Discussion of:

Carry

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Outline

- Summary
- Defining Carry
- Carry Returns
- Empirical Findings
- Carry differences across commodities
- Carry Unwinds

Carry Everywhere

- Using a simple and (relatively) uniform carry measure, KMPV show that long-short carrys portfolio exhibit strong performance in four asset classes:
    - 19 currencies.
    - Global equity indices in 13 countries.
    - Government bonds in 10 countries.
    - 23 commodities.
        - 6 metals; 6 energy; 8 agriculture; 3 livestock.
- The long-short portfolio weights assets in each class with a clever weighting scheme.
    - In contrast to much of the currency carry literature.

Carry Literature

- There is a long literature documenting currency-carry, and forms of carry in other asset classes
  - Currencies:
    - Bilson (1981)
  - Term Structure:
    - Fama and Bliss (1987)
  - Dividend Yields:
    - Fama and French (1988)
  - Commodities:
    - Gorton, Hayashi, and Rouwenhorst (2012)
  - However, the consistent performance of carry across asset-classes has not been recognized or illustrated as it is here.

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Carry definition

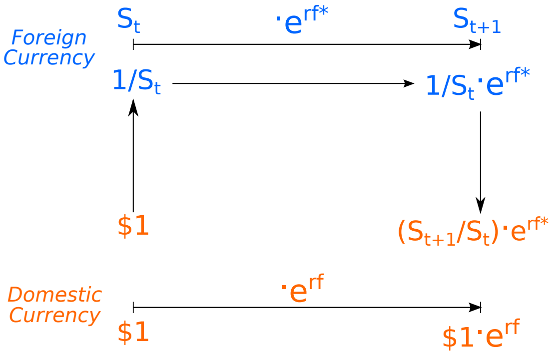
- In words, carry is very simply defined as: *the return that would be earned if the spot price didn't change*.
- Consistent with this, the mathematical definition employed by KMPV is:

$$C_t = \frac{S_t - F_t}{F_t}$$

  where S_t is spot price and F_t the one period forward.
- Depending on the asset class, the measure actually used varies somewhat.

Basic Currency Carry

- Graphically, currency carry is often illustrated as:



- And, by arbitrage,

$$F_t = S_t \times e^{(r_t^f - r_t^{f*})}$$

The basic idea

- The futures price thus reflects the interest rate differential:

$$F_t = S_t \times e^{(r_t^f - r_t^{f*})}$$

  - That is, F_t is always the future value of the spot, minus the carry.
  - If it didn't there would be an arbitrage opportunity.
- However, suppose that the spot price *doesn't* change (or vary with the carry) then buying a future today (at F_t), and then taking delivery and selling at the spot ($S_{t+1} = S_t$) gives a cash-flow of:

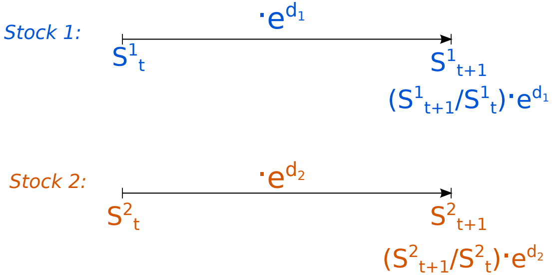
$$S_{t+1} - F_t = S_t - F_t$$

- Normalizing by F_t gives the KMPV carry measure:

$$C_t = \frac{S_t - F_t}{F_t}$$

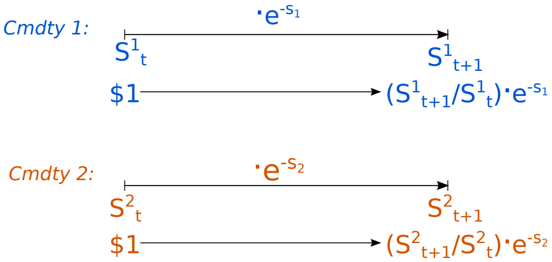
Equity Carry

- Very similar arguments apply to equities and bonds.
- If two equities pay continuously compounded dividends d_i:



Commodity Carry

- There is a rough equivalent for commodities: if the two commodities have storage costs expressed as continuous rates s_i:



Futures Return Calculation

- Since futures are zero investment contracts, the calculation of a futures return is a little ambiguous.
- One approach is to take into account the collateral X required to enter the futures contract.
- Then, the total payoff on the collateralized future contract is

$$Xe^{r_t^f} + S_{t+1} - F_t$$

and the return is:

$$R(X) = \frac{S_{t+1} - F_t + Xe^{r_t^f}}{Xe^{r_t^f}} - 1$$

  - As X changes the leverage on the forward contract changes
- For a fully collateralized futures ($X = F_t$):

$$R(X) = \frac{S_{t+1} - F_t}{F_t} + (e^{r_t^f} - 1)$$

Futures Return Calculation

- The futures return, taking into account the collateral, is:

$$R(X) = \frac{S_{t+1} - F_t + Xe^{r_t^f}}{Xe^{r_t^f}} - 1$$

- This suggests two things:
  1. It might be important to include the risk-free rate of interest in cases where the returns are calculated using futures.
  2. Should contracts be scaled by volatility before rank-weighting?
     - Volatility weighting across asset classes seemed sensible and worked well *ex-post*.
     - Why not do it within asset classes (and across time) as well?

Summary of Empirical Findings

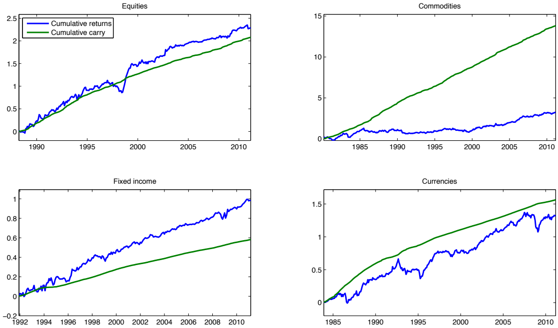
- KMPV's empirical findings are that:
  - In each asset class, the long-short carry portfolio yields high returns and high Sharpe-ratio
    - Sharpe-ratios run between 0.5 and 0.9 in asset classes.
    - Combined/Global carry portfolio SR = 1.41
    - asset-class carry portfolio returns are relatively uncorrelated
  - The results are consisten for Current Carry, and for 1-year average carry (Carry1-12).
  - Standard risk-adjustment techniques don't eliminate the carry premium.
  - Carry predicts returns out about 1 year.
  - Both static and dynamic components of carry are important.
  - Diversified carry trade seems exposed to business cycle risk.

Commodity Carry

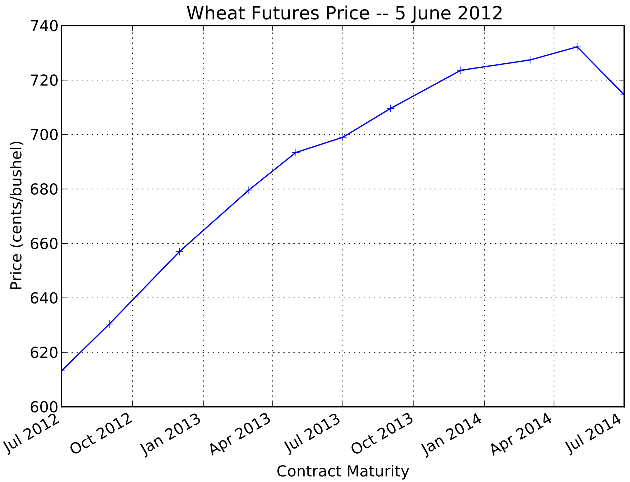
- KMPV run a set of panel regressions:

$$r^i_{t+1} = a^i + b_t + cC^i_t + \epsilon^i_{t+1}$$

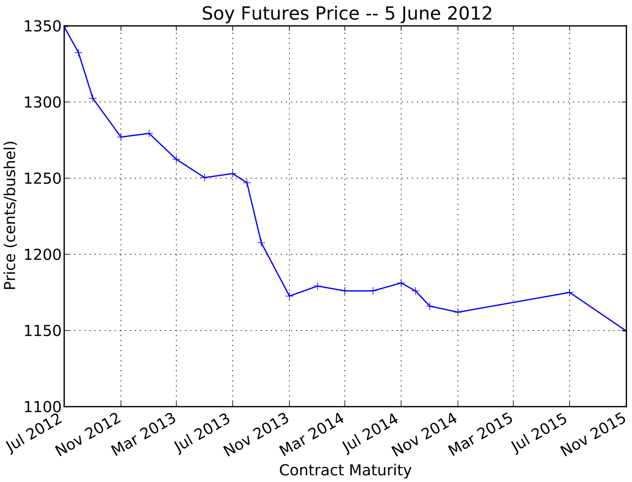
- One particularly intriguing finding is that $c << 1$ for commodities:
  - high $s(\delta)$ yields forecast strong future Δp:



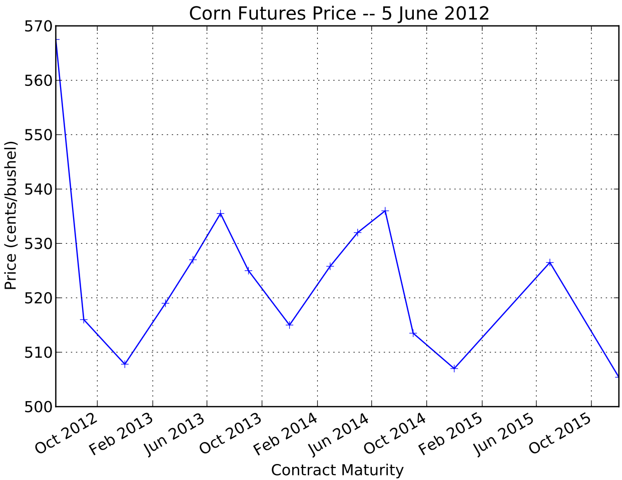
Wheat Futures



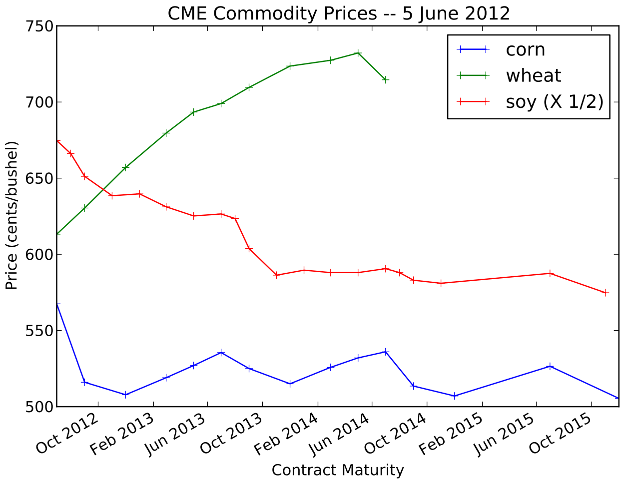
Soybeans Futures



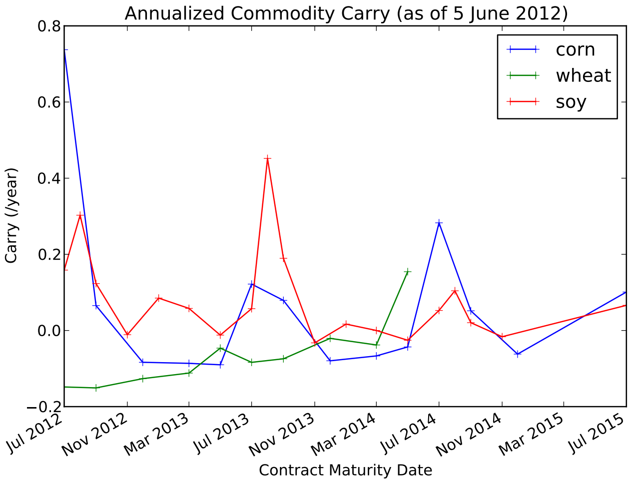
Corn Futures



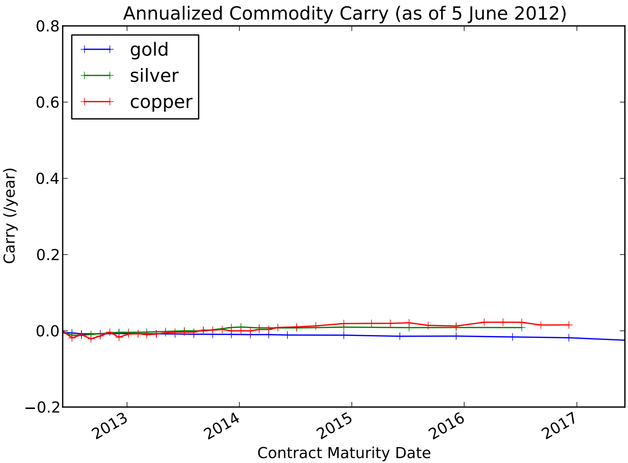
Agricultural Futures-Price Curves



Carry for Agricultural Futures



Carry for Metals Futures



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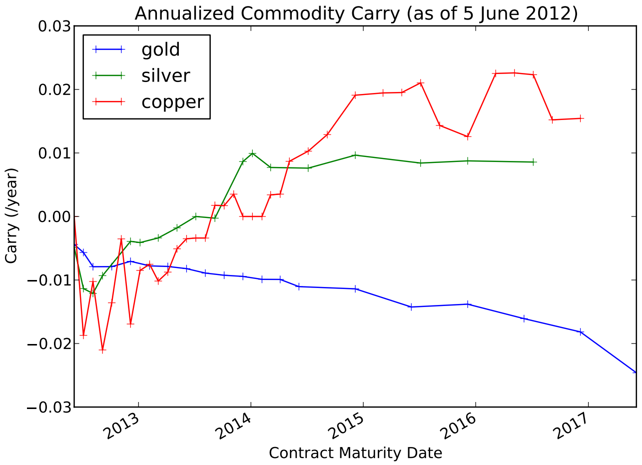
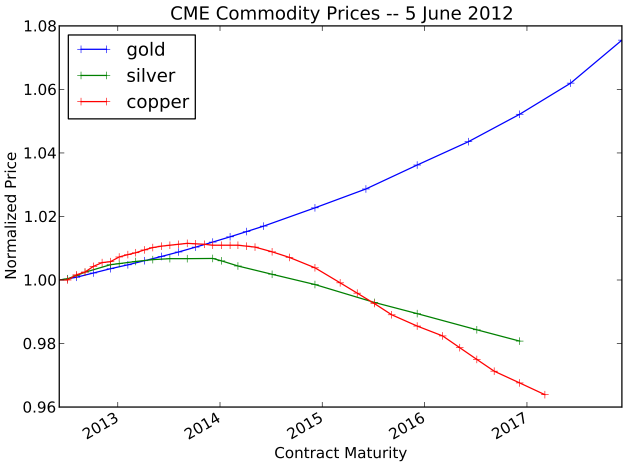


Metals Futures - Futures Curves



Static vs. Dynamic Components of Carry

- The analysis of static vs. dydnamic components of carry finds that the fraction of the carry return that can be attributed to the passive component of the strategy runs from 25% (global equities) to 67% (commodities).

$$
\begin{aligned}
E(r_{t+1}^{\text{carry trade}}) &= E(\sum_i w_t^i r_{t+1}^i) \\
&= \underbrace{\sum_i E(w_t^i) E(r_{t+1}^i)}_{E(r^{\text{passive}})} + \underbrace{\sum_i E\left[\left(w_t^i - E(w_t^i)\right)\left(r_{t+1}^i - E(r_{t+1}^i)\right)\right]}_{E(r^{\text{dynamic}})}
\end{aligned}
$$

- However, the earlier data here starts in the mid 1980's.
- Many data series start in the mid- to late-1990.
- Thus the analysis seems biased towards the finding of large static premia.

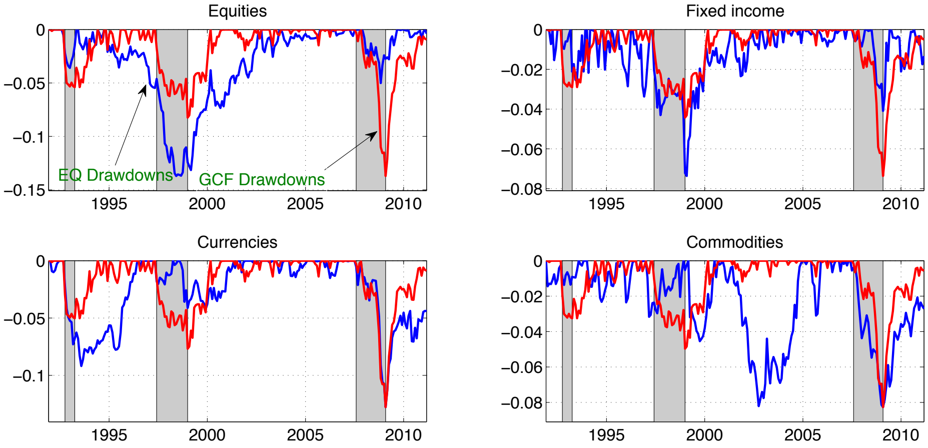
Carry Skewness

- Of course, one of the goals of this paper is to determine the underlying economic mechanism that is responsible for the premium earned by carry strategies.
- For currencies, a set of explanations relate to the risk associated with currency-crash risk:
  - *e.g.,* Farhi and Gabaix (2008), Brunnermeier, Nagel, and Pedersen (2008).
- What is striking here is that, apart from currencies, there is little negative skewness associated with non-currency carry strategies.
  - This is particularly true for the regional strategies KMPV examine.
- Thus, crash risk doesn't seems to be driving carry premia.

Common Factor

- Another set of explanations rely on the exposure of carry trades to some common factor.
  - *E.g.*, Lustig and Verdelhan (2007) argue that the currency carry trade is exposed to aggregate consumption growth risk.
- Several pieces of the the evidence here seem inconsistent with this explanation:
  - carry trades close to uncorrelated across asset classes.
  - High Sharpe ratio for diversified carry strategy. (SR$=$ 1.41.)
- However, the fact that carry trades all tend to “fall” during downturns is perhaps consistent with this hypothesis.
  - This is perhaps related to the (casual) fact that markets seem to “crash” sequentially in financial crises – sometimes with long lags between crashes.

Carry Drawdowns



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