Commodity Returns: Lost in Financialization

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- Many studies posit a risk-based explanation for the excess return they find
  - Asness et al (2013,JF), Szymanowska et al (2014,JF), Bakshi et al (2019,MS), ...
  - Bakshi et al (2019,MS): "The takeaway is that the high average returns of carry and momentum speak to the multifaceted nature of risk compensation in commodity markets."

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  - ...with some studies going as far back as 1960.

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- Many studies posit a risk-based explanation for the excess return they find
- Standard practice is to focus on the market in its entirety over time
  - ...with some studies going as far back as 1960.
- However, the market structure of commodity futures markets fundamentally changed around 2004

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    $\rightarrow$ Index flows increased from about \$10b in 1998, to \$15b in 2003, to $>$ \$200b in 2008

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  - Substantial increase in the investment inflows into this market
  - Strong increase in participation of institutional and index investors
    $\rightarrow$ In 2008, of the total net notional value of funds invested in commodity indexes:
    - $\approx$ 24% held by "index funds"
    - $\approx$ 42% held by "institutional investors"

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  - Strong increase in participation of institutional and index investors
- Literature shows that "financialization" impacts commodity futures markets in many dimensions, e.g.: prices and volatilities ↑, price informativeness ↓
  - Basak & Pavlova (2016,JF), Broogard et al (2019,RFS), Baker (2021,MS), Goldstein & Yang (2022,JF),...

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- Literature shows that "financialization" impacts commodity futures markets in many dimensions, e.g.: prices and volatilities ↑, price informativeness ↓
- **Question:** What is the impact of financialization on return dynamics of commodity trading strategies?
  - Entry of index investors should improve risk sharing and lower risk premia (e.g., models of reduced limited participation as Chabakauri and Rytchkov (2021,JFE)).

This Paper

- Impact of financialization (and index investing) on return dynamics of commodity long-short strategies

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- New stylized fact:
  - About 80% of commodity futures strategies published in the academic literature are unprofitable post-financialization
    - 13 of the 21 strategies we replicate generate a significant spread in returns pre-financialization
    - ...however, this number falls to 3 post-financialization

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- Deterioration in returns across investment strategies is systematic and not idiosyncratic
- Systematic index-mechanism associated with "financialization" that might help explain the depression of commodity investment returns

Literature Review

1. **Commodity Factors and Trading Strategies:**
   - Gorton et al (2012,RF), Hong & Yogo (2012,JFE), Szymanowska et al (2014,JF), Bianchi et al (2015,JBF), Boons & Prado (2019,JF), Bakshi et al (2019,MS), ...
2. **"Financialization" of Commodity Futures Markets:**
   - Cheng & Xiong (2014), Henderson et al (2015,RFS), Basak & Pavlova (2016,JF), Baker (2021,MS), Goldstein & Yang (2022,JF), Da et al (2024,MS), ...
3. **Post-Publication Return Predictors:**
   - McLean & Pontiff (2016,JF), Jensen et al (2022,JF), Bartram et al (2025,JFQA), ...
4. **Impact of Index Investing on Asset Prices:**
   - Broogard et al (2019,RFS), Chabakauri and Rytchkov (2021,JFE), Breugem and Buss (2019,RFS), Buffa et al (2022,JPE), ...

Data - Commodity Returns

- Futures on 32 commodities;
- Focus on Monthly returns from March 1986 to August 2021;
- From Commodity Research Bureau up to 2014, then from Datastream and Factset;
- Excess returns between t and $t+1$ (i.e. r_{t+1}) computed as in Baski et al (2019,MS):
  - Take a position in the future contract with the *second* shortest maturity at the end of month t (i.e. $F_t^{(1)}$) ...
  - ... While guaranteeing that its first *notice day* is *after* the end of month $t+1$;
  - Returns calculated as:

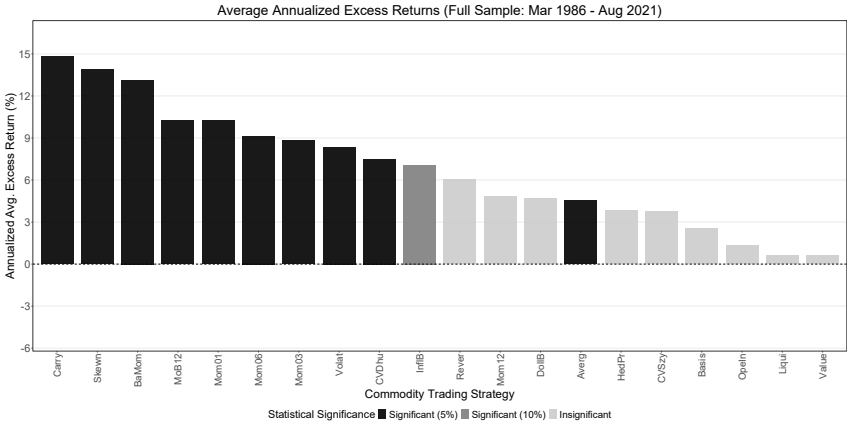
$$r_{t+1} = \frac{1}{F_t^{(1)}}(F_{t+1}^{(1)} - F_t^{(1)})$$

additional data

Strategies - Commodity (HML) Factors Overview

- **Carry** and **Basis**
  Bakshi et al (2019,MS), Szymanowksa et al (2014,JF) and Boons & Prado (2019,JF).
- **Short** (1-, 3-) and **Long** (6-, 12-months) **term Momentum**
  Miffre & Rallis (2007,JBF), Bakshi et al (2019,MS), Szymanowksa et al (2014,JF), among others.
- **Basis-Momentum**
  Boons & Prado (2019,JF).
- **Value**
  Asness et al (2013,JF).
- **Reversal**
  Bianchi et al (2015,JBF).
- **Coefficients of Variation**, w/ *returns* or *prices*. Dhume (2010) or Szymanowksa et al (2014,JF)
- **Volatility** and **Inventory**
  Gorton et al (2012,RF).
- **Open Interest**
  Hong & Yogo (2012,JFE).
- **Hedging Pressure**
  de Roon et al (2000,JF), among others.
- **Liquidity**
  Marshall et al (2012,RFS), Marshall et al (2013,JBF).
- **Inflation-β** and **Dollar-β**
  Erb & Harvey (2006,FAJ), among others.
- **Skewness**
  Fernandez-Perez et al (2018,JBF).
- **Average**
  Bakshi et al (2019,MS).

Average Excess Returns to Commodity Strategies

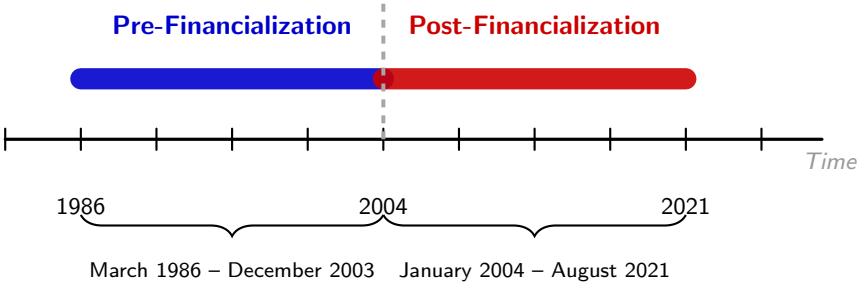


- 12 of 20 strategies generate a significant excess return over the sample period

Correlation Matrix

Effect of Financialization

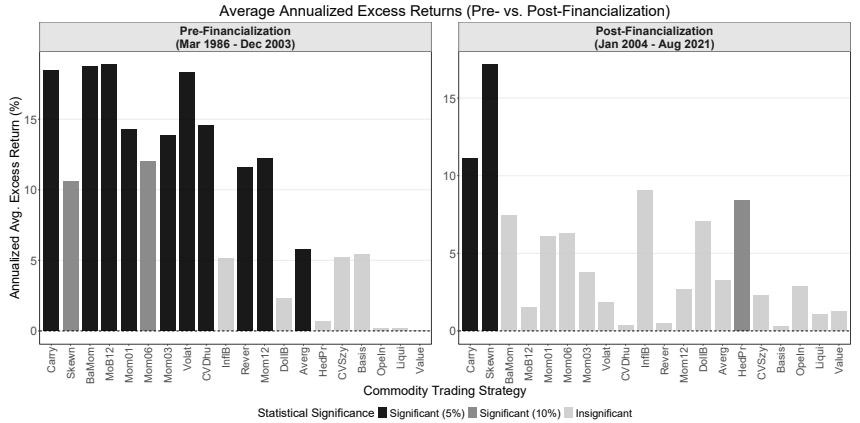
- Split sample period into two, centered around Financialization:



- Compare strategy average returns before and after Financialization.

Why 2004? | Bayesian Analysis

Effect of Financialization



- Most strategies see a significant reduction in average returns post-financialization
- ...economic and statistical ⏩ robust to excluding gfc & covid ⏩ Figure Pattern ⏩ Equity Strategies

Alternative Hypothesis: Publication?

- Most commodity futures strategies published in the literature in the post-financialization period
- Reduction in strategy returns might be a post-publication effect, not a financialization effect
  - Decay in strategy returns post-publication: McLean and Pontiff (2016,JF) in equity, Bartram et al (2023,JFQA) in FX
- Offers an alternative mechanism for why returns have deteriorated
- Run the following specification to test this alternative hypothesis:

$$R_{i,t} = \alpha_i + \beta_1 \text{Post-Fin}_t + \beta_2 \text{Post-Pub}_{i,t} + e_{i,t}$$

Robustness - Financialization or Publication?

Table: Regression of Returns to Commodity Strategies on Post-Publication and Post-Financialization Indicators

	Model (1)	Model (2)	Model (3)	Model (4)
Post-Financialization	-0.498^{***}	-0.407^{**}		
	$[-3.74]$	$[-2.44]$		
Post-FinaToPublication			-0.406^{**}	
			$[-2.41]$	
Post-Publication		-0.181	-0.583^{***}	-0.475^{***}
		$[-0.91]$	$[-3.51]$	$[-2.97]$
Observations	8499	8499	8499	8499
Factor Fixed Effect	Yes	Yes	Yes	Yes

- About 70% of decay in returns to strategies can be attributable to the financialization

Channel: Systematic or Idiosyncratic Strategy Deterioration?

- Estimate a latent factor model to explain the **returns** to the strategies
  1. Extract latent factors from cross-section of strategy returns using RP-PCA of Lettau & Pelger (2020,RFS)
  2. Select **six factors** based on the scree plot (e.g., Giglio et al (2024,JF)) scree plot
  3. Run Fama & MacBeth (1973,JPE) **two-step asset pricing tests** of the returns to the commodity futures strategies on the first six RP-PCs:
     1. Over the full sample (03/1986-08/2021);
     2. Pre-financialization (03/1986-12/2003);
     3. Post-financialization (01/2004-08/2021).
- Do we need as many factors as strategies to significantly reduce the strategy alphas?
- How does the model perform pre- and post-financialization?

Systematic or Idiosyncratic Strategy Deterioration? - Results

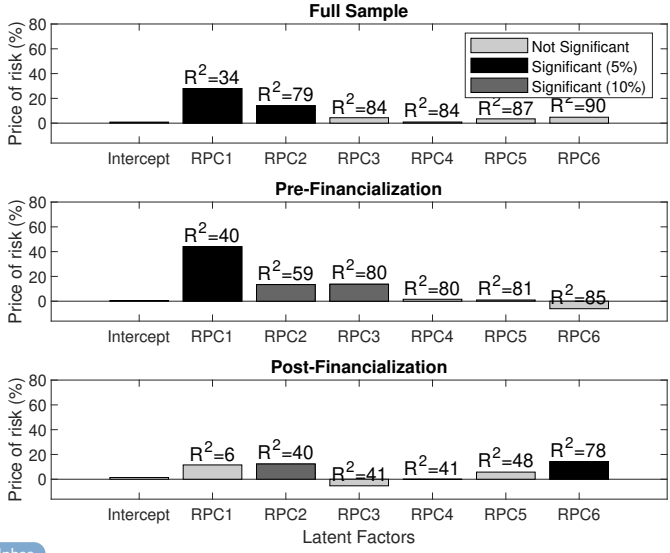


Table | 1 stage alphas

Rolling Average Returns of Latent Factors

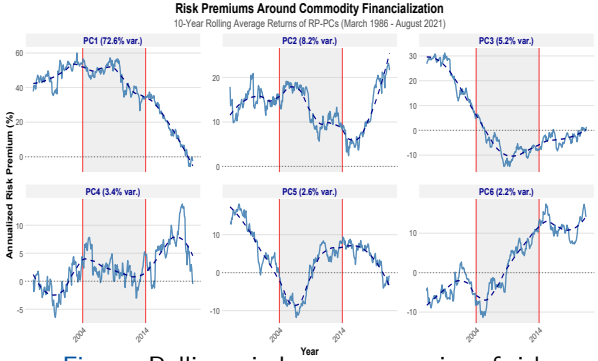


Figure: Rolling-window average price of risk

- (Especially) PC1, PC3 and PC6 have seen material changes in average returns pre- vs post- financialization

Index Flow Mechanism

- Financialization was marked by a rise in indexing, e.g. Brogaard et al. (2019,RFS)
- The entry of index investors enhances market's the aggregate risk-bearing capacity
  - Improved risk sharing arises from reduced market segmentation
- This results in risk premium compression for assets heavily featured in the index
  - The reduction is stronger when index traders are more committed, i.e., when index weights are higher
- **Implication**: Excess returns decay should be positively related to exposure to commodities with high weights indices

Index Flow Mechanism

- Formal test of this hypothesis:

$$R_{i,t+1} = \alpha_i + \beta_1 D_{i,t} + \Gamma D_{i,t} * \delta_t + e_{i,t+1}$$

- where α_i is a dummy capturing strategy fixed effects
- where $D_{i,t}$ is dummy equal to 1 if the futures strategy i has exposure to any commodity in the top-3 weighted commodities in the DJCI index at time t
- $D_{i,t} * \delta_t$ dummy that captures exposure by time fixed effects

Index Flow Mechanism - Results

Table: **Index Flow Mechanism - Exposure × Time Dummy Regressions**

	Baseline	Model (2)	Model (3)
$D_{i,t}$	-0.436^{***}	-0.498^{***}	-0.365^{***}
	$[-4.94]$	$[-4.00]$	$[-4.57]$
Strategy Fixed Effects	Yes	Yes	Yes
Exposure × Time Fixed Effects	Yes	Yes	Yes
Open interest control	No	Yes	No
Dollar open interest control	No	No	Yes
Observations	4139	4139	3933

- Exposure to the index has a negative effect on the average return of a futures strategy
- Results hold for reasonable variations of top-3 commodities in the index

Model in a Nutshell

- **Environment:**
  - Two dates $t \in \{0, 1\}$; N risky contracts with terminal *excess* payoffs (mean μ, covariance Σ); fixed net supply s.
  - Prices in excess-return units: $P = \mu - \pi$ (so $R_f = 1$ and $d \log P = -(P)^{-1} d\pi$).
- **Agents:**
  - **Incumbents (CARA γ_0):** Mean–variance demand $q_0(\pi) = \frac{1}{\gamma_0} \Sigma^{-1} \pi$.
  - **Entrants (mass λ, capital W, CRRA ρ_I):** Track benchmark $\omega \in \Delta^{N-1}$ with intensity $\kappa \geq 0$.

Model — Predictions

Testable **empirical predictions**:

1. Greater entrant scale A (index AUM/inflows) $\Rightarrow$ decrease in average risk premia / excess returns ($\pi_1 < \pi_0$). ✓
2. **Cross-section:** The premium compression is larger where index weights ω are higher and where long absorption is needed ($s_i > 0$); state variables (e.g., basis / inventories) strengthen this effect. ✓
3. **Discipline:** Tighter benchmarking (higher κ, lower realized tracking error) reduces premia in assets that entrants are underweight relative to equilibrium (BUC$^\sharp$ condition). [proxied via tracking error] ✓
4. **Systematic repricing:** The decline in average returns is primarily attributable to compression in systematic risk factor premia (post–entry). ✓

Conclusion

- Excess returns to most commodity futures strategies recently published in the academic literature have deteriorated
- Significant majority of this deterioration is attributable to the financialization of commodity markets
- Deterioration in returns of the strategies can be linked to the fundamental drivers of returns in this market
- Evidence shows that indexing negatively impacts commodity futures strategy returns

- Thanks!

Data - Additional Data

- **Additional data on characteristics:**
  - *Hedging pressure*: short and long hedge positions by large traders (i.e. #-contracts) from Commitment of Traders reports issued by the Commodity Futures Trading Commission (CFTC);
  - *Open interest*: total open interest from Commitment of Traders reports issued by CFTC;
  - *Inventory*: from Gorton et al (2012,RF);
  - *Volume*: from Datastream and Factset;
  - *U.S. dollar* and *Inflation*: from FED Board and FRED.
- **Data on constituents of commodity indexes and their weights:**
  - Dow Jones Commodity Index (DJCI);
  - Available from January 2004.

back

Correlation Matrix

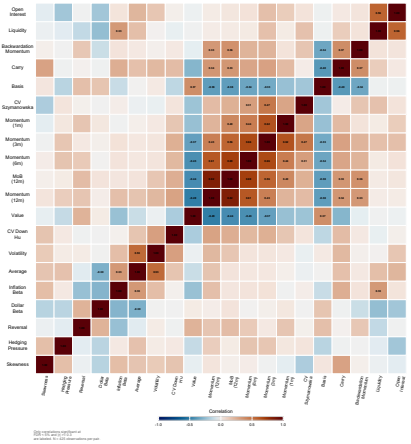


Figure: Correlation matrix of the commodity investment strategies

Correlations among the strategies are generally not very high $\Rightarrow$ the strategies tend to capture different dynamics (as confirmed also by spanning tests) back

Extra Slides - Scree Plot

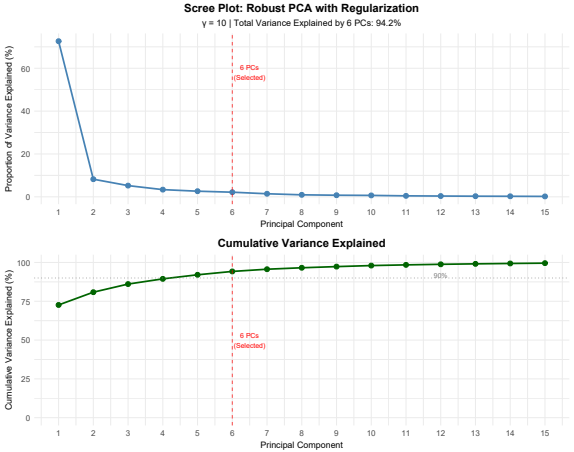


Figure: Scree plot of the PCA components

Extra Slides - Why 2004

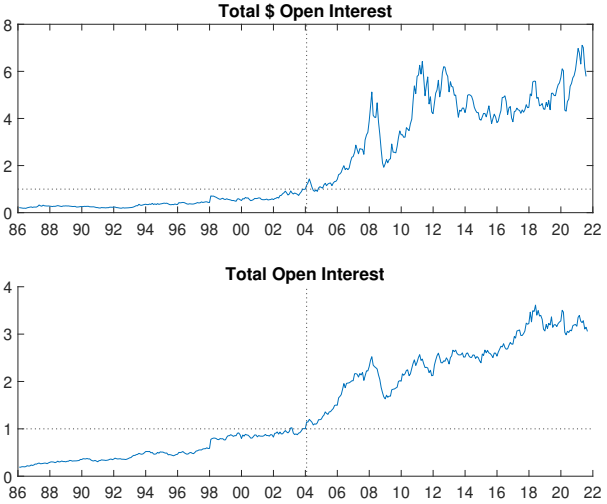


Figure: Total (Dollar) Open Interest

Extra Slides - Why 2004 - Bayesian Analysis

Figure: Inferring the Financialization Breakpoint

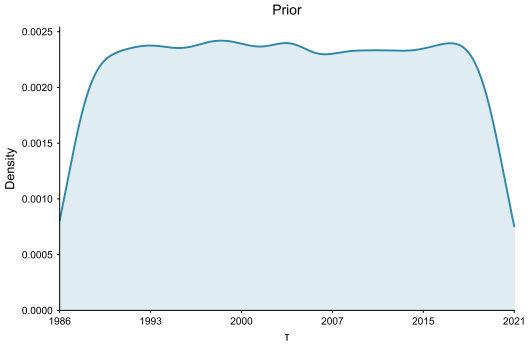


Figure: Prior Distribution of Financ. Date

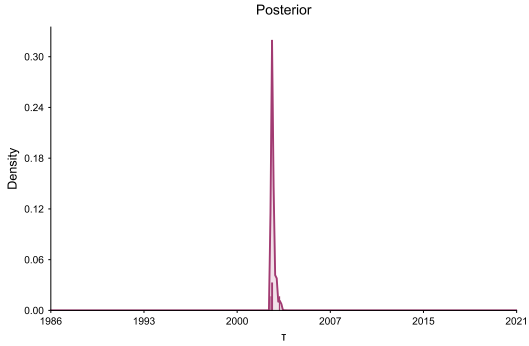


Figure: Posterior Distribution of Financ. Date

The posterior distribution for most likely date of financ. is centered around 2003 back

Extra Slides - Excluding GFC and Covid

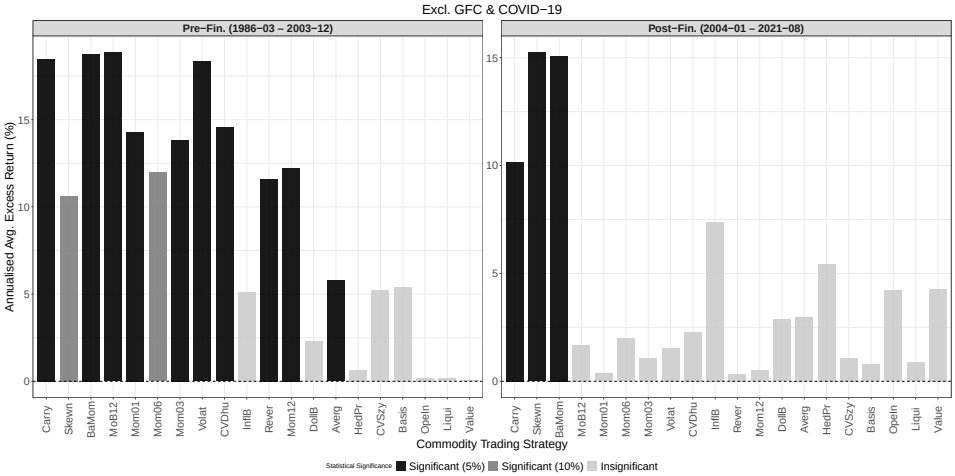


Figure: Average Returns to the Strategies

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Impact of Financialization on Commodity Strategies

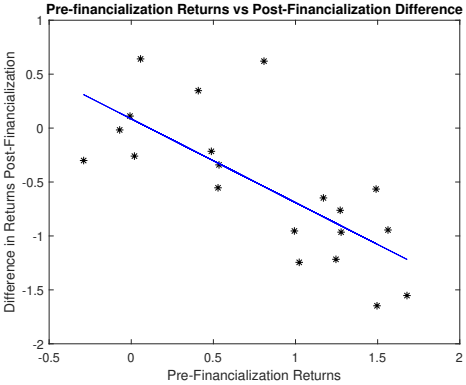

Figure: Relation between pre- and post-financializtion returns

Commodity strategies with higher returns pre-finan. show higher declines in returns post-finan.

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Impact of Financialization on Equity Strategies Applied to Commodities

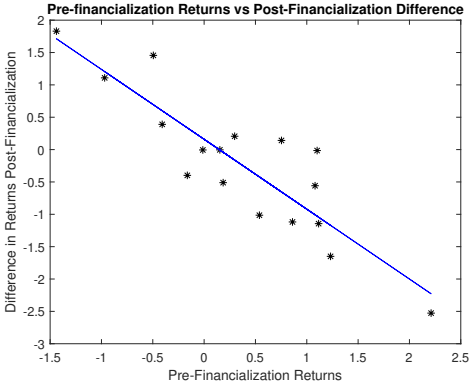


Figure: Relation between pre- and post-financializtion returns to equity strategies

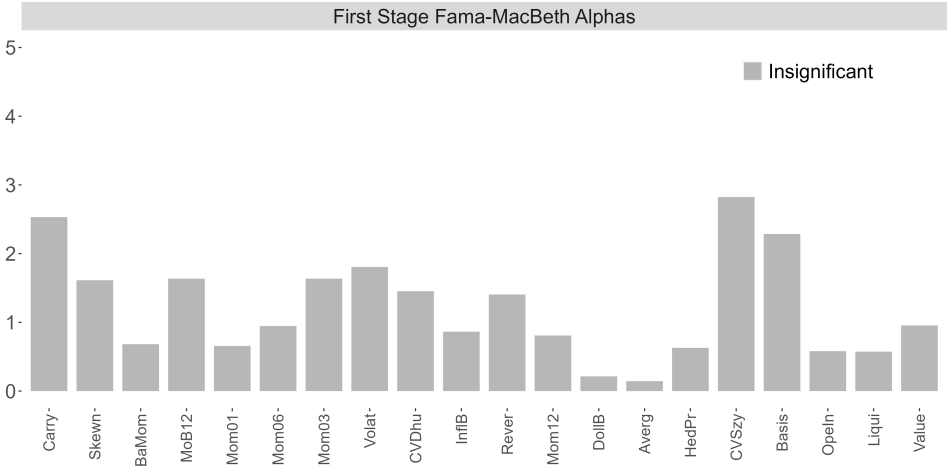
Equity strategies (applied to commodities) with higher returns pre-finan. show higher declines in returns post-finan. back

Unconditional Asset Pricing Tests - Second Stage Regressions

	Intercept	PC1	PC2	PC3	PC4	PC5	PC6
Panel A: Full Sample							
RP (%)	0.82	27.86***	14.64***	4.86	1.36	3.29	5.22
$tstat_{\pi}$	[0.82]	[3.04]	[2.74]	[0.91]	[0.29]	[0.74]	[1.25]
TS R^2 (%)		71.9	80.2	85.6	89.0	91.8	94.0
Panel B: Pre-Financialization							
	Intercept	PC1	PC2	PC3	PC4	PC5	PC6
RP (%)	0.46	43.14***	14.13*	14.64*	1.40	2.24	-5.32
$tstat_{\pi}$	[0.33]	[3.03]	[1.82]	[1.88]	[0.21]	[0.35]	[-0.87]
TS R^2 (%)		83.0	90.1	92.7	94.5	95.9	96.8
Panel C: Post-Financialization							
	Intercept	PC1	PC2	PC3	PC4	PC5	PC6
RP (%)	1.34	11.65	13.07*	-5.29	1.03	4.69	14.63**
$tstat_{\pi}$	[1.06]	[1.04]	[1.76]	[-0.74]	[0.15]	[0.77]	[2.58]
TS R^2 (%)		53.1	74.2	81.6	86.8	90.8	93.6

back Figure | 1 stage alphas

Latent Factor pricing - Results



- First stage alphas across strategies economically and statistically insignificant.

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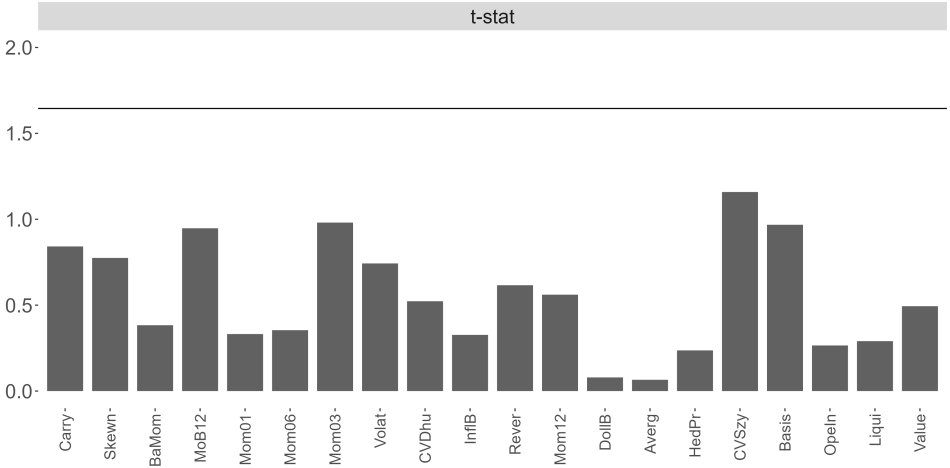
Latent Factor pricing - Results



- First stage alphas t-stat materially small.

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