Akram, Rime, and Sarno (2008))
- ⇒ the log currency excess return equals approximately the interest rate differential less the rate of depreciation

$$rx_{t+1} \approx i_t^* - i_t - \Delta s_{t+1}$$

Assume $i^* > i$

Strategy:

Borrow domestic currency, lend foreign currency. Using forward contracts to cover exchange rate (F_t).

⇒ time t: $1 \to S_t$

⇒ time $t+1$: $S_t(1+i^*) \to \frac{S_t(1+i^*)}{F_t}$

If there is no arbitrage,

$$\frac{S_t(1+i^*)}{F_t} = 1+i$$

i.e. $$\frac{F_t}{S_t} = \frac{1+i^*}{1+i}$$

b.c. $\log x = x$ when x is close to 1 (?)

Data

- Daily spot and forward exchange rates in U.S. dollars.
- End-of-month series from November 1983 to December 2009 (data collected by Barclays and Reuters).
- At most 35 different currencies, spanning developed and emerging economies.
- The Euro starts in January 1999 $\Rightarrow$ exclude euro area countries after this date and keep only the euro series.
- Delete some observations from sample based on large failures of CIP.

Outline

Sorting Currencies

- At the end of each period t, allocate all currencies to 6 portfolios on the basis of their forward discounts $f - s$ observed at the end of t.
- Portfolios are rebalanced at the end of every month.
- They are ranked from low to high interest rate.
- $\Rightarrow$ Portfolio 1 contains currencies with lowest interest rate or smallest forward discounts; Portfolio 6 contains currencies with highest interest rate or largest forward discounts.
- The log currency excess return for portfolio j is the average of the log currency excess returns in each portfolio j.

differential

forward : risk-free (?)

Properties of Currency Portfolios

expect spot rate to increase in the future

yes. spot rate increases but not as large as forward discount expects

yes. but not as large as forward discount

expect foreign to appreciate (forward premium)

Similar results!

Although decreases a little, the magnitude remains the same.

Table 1
Currency portfolios—U.S. investor

Portfolio	1	2	3	4	5	6	1	2	3	4	5
	Panel I: All Countries						Panel II: Developed Countries				
	Spot change: Δs^j						Δs^j				
Mean	−0.64	−0.92	−0.95	−2.57	−0.60	2.82	−1.81	−1.87	−3.28	−1.57	−0.82
Std	8.15	7.37	7.63	7.50	8.49	9.72	10.17	9.95	9.80	9.54	10.26
	Forward Discount: $f^j - s^j$						$f^j - s^j$				
Mean	−2.97	−1.23	−0.09	1.00	2.67	9.01	−2.95	−0.94	0.11	1.18	3.92
Std	0.54	0.48	0.47	0.52	0.64	1.89	0.77	0.62	0.63	0.66	0.74
	Excess Return: rx^j (without b–a)						rx^j (without b–a)				
Mean	−2.33	−0.31	0.86	3.57	3.27	6.20	−1.14	0.93	3.39	2.74	4.74
Std	8.23	7.44	7.66	7.59	8.56	9.73	10.24	9.98	9.89	9.62	10.33
SR	−0.28	−0.04	0.11	0.47	0.38	0.64	−0.11	0.09	0.34	0.29	0.46
	Net Excess Return: rx^j_{net} (with b–a)						rx^j_{net} (with b–a)				
Mean	−1.17	−1.27	−0.39	2.26	1.74	3.38	−0.02	−0.11	2.02	1.49	3.07
Std	8.24	7.44	7.63	7.55	8.58	9.72	10.24	9.98	9.87	9.63	10.32
SR	−0.14	−0.17	−0.05	0.30	0.20	0.35	−0.00	−0.01	0.21	0.15	0.30
	High-minus-Low: $rx^j - rx^1$ (without b–a)						$rx^j - rx^1$ (without b–a)				
Mean		2.02	3.19	5.90	5.60	8.53		2.07	4.53	3.88	5.88
Std		5.37	5.30	6.16	6.70	9.02		7.18	7.11	8.02	9.64
SR		0.38	0.60	0.96	0.84	0.95		0.29	0.64	0.48	0.61
	High-minus-Low: $rx^j_{net} - rx^1_{net}$ (with b–a)						$rx^j_{net} - rx^1_{net}$ (with b–a)				
Mean		−0.10	0.78	3.42	2.91	4.54		−0.09	2.04	1.51	3.09
		[0.30]	[0.30]	[0.35]	[0.38]	[0.51]		[0.41]	[0.40]	[0.45]	[0.54]
Std		5.40	5.32	6.15	6.75	9.05		7.20	7.11	8.04	9.66
SR		−0.02	0.15	0.56	0.43	0.50		−0.01	0.29	0.19	0.32

carry

Pure bet on currency speculation

- returns are high
- Sharpe ratios are high

even compared to US equity market

b-a bid-ask spread (transaction costs)

Properties of Currency Portfolios cont'd

The model performs on nominal interest rates. But we can see that nominal interest rate relies on real interest rate. (not driven by inflation)

Table 1
Continued

Portfolio	1	2	3	4	5	6	1	2	3	4	5
	Panel I: All Countries						Panel II: Developed Countries				
	Real Interest Rate Differential: $r^j - r$						$r^j - r$				
Mean	−1.81	−0.13	0.45	1.04	1.80	3.78	−1.11	0.20	0.76	1.27	3.01
Std	0.56	0.56	0.49	0.57	0.65	0.77	0.78	0.60	0.62	0.62	0.71
	Frequency										
Trades/currency	0.20	0.34	0.41	0.44	0.42	0.14	0.14	0.28	0.36	0.35	0.10

Summary of Results

- A U.S. investor with access to forward currency markets can generate large returns with annualized Sharpe ratios that are comparable to those in the U.S. stock market.
- Similar results are obtained on a smaller sample of developed countries. (Not driven by emerging market)
- The results contradict the standard UIP condition that the average rate of depreciation of currencies in portfolio j should equal the average forward discount on these currencies.

When the no-arbitrage condition is satisfied without the use of a forward contract to hedge against exposure to exchange rate risk.

If $i_t = \frac{E_t(S_{t+1})}{S_t}(1+i_t^*)$

Uncovered Interest Rate Parity

$F_t = E_t(S_{t+1})$

$E(F_t - S_t) = E(S_{t+1} - S_t)$

Average vs Current Interest Rate Differences

Risk premium on investing in currencies with currently high interest rate (not those with high interest rate on average)

Table 2
Currency portfolios—sorts on mean forward discounts (half sample)

Portfolio	1	2	3	4	5	6	1	2	3	4	5
	Panel I: All Countries						Panel II: Developed Countries				
	Sorts on Mean Forward Discounts (Half Sample)										
	Excess Return: rx^j (without b–a)								rx^j (without b–a)		
Mean	−2.28	−0.69	0.09	1.14	1.74	3.06	−2.94	−0.61	2.01	1.44	1.86
SR	−0.24	−0.18	0.01	0.15	0.18	0.26	−0.28	−0.06	0.24	0.15	0.21
	Net Excess Return: rx^j_{net} (with b–a)								rx^j_{net} (with b–a)		
Mean	−1.52	−1.21	−0.67	0.45	0.67	1.31	−1.94	−1.42	1.18	0.26	0.48
Std	9.45	3.78	7.32	7.75	9.95	11.88	10.41	10.32	8.37	9.49	9.02
SR	−0.16	−0.32	−0.09	0.06	0.07	0.11	−0.19	−0.14	0.14	0.03	0.05
	High-minus-Low: $rx^j_{net} - rx^1_{net}$ (with b–a)								$rx^j_{net} - rx^1_{net}$ (with b–a)		
Mean		0.32	0.86	1.97	2.19	2.83	0.51		3.11	2.20	2.42
SR		0.04	0.10	0.23	0.25	0.23	0.05		0.25	0.20	0.21
	Real Interest Rate Differences: $r^j - r$								$r^j - r$		
Mean	−0.96	0.52	−0.23	0.61	0.92	2.43	−1.16	−0.68	0.48	0.27	1.56
Std	0.44	0.60	0.49	0.43	0.55	0.49	0.73	0.42	0.44	0.47	0.45
	Sorts on Current Forward Discounts (Half Sample)										
	Excess Return: rx^j (without b–a)								rx^j (without b–a)		
Mean	−3.83	−1.36	0.22	1.99	2.22	6.33	−2.25	−0.53	0.91	1.94	3.90
SR	−0.50	−0.20	0.03	0.32	0.29	0.67	−0.24	−0.06	0.10	0.22	0.37
	Net Excess Return: rx^j_{net} (with b–a)								rx^j_{net} (with b–a)		
Mean	−2.81	−2.23	−0.70	1.02	0.81	3.46	−1.26	−1.48	−0.15	0.84	2.50
SR	−0.37	−0.33	−0.10	0.16	0.11	0.37	−0.13	−0.16	−0.02	0.10	0.24

passive (don't rebalance)

Average vs Current Interest Rate Differences cont'd

Table 2
Continued

Portfolio	1	2	3	4	5	6	1	2	3	4	5
	Panel I: All Countries						Panel II: Developed Countries				
	High-minus-Low: $rx^j_{net} - rx^1_{net}$ (with b–a)						$rx^j_{net} - rx^1_{net}$ (with b–a)				
Mean		0.58	2.11	3.83	3.63	6.28		−0.22	1.11	2.10	3.76
SR		0.11	0.43	0.66	0.54	0.70		−0.03	0.14	0.24	0.35
	Real Interest Rate Differences: $r^j - r$								$r^j - r$		
Mean	−1.43	−0.12	0.30	0.81	1.31	3.65	−1.40	−0.26	0.25	0.75	2.69
Std	0.49	0.49	0.33	0.47	0.55	0.67	0.72	0.43	0.42	0.49	0.56

active

higher sharpe ratio