Discussion of “Carry”
by Ralph Koijen, Tobias Moskowitz, Lasse Pedersen and Ewert Vrugt

Pierre Collin-Dufresne
Columbia, EPFL & SFI

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Methodology

- Document that *carry* predicts returns in major asset classes
  - Equity index futures from 13 countries from 1988 to 2011
  - Currency forwards from 19 countries from 1983 to 2011
  - Bond synthetic futures from 10 countries from 1991 to 2011
  - Commodity futures for 23 commodities from 1980 to 2011

- Form portfolios long high carry assets and short low carry asset, where carry is defined as the slope of the futures curve.

- Analyze the performance of cross-sectional strategies within each asset class and the combined strategy across all classes

- Investigate the ability of carry to predict future returns (total and net of carry).

- Study the relation between carry portfolios and other, well-known, strategies (value, momentum).

- Study the behavior of carry strategies over local and global business cycles

- Investigate the relation between carry returns and funding and market liquidity measures.
Results

- Carry achieves high Sharpe ratios for all asset classes (ranging from .5 for commodities to .9 for equities) and as high as 1.41 combined.

- Carry strategies have very little correlation across asset classes.

- Carry strategies do not load significantly on known factors (value, momentum) or liquidity measures.

- Carry helps forecast the total return positively for all asset classes.

- Carry forecasts the price change (return net of carry) positively for all except commodities.

- Carry returns seem to have some exposure to business cycle risks.

- Only currency carry seems to have exposure to funding and market liquidity measures.
Contribution

- Long literature that documents that ‘Carry’ predicts returns, where carry defined as:
  - Dividend-yield for stock returns (Fama-French (1988))
  - Term structure slope for bond returns (Fama-Bliss (1981))
  - Conveniency yield/futures slope for commodity futures (Gorton-Hayashi-Rouwenhorst (2008))
  - Interest rate differentials for currency forwards (Bilson(1981))

- Early papers focused on time series predictions, but more recently papers have investigated cross-sectional strategies, and risk-factor explanation à la Fama-French:
  - Yang (2009) finds that beta w.r.t. a level and carry factor can explain the cross-section of commodity futures returns consistently also across maturities (proposes an investment risk-based theory).
  - Lustic, Roussanov, Verdelhan (2010) document that a three factor FF-style model can explain the cross-section of currency returns.

- Contribution of this paper:
  - Focus on cross-sectional performance of carry for futures returns.
  - Use a consistent measure of carry: the difference between futures price and spot price.
  - Analyzes the commonality (and differences) between the carry portfolios across these different asset classes.

⇒ The hope (I think) is to explain what economic mechanism drives the carry performance.
What is carry?

- Two carry definitions in words:
  - Expected return on a security can be decomposed into a model-free ex-ante observable carry and expected price appreciation.
  - Carry is the return earned if the price of the security is unchanged.

- Define carry as: \( C_0 = \frac{S_0 - F_0}{F_0} \)

- Define the return on a futures position: \( R^F = \frac{S_1 - F_0}{F_0} = \frac{S_1 - S_0}{F_0} + C_0 \)

- The futures price: \( F_0 = E^Q[S_1] \) where \( Q \) is the risk-neutral measure.

- The spot price \( S_0 = E^Q[e^{-r}(S_1 + D_1)] \)

- Thus \( F_0 = S_0 e^r - E^Q[D_1] \) the classic cash and carry formula.

- Combining we get: \( R^F = \frac{S_1 - S_0}{F_0} + \frac{S_0(1 - e^r) + E^Q[D_1]}{F_0} \)

- Compare with the spot return: \( R^S = \frac{S_1 - S_0}{S_0} + \frac{D_1}{S_0} \)

⇒ Carry on futures sorts on risk-neutral expected dividend. It is different from the carry on underlying security return when dividends are stochastic.

⇒ The two definitions of carry are not identical for spot returns when dividends are stochastic.
How to compute Futures returns? The role of Collateral

- Since futures are zero NPV investments it is not obvious how to calculate a return.
- One approach is to consider that there is some collateral $X$ required to enter the futures contract which pays $S_1 - F_0$.
- The total payoff on the collateralized future contract is then $Xe^r + S_1 - F_0$.
- Thus the return on the futures is $R^F(X) = \frac{S_1 - F_0 + Xe^r}{X} - 1$.
- As $X$ changes we change the leverage on the forward contract.
- With this definition the return on a futures is identical to a levered spot return.
- To see this, suppose we borrow $B$ to buy the spot. Then $R^S(B) = \frac{S_1 + D_1 - Be^r}{S_0 - B} - 1$
- It is clear that $R^S(S_0(1 - e^r) + D_1) = R^F(F_0) = \frac{S_1 - F_0}{F_0} + e^r - 1$
- Note the futures return has an additional component: the collateral interest.
- This may not be quantitatively very important for their results, but it could matter if collateral requirements are related to carry.
  If high dividend countries are countries with low interest rates, then if we ignore the collateral return when backtesting the carry, the strategy profits will be biased upwards, since we are ignoring the collateral cost shortfall equal to the difference between the interest earned on the low collateral (high carry) futures and the interest paid on the high collateral (low carry) futures.
What drives carry?

- In theory, it is not obvious why carry should predict total expected returns. (even with time varying carry, total expected returns could be constant if expected price appreciation offsets changes in carry.)

- But for currencies there are now a host of theoretical explanations:
  - Crash risk (Farhi-Gabaix)
  - Peso premium (Burnside, Eichenbaum and Rebelo)
  - Endogenous risk and deleveraging (Shin-Plantin)
  - Slow portfolio adjustments (Bacchetta-van Wincoop)
  - Aggregate consumption risk (Lustig-Verdelhan)

- Do these theories also explain other carry return strategies?

- I don’t know, but we can make a few observations:
  - Only currency carry has strong negative skewness: crash risk explanation ↓?
  - Carry strategies have zero correlation across asset classes: common carry risk factor ↓?
  - Business cycle exposure ↑:
    - Since dividend yield goes up and interest rates slope goes down in recessions Bond and equity Carry strategy tend to be long ‘recession countries’,
    - Since interest rates go down in recessions currency carry tends to short countries in recession

⇒ It seems difficult to find a consistent simple story to tie all carry return strategies together.

- No other well-known ‘risk-factor’ or other strategy seems to explain carry returns.
- Carry predicts price appreciation of stocks and bonds, but price depreciation for commodities, and nothing for currencies.
Why are commodities different?

- Commodities behave differently:

  - If we take the definition that carry is a return earned if the price does not change, then commodities are different from the other financial securities.
  - Cash and carry cannot be implemented easily for commodities.
  - The dividend/convenience yield in the expression $F_0 = S_0 e^r - E^Q[D_1]$ is really a ‘fudge’-factor: it is not a cash return (carry) earned if you buy the spot. Of course, you do ‘earn’ it if you roll the futures.
  - The convenience yield is also more volatile than the other carry factors.
Conclusion

- Comprehensive study of cross-sectional carry trade portfolios for futures of different asset classes.

- Interesting results that highlight some commonalities, but in my view, also many differences between all these asset classes.

- It would be interesting to tie the findings more to the available economic theories to help sort out which may be right.

- At the end, carry is a measure of something stable related to fundamental, like dividends or interest rates, divided by price (the Berk critique). So, the results show that when price tends to be low (high) relative to a measure of fundamentals they tend to appreciate (depreciate). But what drives prices? Risk, liquidity, irrationality?

- We'd like to understand whether these returns are anomalies or compensation for risk.

- If they are anomalies, since they have been the bread and butter of all multi-strategy Macro hedge funds, why do they persist? (N.B: a lot of these hedge funds, have actually blown up...drawdowns, volatility?).

- Stay tuned for the next version, where they'll explain what is driving carry!