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# Convenience yield and time adjusted basis stylized facts

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# Motivation and objective of the paper

- **Goal of the paper: to revisit the empirical stylized facts of the convenience yield with a more precise definition than in previous empirical studies;**

- **We only present a preliminary draft for oil and copper commodities;**

- **Preliminary results: stylized facts studied under our definition are more robust than under the usual empirical measure;**

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# The convenience yield (CY) is still subject to intense debates

- **Why studying the convenience yield: The convenience yield is a variable that is still subject to considerable debates (see e.g. Lautier, 2009):**
  - **Some authors believe in an economic rational at the heart of the definition of this variable, e.g Brennan, 1991:**
    - **The convenience yield is (the value of) the flow of services that accrue to the owner of commodity inventory as opposed to the owner of contracts for future delivery;**
  - **Other authors believe that it is just an ad-hoc variables to statistically reproduce backwardation, e.g. Hull (Options, futures and other derivatives);**

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# Stylized facts involving the CY usually considered

- **Main stylized facts under consideration usually (e.g Routledege et al., 2000; Dincerler et al., 2005):**
  - **Link between the spot price and the convenience yield:**
    - **The correlation should be dynamic as a decreasing function of the level of inventory;**
  - **Link between the convenience yield and the level of inventory:**
    - **The convenience yield should be a convex decreasing function of inventory: the so called Kaldor-Working curve;**
  - **Link between the volatility of the convenience yield and the level of inventory:**
    - **The volatility should be dynamic as a decreasing function of the level of inventory;**

# The time adjusted is usually used as a proxy for the CY

- **In empirical studies the convenience yield is usually proxied by the time adjusted basis, b(T):**

$$b(T) = -\frac{1}{T}\left[\ln\left[P(T)F(T)\right] - \ln\left[S\right]\right]$$

  - **P, F and S designates the zero coupon bond price, futures price and spot price, respectively; T is the (time to) maturity of the futures contract;**

- **This relation is justified by cash and carry arbitrage with an assumed deterministic convenience yield δ:**

$$F(T) = \frac{S}{P(T)}\exp(-\delta * T)$$

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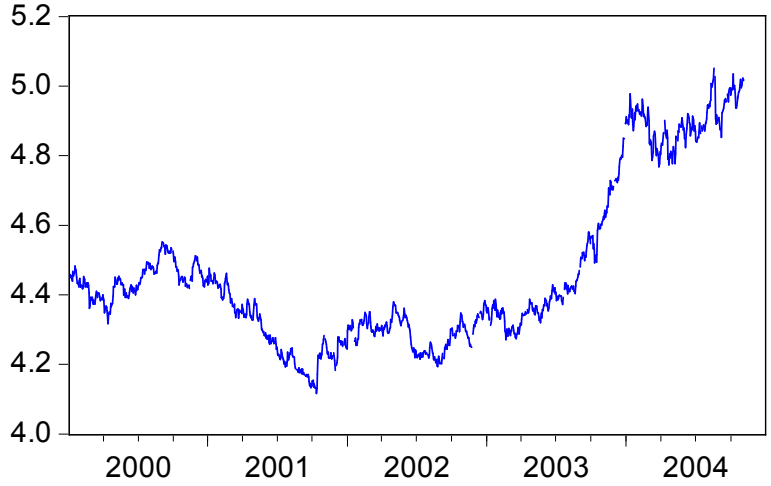
# Preliminary Data Set

- **Stochastic Behavior of the CY**

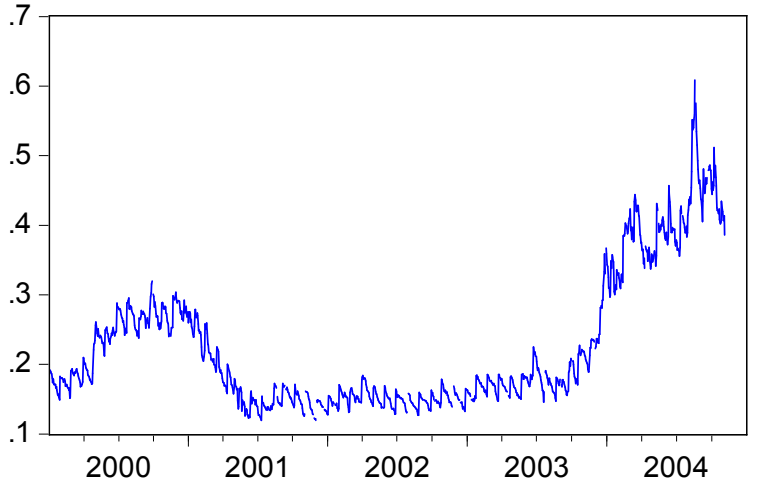
- **The convenience yield and spot price state variables are obtained by the model of Casassus and Colin-Dufresne (2005):**
  - **This model is a conditionally Gaussian affine model with stochastic risk premia;**
  - **Data from 2000 to 2004;**

# Motivation and objective of the paper: Spot and CY from CCD model

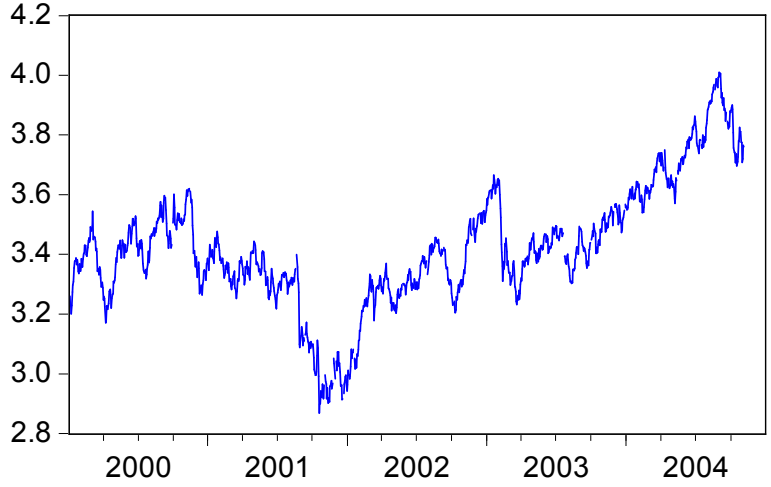
LOG_SPOT_COPPER



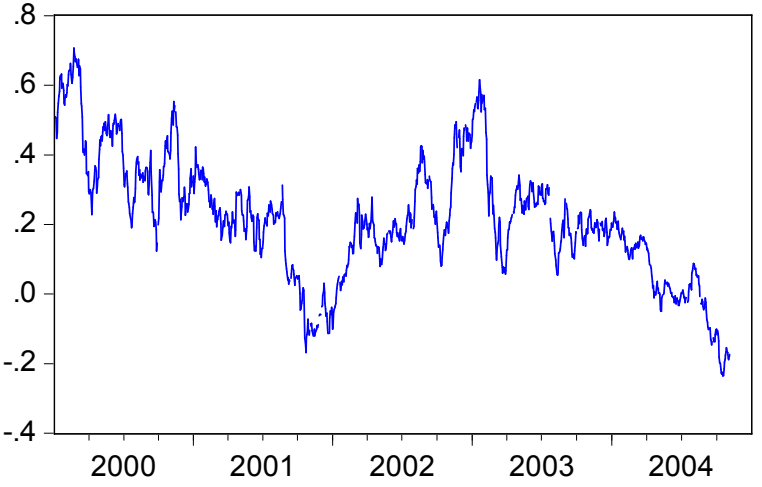

CY_COPPER




LOG_SPOT_OIL




CY_OIL



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# A stochastic CY leads to a more complex relation with the basis

- **The assumption of a deterministic convenience yield can certainly not be made!**

- **Under a dynamic convenience yield, the following relation pertain between the time adjusted basis and the convenience yield:**

$$\exp\left(b_t(T)\right) = E_t^{P^{(S)}}\left[\exp\left(\int_t^T \delta_u du\right)\right]$$

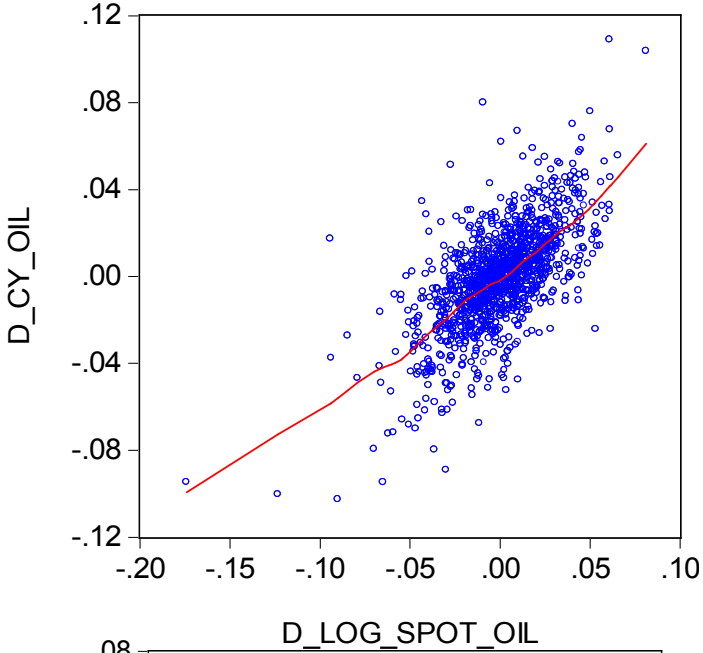
- **$P^{(S)}$ is a probability measure that takes into the convenience yield risk premium as well as the volatility of the spot price;**

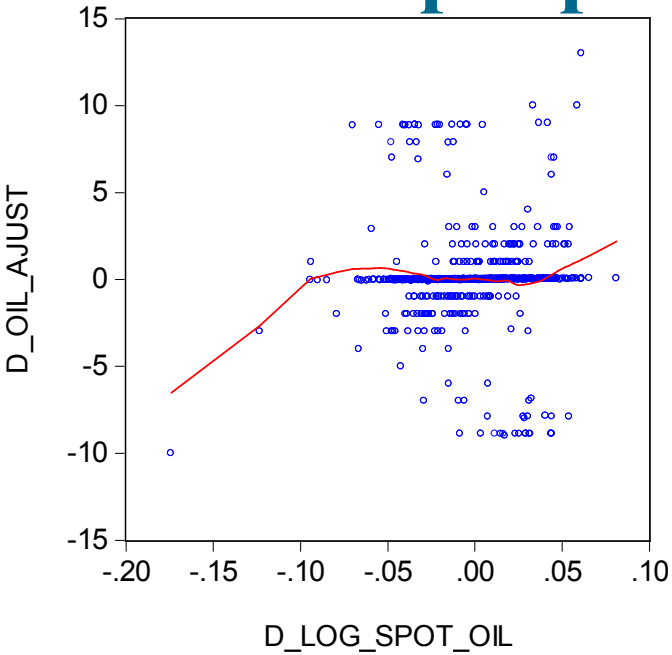
# CY is model dependent but has an economic rational

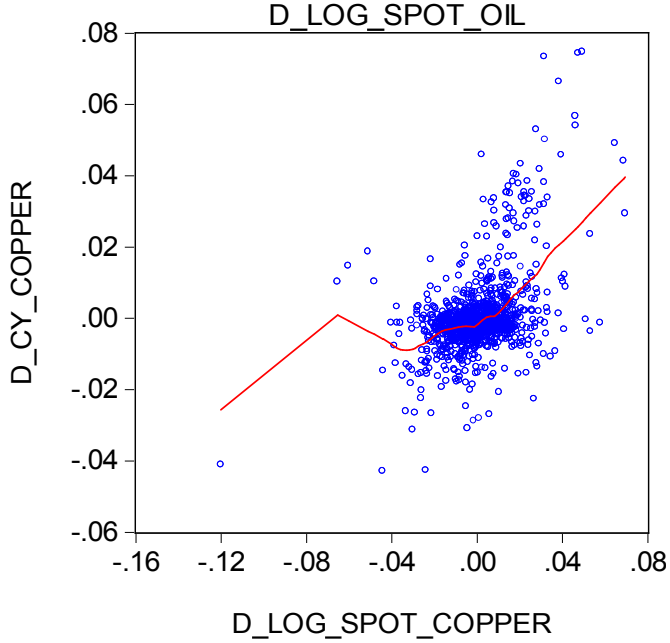
- **The time adjusted basis contains a risk premium in addition to the convenience yield (Considine and Donaldson, 2001);**

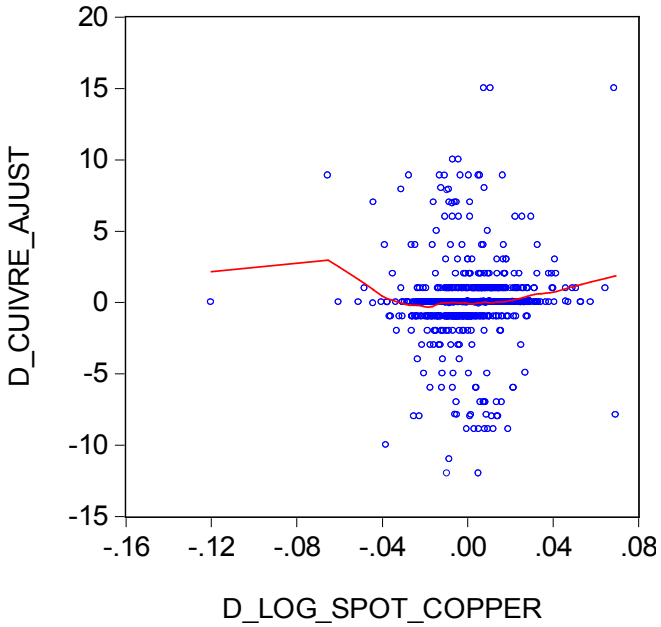
- **The convenience yield is not observable and depends on the model:**
  - **However, parameters are often consistent across models and commodities;**
  - **Schwartz and Smith (2000) find similar state variables implied by different but contemporaneous data set;**
  - **=> argue in favor of an economic interpretation of the convenience yield;**

# Link between the CY and the spot price

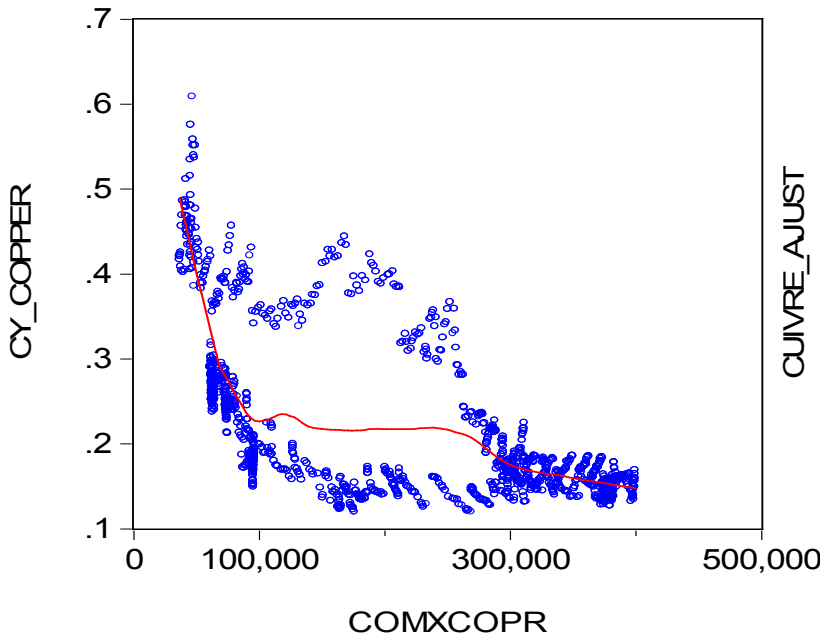


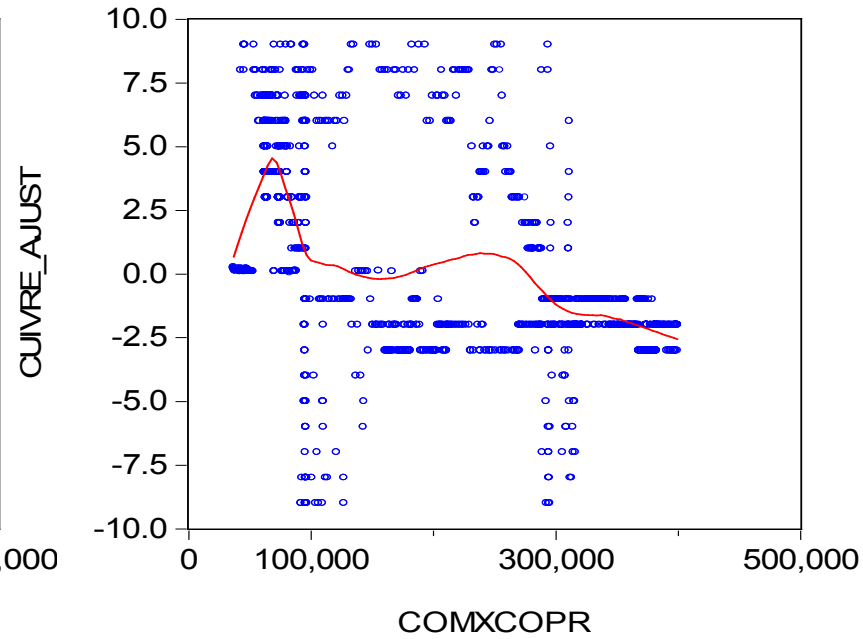



# Kaldor-Working curve for copper



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# Conclusion

- **We justified both theoretically and empirically that the time adjusted basis could not be used as a proxy to study the empirical properties of the convenience yield;**
- **We have shown that (some of) the usual assumed properties of the convenience yield are more robust under the true definition of the convenience yield**
- **Some extensions need to be done:**
  - **To check other properties of the convenience yield, e.g.:**
    - **Spot price convenience yield correlation as a function of inventory;**
    - **Convenience yield volatility as a function of inventory;**
  - **To test robustness with other models of the convenience yield;**

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# Conclusion con't

- **We are now considering recent time series:**
  - **In light of the financialization of the commodity markets;**
  - **Does the theory of storage pertain?**