### **Carry Strategies – Don't get Carried away!**

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# Summary

- Buying high yielding currency and shorting low-yielding currency has been a profitable strategy and has been used for decades in the FX markets. Academics have long argued that Forward rates are biased predictors of future spot rates
- We review the academic research on Carry strategies and review some of the rationale for the existence of a positive excess return.
- We investigate the performance of some popular carry strategies and investigate their more recent performance.
- We introduce a carry strategy that uses fundamental/macro-economic data and show the strategies recent performance.

# **Carry Strategies:**

- Carry trades in other asset classes
  - Interest rate carry Basis trades free lunches
  - Cross-country FI carry Long duration in countries with steep yield curves and short duration in countries with flat /inverted curves.
  - Credit Carry Buy HY or EM credit and short JGBs.
    - Borrow in dollars (or other pegged currencies) and long local debt in EM.

# **FX Carry - Literature review**

- Brunnermeier(2008) shows that carry trade portfolios are negatively skewed and investors are earning a crash risk premia. (i.e. similar to selling put options on the SPX)
- Brunnermeier and Pedersen (2009) compare funding liquidity to asset market liquidity and argue that liquidity is an important factor in explaining excess returns in currencies.
- Adrian (2009) show that carry trade returns are associated with liquidity risk premia and could well be explained by liquidity factors.
- Burnside (2008) explain the performance of the carry trades by way of the Peso problem.
  The excess returns are due to the perceived risk of sharp depreciations by investors.
- Active Carry Strategies
  - Fletcher et.al (2009) look at using Machine Learning to trade FX Carry
  - Dong et.al(2008) using logistic regression to identify Carry Unwind events.

# **FX Carry – Naive Model**

- Ranking Model
  - ► G10 Universe
  - Rank currencies by their interest rates.
  - Take equally weighted in the top-3 vs. bottom-3 yielding currencies.
  - Rebalance every month.
  - Trading frequency doesn't matter as central bankers tend to be slow moving. Interest rate policy is typically well articulated ahead of time. (managing expectations)

# **Carry Strategies Review**

### Ranking Model

- Reweight the positions using a sliding weighting scale.
  (50%/30%/20%)
- Broaden the universe to EM currencies.
- Carry model with other indicators (Trend/momentum)
- Carry with filter
  - Realized/Implied volatility to scale positions or cut positions.
  - Optimize a portfolio based on mean-variance or other optimization method. (e.g. Barclays ICI, Credit Suisse Carry Model etc)
  - Use Carry-to-volatility ratio to filter trade entry. Alternatively use carry-to-volatility to **position through options**. (remove the negative skew in your distribution)
- Carry positioning through Options. (Spreads ATMF vs ATMS)

## **Carry Performance – Review 1**



Carry vs SPX Performance

Annualized Risk

### **Carry Performance – Review 2a**



Carry vs SPX Performance

### **Carry Performance – Review 2b**



# **Carry Performance – Review 3**

#### Performance from 2001 - 2007

		Vol	Carry	
		Targeted	with Vol	
	Naïve Carry	Carry	Filter	Equities
Annualized Return	8.7%	10.4%	17.1%	4.5%
Annualized Volatility	6.9%	6.2%	6.9%	13.6%
Annualized Sharpe	1.26	1.67	2.49	0.33

#### Performance after 2008

		Vol Targeted	Carry with Vol	
	Naïve Carry	Carry	Filter	Equities
Annualized Return	-9.6%	-5.1%	14.1%	-12.1%
Annualized Volatility	19.9%	7.0%	15.0%	30.8%
Annualized Sharpe	(0.48)	(0.74)	0.95	(0.39)

### **Carry Performance – Review 4**

Carry vs SPX Performance



Annualized Risk

#### **Fair Valuation**



As the chart above shows JPY is currently overvalued by about 25% vs USD.

#### **Carry – Interest rate differential**



The chart on the left shows USDJPY carry is at historic lows the carry was as high as 7%.

### Implied vs. Realized Volatility



The chart on the left shows that front-end realized volatility has been higher than implied volatility. Additionally we also see that the term structure of volatility is upward sloping and steeper compared to historicals.

### **Implied Skew**



The chart on the left shows that the risk reversal after being extremely negative (bid for JPY calls) has now retraced and is not as attractive. However the chart on the right above shows JPY skew is still bid for the downside particularly for long-dated options.

### Positioning



Source: Pojarliev (2011)

# Macro Carry Model (MCM)

- Macro Carry Model
  - We propose a carry model that takes fundamental data to decide on being long or short carry positions.
  - We look at a range of useful factors such as implied risk-premia, riskaversion, positioning, liquidity premia, cross-asset co-movement, lagged carry performance, performance of other strategies.
  - We use the above market data to build a statistical learning model that improves on the existing carry strategies.

# **Macro Carry Model -2**



## **Macro Carry Model -3**

		Risk	Risk	Carry		
Date	Liquidity	Premia	Aversion	Attractiveness	Positioning	SIGNAL
11/16/2001	(0.356)	(0.999)	(1.594)	(0.704)	0.580	-1
11/23/2001	(0.397)	(1.542)	(1.239)	(0.388)	1.191	1
11/30/2001	0.760	(1.573)	(0.705)	(0.390)	1.111	1
12/7/2001	1.085	(1.235)	(0.246)	(0.775)	0.358	1
12/14/2001	(0.515)	(1.102)	(0.357)	(0.990)	(0.092)	-1
12/21/2001	(0.091)	(0.857)	0.330	(0.447)	(0.487)	1
12/28/2001	(0.595)	(1.117)	0.211	(1.049)	(0.498)	1
1/4/2002	(0.703)	(1.152)	1.646	(1.106)	(1.169)	-1
1/11/2002	1.191	(1.242)	0.564	(1.010)	(0.796)	-1
1/18/2002	(0.827)	(0.626)	(1.475)	(1.006)	(0.748)	1
1/25/2002	(0.733)	(0.529)	(2.050)	0.114	0.648	-1
2/1/2002	(0.720)	(1.127)	(0.622)	0.381	(0.111)	1
2/8/2002	(0.192)	(1.046)	(1.595)	1.391	(0.468)	1
2/15/2002	(0.521)	0.590	(1.360)	2.005	(0.268)	-1
2/22/2002	(1.080)	(0.050)	(1.792)	1.379	0.941	1
3/1/2002	(1.296)	0.429	(1.710)	1.672	2.345	-1
3/8/2002	(0.261)	(1.599)	(1.823)	1.326	1.083	1
3/15/2002	(0.201)	(1.847)	(1.348)	1.448	(1.287)	1
3/22/2002	0.532	(1.866)	(1.148)	2.233	0.135	-1
3/29/2002	1.652	(1.749)	(0.809)	2.216	1.254	-1

We use a variety of statistical learning algorithms on this data (after some pre-processing) to build our model. We then use bundling to combine the models.

# **Statistical Learning with R**

- R has a wide suite of statistical models including graphical models.
- Some of the models that we find useful are rpart, stabilized linear discriminant analysis, support vector machines, random forest, boosting, nearest neighbour.
- R is well suited for these kinds of problems and has very good implementations of statistical learning algorithms and tools for visualization, pre-processing and model building.

### **MCM - Performance**



## **MCM – Performance 2**

		Vol	Vol	
	Naïve Carry	Targeting	Filtering	МСМ
Annualized Return	9.8%	2.9%	2.3%	7.2%
Annualized Volatility	11.6%	4.9%	12.1%	9.7%
Sharpe Ratio	0.84	0.59	0.19	0.74

	Naïve		Vol	
	Carry	Vol Targeting	Filtering	мсм
Semi Deviation	1.8%	0.7%	1.9%	1.3%
Gain Deviation	0.8%	0.4%	0.9%	0.8%
Loss Deviation	1.3%	0.5%	1.5%	1.1%
Downside Deviation (MAR=43.33333333333333)	2.0%	1.1%	2.1%	1.7%
Downside Deviation (Rf=0%)	1.8%	0.7%	2.0%	1.7%
Downside Deviation (0%)	1.8%	0.7%	2.0%	1.7%
Maximum Drawdown	10.0%	5.4%	17.6%	5.2%
Historical VaR (95%)	-2.5%	-0.7%	-2.8%	-2.3%
Historical ES (95%)	-3.7%	-1.5%	-4.2%	-3.1%
Modified VaR (95%)	-2.8%	-1.2%	-3.1%	-2.3%
Modified ES (95%)	-4.0%	-2.1%	-5.1%	-3.3%

# Conclusion

- Carry strategies have and continue to be a popular strategy in currencies. However they have increasingly seen dramatic corrections due to crowding and return chasing.
- We have shown a macro/fundamental based carry model that enhances on existing carry strategies.
- The model combines existing filter based approaches with other market data in an intuitive fashion. We show that the model is robust and outperforms models simple Volatility based models.
- Some of the many packages that were used in this presentation.
  e1071,randomForest,party,PerformanceAnalytics