How can we define beta in FX and how can we make it smarter? Using Python to analyse markets

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Outline

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- Introduction to FX market
  - FX trading volumes
  - What factors impact FX?
- FX beta
  - Why is FX different when it comes to beta?
  - How can we construct proxies for FX beta?
  - Comparing FX beta from different vendors
- Using Python to analyse markets
  - finmarketpy, findatapy and chartpy open source libraries

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Introduction to FX markets

G10

- Code – official name – nickname – unit = subunit (average daily turnover in April 2013)
- EUR – euro – euro, 1 euro = 100 cents (33.4%)
- GBP – British pound – sterling, 1 pound = 100 pence (11.8%)
- AUD – Australian dollar – Aussie/lifestyle, 1 dollar = 100 cents (8.6%)
- NZD – New Zealand dollar – Kiwi, 1 dollar = 100 cents (2.0%)
- USD – United States dollar – dollar, 1 dollar = 100 cents (87.0%)
- CAD – Canadian dollar – Cad/loonie, 1 dollar = 100 cents (4.6%)
- CHF – Swiss franc – Swiss/Swissie, 1 franc = 100 centimes (5.2%)
- NOK – Norwegian krone – Nokkie, 1 krone = 100 ore (1.4%)
- SEK – Swedish krona – Stokkie, 1 krona = 100 ore (1.8%)
- JPY – Japanese yen – yen, 1 yen = 100 sen, 1000 rin (23%) (smallest coin is 1 yen)
- (DKK – Danish krone – danish, 1 krone = 100 ore (0.8%))
- Written down in quotation convention
- FX transactions involves two currencies (hence the per currency turnover totals to 200%)
- BIS publish triennial central bank survey (last published 2013) which gives details of foreign exchange market activity

EM - EEMEA

- EEMEA – Emerging Europe, Middle East and Africa
  - TRY – Turkish new lira – Turkey/lira – 1 lira = 100 kurus (1.3%)
  - ZAR – South African rand – South Africa/rand, 1 rand = 100 cent (1.1%)
  - ILS – Israeli new shekel – Israel/shekel, 1 shekel = 100 agora (0.2%)
  - PLN – Polish zloty – Poland, 1 zloty = 100 grosz (0.7%)
  - CZK – Czech korona – Czech, 1 koruna = 100 haler (0.4%)
  - HUF – Hungarian forint – huf, 1 foint = 100 filler (0.4%) (smallest coin is 5 forint)
  - RUB – Russian rouble – Russia/rouble, 1 rouble = 100 kopeks (1.6%)
  - SAR – Saudi riyal – Saudi, 1 riyal = 100 halala (0.1%)
  - QAR – Qatari riyal, AED – United Arab Emirates dirham, KWD – Kuwaiti dinar

EM - LATAM

- LATAM – Latin America
  - BRL – Brazilian real – Brazil/real – 1 real = 100 centavos (1.1%)
  - MXN – Mexican peso – Mex, 1 peso = 100 centavos (2.5%)
  - CLP – Chilean peso – Chile, 1 peso = 100 centavos (0.3%) (smallest coin is 1 peso)
  - COP – Columbian peso, 1 peso = 100 centavos (0.1%)
  - PEN – Peruvian nuevo sol, ARS – Argentinean peso

EM - AEJ

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- AEJ or Non-Japan Asia or Asia
  - KRW – South Korean won – Korea/won, 1 won = 100 jeon (1.2%) (smallest coin is 1 won)
  - SGD – Singapore dollar – Sing, 1 dollar = 100 cents (1.4%)
  - INR – Indian rupee – India, 1 rupee = 100 paisa (1.0%)
  - TWD – New Taiwan dollar – Taiwan, 1 dollar = 100 cents (0.5%)
  - CNY (CHN) – Chinese renmimbi – China, 1 yuan = 10 jiao = 100 fen (2.2%)
  - MYR – Malaysian ringgit – Malay/ringgit, 1 ringgit = 100 sen (0.4%)
  - THB – Thai baht – Thailand, 1 baht = 100 satang (0.3%)
  - PHP – Philippine peso – Philippines, 1 peso = 100 centavos (0.1%)
  - IDR – Indonesian rupiah – Indonesia, 1 rupiah = 100 sen (0.2%) (50 rupiah is smallest coin)

Cross volume

- Major crosses
  - EUR/USD (24.1%), USD/JPY (18.3%), GBP/USD (8.8%)
  - AUD/USD (6.8%), USD/CAD (3.7%), USD/CHF (3.4%)
  - EUR/JPY (2.8%), EUR/GBP (1.9%), EUR/CHF (1.3%)
  - USD/MXN (2.4%), USD/CNY (2.1%), NZD/USD (1.5%), USD/RUB (1.5%)
  - USD/Others (4.0), EUR/Others (1.0%), Other pairs (1.7%) – outside major G10/EM
  - Most currencies are primarily quoted against USD
  - CEE and Scandis are quoted primarily quoted against EUR
  - We can construct other cross-rates not listed above

Total daily FX turnover

- Total Daily FX turnover is 5.3tr USD (April 2013 / BIS)
  - Spot – 2046bn USD – exchange cash in two different currencies, with T+2 settlement (CAD, TRY and RUB are T+1 settlement)
  - Outright forwards – 680bn USD – buying currency for delivery at a later date at a pre-agreed rate
  - Foreign exchange swaps – 2228bn USD – buying and selling of currency in the same quantity but two different value dates which is equivalent to entering into a spot and a forward contract
  - Currency swaps – 54bn USD
  - Options and other products – 337bn USD
- Why are FX swaps such a large part of market?
  - A spot position is not held overnight
  - Instead it is rolled using a tom/next (tomorrow/next) swap
  - The cost of the roll is related to the interest rate differential between the two currencies and is carry

Who trades FX?

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- Market participants in foreign exchange markets
  - Corporate – corporations may need to engage in foreign exchange to do cross-border business
  - Central Banks – engage in FX markets to manage their currency reserves and their home currency
- Investors
  - Sovereign Wealth Funds
  - Hedge Funds
  - Real Money
  - Retail
- Not everyone trading is FX is speculating – this creates opportunities and offsets the zero-sum game of FX
- Furthermore, investors primarily trading other asset classes will frequently need to trade FX
  - Foreign bonds and equities

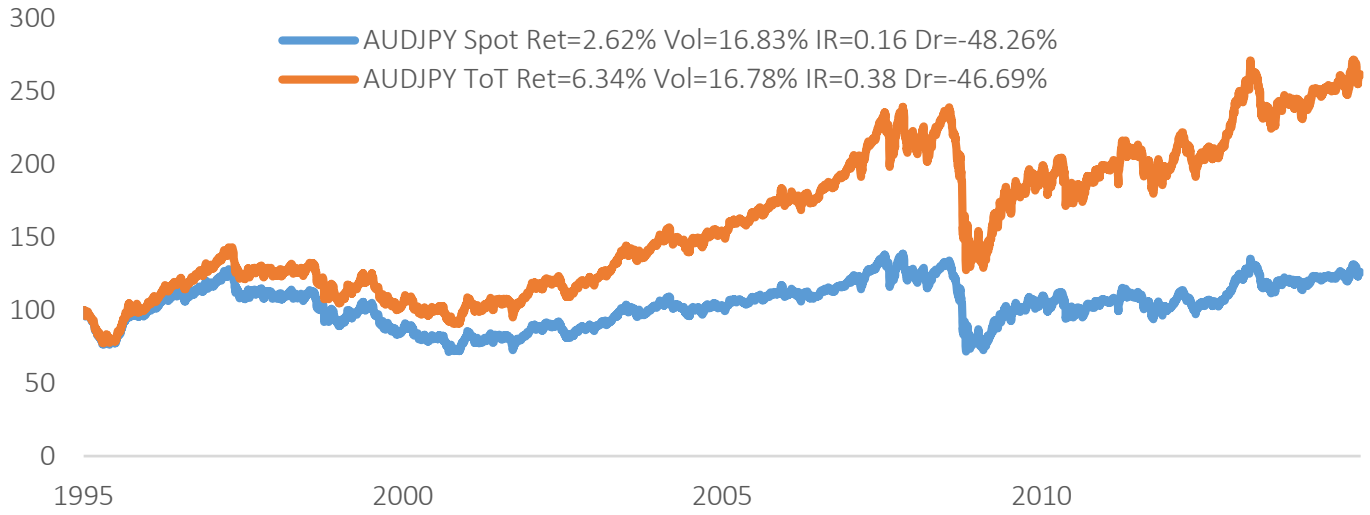
Total returns in FX

- Let us take an example spot trade
  - We sell USD/CHF
  - We borrow USD (pay USD rates)
  - With our borrowed USD we buy CHF (receive CHF rates)
- Total returns
  - Spot returns – related to USD/CHF appreciation/depreciation
  - Carry returns – related to the interest rate differential between USD and CHF rates
- Simple approximation for total returns for long spot position
  - R=spot return, C=carry return, TR=total return, S=spot, rb=interest rate of base currency (USD), rt=interest rate of terms (CHF) currency, d=days trade has been held (we accrue more interest over the weekend)

$$R_t = \frac{S_t}{S_{t-1}} - 1, C_t = (r_b - r_t)\frac{d}{360}, TR_t = R_t + C_t$$

Are total returns very different?

- Let us take the example of AUD/JPY
  - We buy AUD/JPY
  - We borrow JPY (pay JPY rates)
  - With our borrowed JPY we buy AUD (receive AUD rates)
- There is a considerable difference between the total returns which include carry and spot returns



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FX beta

What factors impact FX?

- FX moves on flows – a number of factors may drive flows
  - Carry – buying high yielding currencies funded by selling low yielding currencies
  - Trend – buying currencies which are trending higher, and selling those trending lower
  - Value – buying undervalued currencies and selling overvalued currencies using some long term measure
  - Relative yield momentum – trading relative monetary policy via FX
  - Fundamentals – underlying economic environment
  - Risk sentiment – flight to quality vs. buying risky assets
  - Flows – related to other activity, such as M&A
  - Politics – become particularly important during the Eurozone crisis
  - News – can come from many different areas
  - This is only a short list and at different times, certain factors become more important

What is beta in capital markets?

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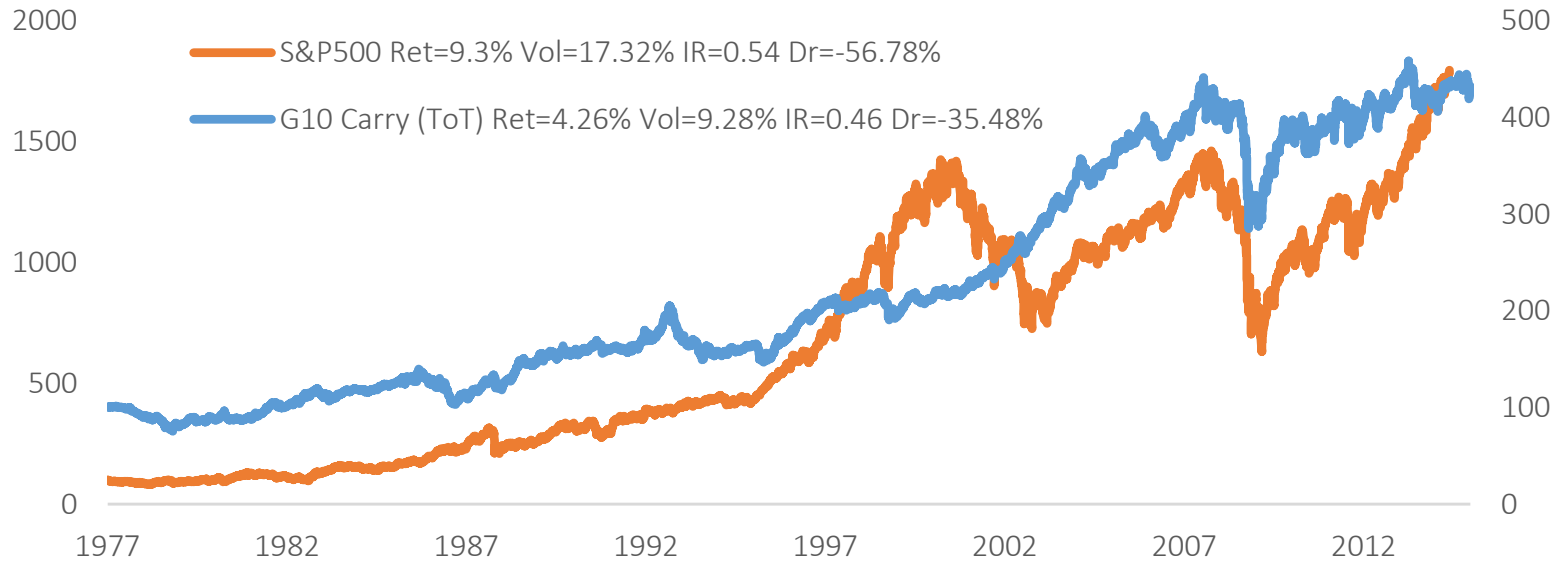
- In other asset classes the concept of beta or the concept of the market benchmark is clearer
  - How can we represent most investors' returns?
  - In equities, we could use S&P500
  - In bonds, we could use broad based indices, such as Barclays Global Aggregate
- In FX there is no such obvious benchmark
- We need to consider the major factors impacting FX and create strategies based on this
  - Carry
  - Trend
  - Value
  - Long term directional moves USD depreciation, CNY appreciation etc.

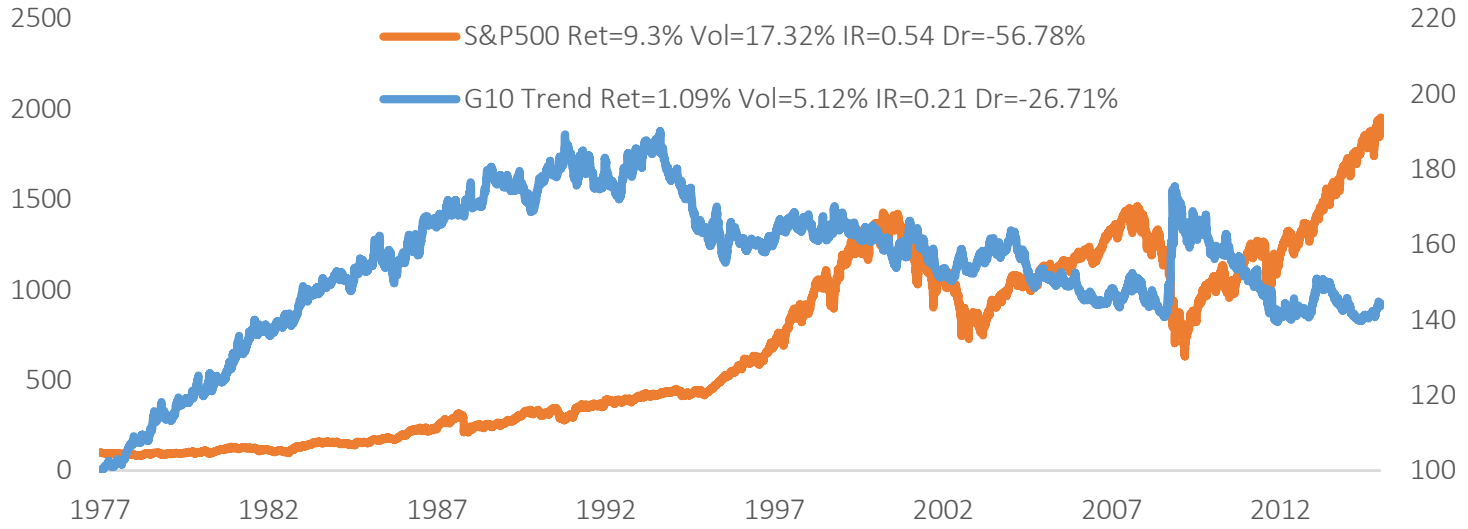
Idea for carry

- Buy high yielding currencies vs. selling low yielding currencies
  - Method of collecting risk premium within FX space
  - Generic basket, buys the top 3 highest yielders and sells 3 lowest yielders in G10
  - Displays reasonable relationship with S&P500



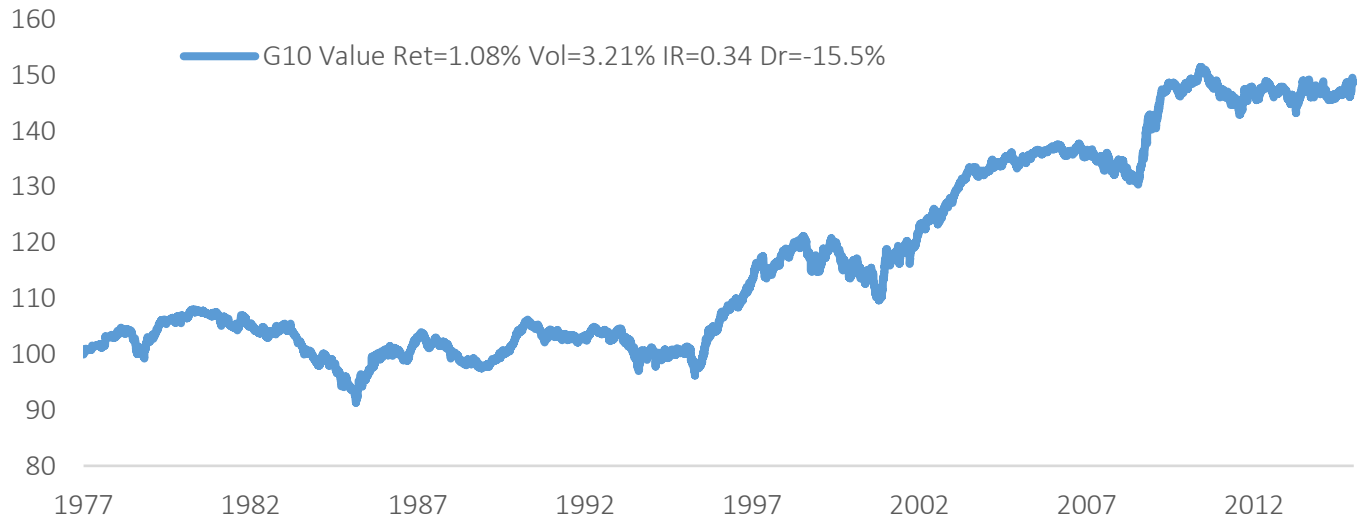
Idea for trend

- Trend is a sub-set of technical based strategies
  - Rational is that many market participants follow a similar strategy so becomes self-fulfilling
  - Even fundamental based traders may use technicals for timing
  - Generic trend basket, which trades USD, EUR and JPY crosses in G10 space (Lequeux and Acar), which is an equally weighted SMA model
  - By inspection the relationship with S&P500 seems weak



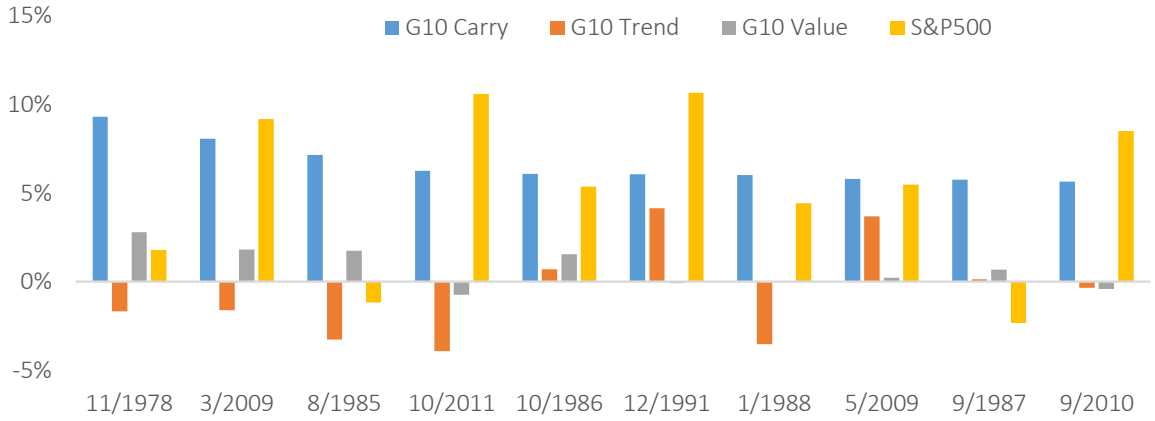
Idea for value

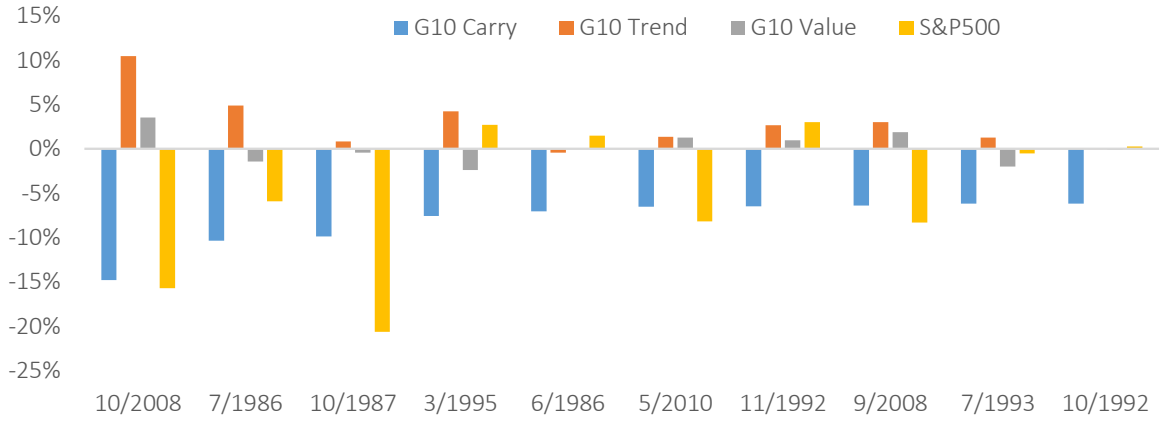
- Use a long term metric to judge valuation such as PPP (OECD or Bloomberg)
  - Sell overvalued currencies (+20%) and buy undervalued currencies (-20%)
  - Currencies can remain over/undervalued for many years



Comparing the various strategies

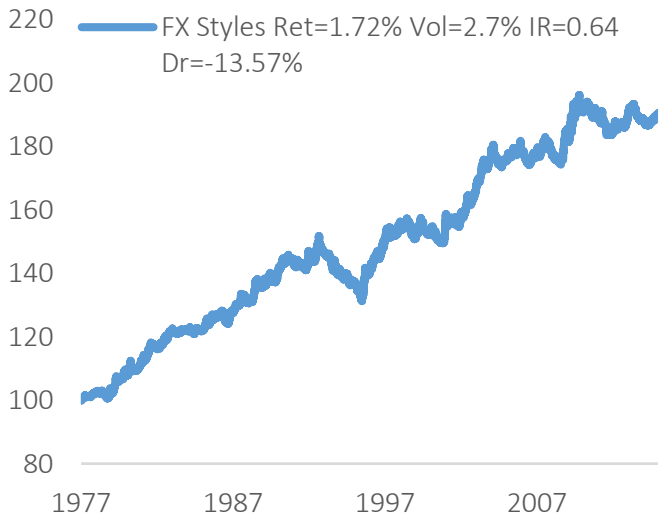
- Generally when carry is positive so is S&P500 (and vice-versa)
  - Carry performance depends on risk sentiment (as does S&P500)
  - Plot the best/worst 10 months for FX carry
- Trend seems to behave like a hedge to carry





FX styles portfolio

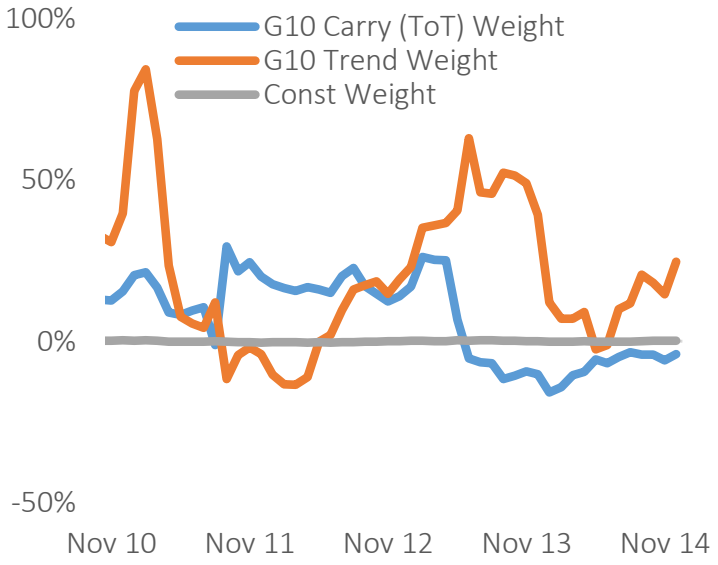
- We can create an FX styles portfolio
  - Use vol weighting to combine carry, trend and value
  - Portfolio does have drawdowns, but for a very simple portfolio it does relatively well
  - We also calculate the long term correlation between the various assets

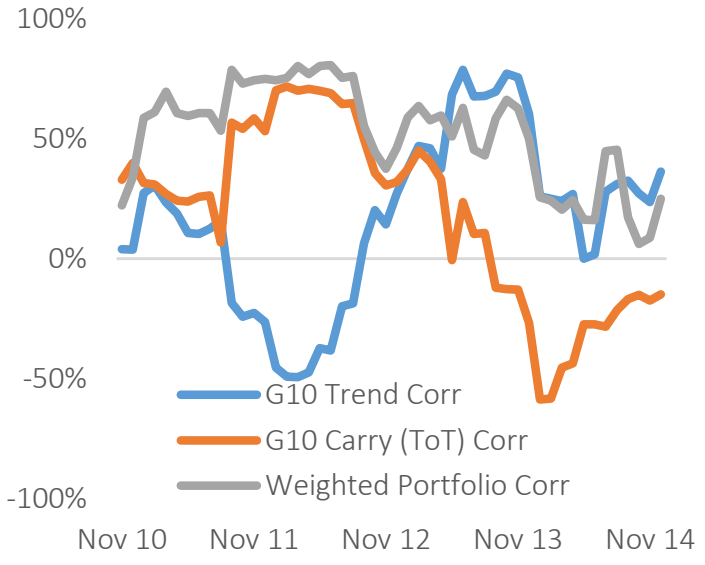


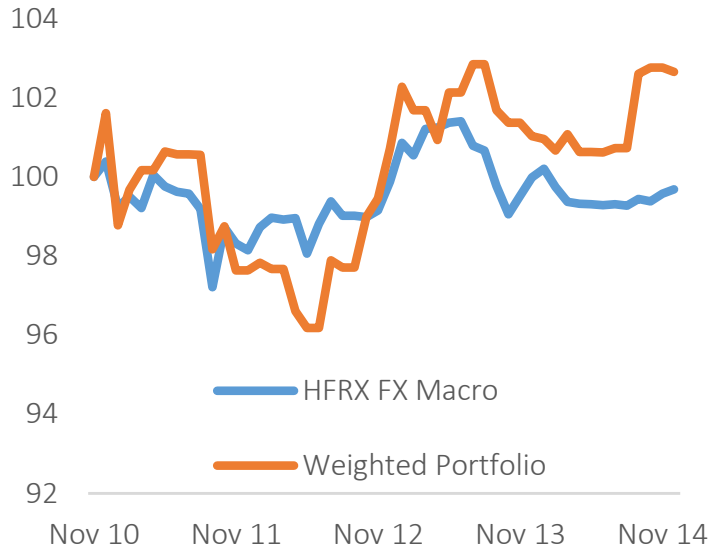
	G10 Trend	G10 Carry (ToT)	G10 Value	FX Styles	S&P500
G10 Trend		-23%	-21%	50%	-18%
G10 Carry (ToT)	-23%		18%	60%	30%
G10 Value	-21%	18%		44%	5%
FX Styles	50%	60%	44%		10%
S&P500	-18%	30%	5%	10%	

Relationship with FX fund returns

- We try to replicate FX fund returns using carry and trend beta FX indices
  - Create a portfolio based on regression which is weighted combination of carry and trend (LHS)
  - We calculate the correlation with HFRX currency fund Index of carry and trend (MID)
  - Weighted portfolio follows HFRX currency fund index relatively well, suggests our beta proxies are reasonable (RHS)

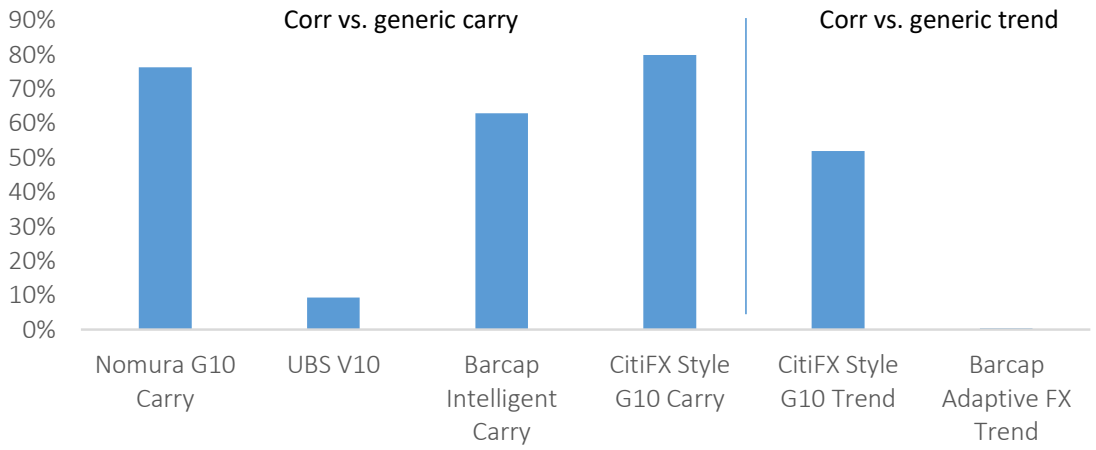


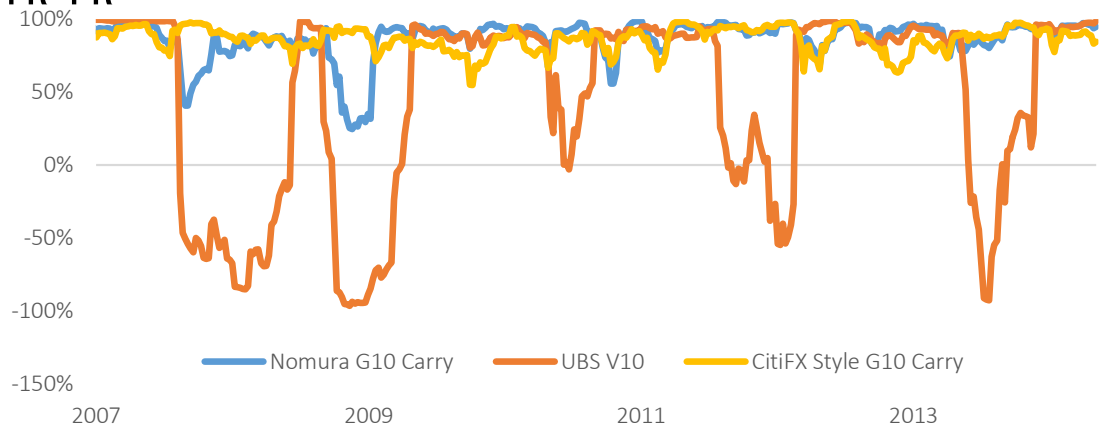


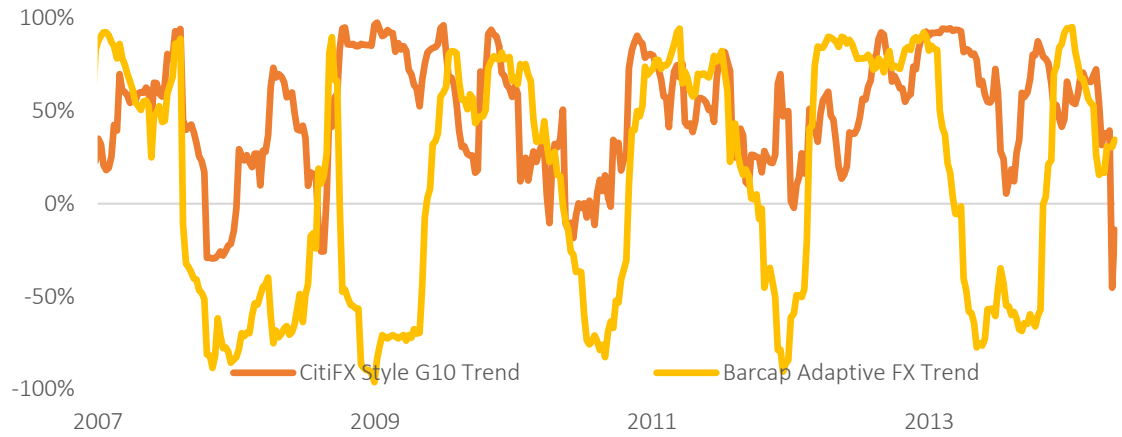


Comparing FX betas from vendors

- Compare FX betas from vendors with generic
- Not all seems to be as “beta” as others
- Could apply same approach to funds







Using Python to analyse markets

Why Python?

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- Relatively easy to use
- General purpose language (unlike R)
- Lots of great libraries for data science (SciPy stack which includes: pandas, NumP and SciPy library)
- The downside is that it is slowly than compiled languages like C++
- But processing power is cheap these days!

Open source

- Python has a strong open source ethos (like other languages)
- Benefits of open source are that we don’t have to reinvent the wheel
- When you open source your code, you get more people looking at it
- Helps to find bugs!
- And can also help to find contributors

My financial Python libraries!

- Started open source library PyThalesians, but I've now split this up into several smaller libraries, with an easier to use API
- chartpy – for doing charts with many different Python backends (plotly, bokeh and matplotlib), with a common API
- findatapy – download market data from different sources (Bloomberg, Quandl, Dukascopy etc) using easy to use API
- finmarketpy – analyse markets, do backtesting of trading strategies and much more!
- Download these from http://www.github.com/cuemacro
- **Contributors are always welcome!!**

Will do some interactive demos!

- Please also check out the examples on the GitHub pages of my libraries for much of this code

Founder of Cuemacro – Saeed Amen

- Over decade in currency markets starting at Lehman Brothers and latter at Nomura as an Executive Director developing systematic trading strategies
- One of team who created Lehman Brother's MarQCuS FX factor model, which had **2bn USD AUM**
- Created finmarketpy, findatapy and chartpy open source **Python financial analysis** libraries (grew out of pythalesians library) – finmarketpy is number 2 Python trading library on GitHub
- Co-founded **the Thalesians** a quant think tank, with finance events in London, New York & Budapest
- Now established **Cuemacro**, focused on quant consulting in **macro markets** and creating innovative datasets to model macro economic sentiment
- Projects for companies including **Investopedia** (financial news website), **RavenPack** (news data) and **TIM Group** (alpha capture data), other clients include several **large UK quant funds**.
- Presented my research at **Federal Reserve Board** and **Bank of England** and major quant conferences
- Author of **Trading Thalesians**: What the ancient world can teach us around about trading today (available on Palgrave Macmillan)

Any questions?

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- Drop me an e-mail at saeed@cuemacro.com, ring me/IB me on Bloomberg or tweet to @saeedamenfx
- Arrange a meeting to see a demo of my Python financial analysis libraries and my research