The Challenges of Oil Investing – Contango & Crowding

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Ludwig B. Chincarini, Ph.D., CFA
University of San Francisco
United States Commodity Fund Investments

Thank you for coming. Thanks to the WEAI Conference.
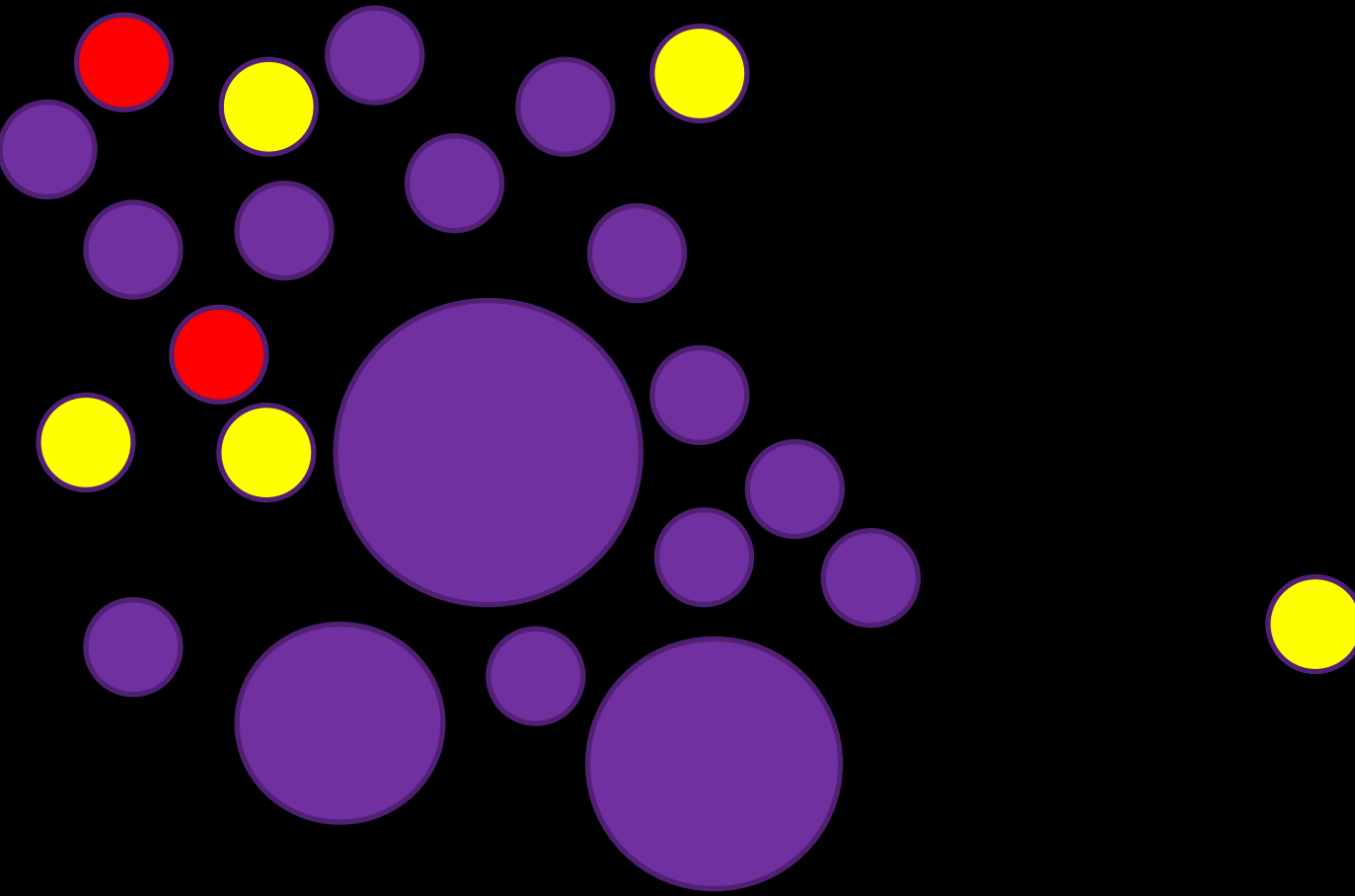
1. Crowding Idea is Spreading

- *The Crisis of Crowding* by Ludwig Chincarini.

- Recent academic literature has spawned in the last 6 years.

- For more info, go to: http://ludwigbc.com/presentations/slides/

2. Background of Research

- Oil Investing is difficult, especially when investors interpret spot oil as benchmark

- Many reasons why oil investing can be difficult

- A new/old reason - crowding

3. Contango and Tracking Error
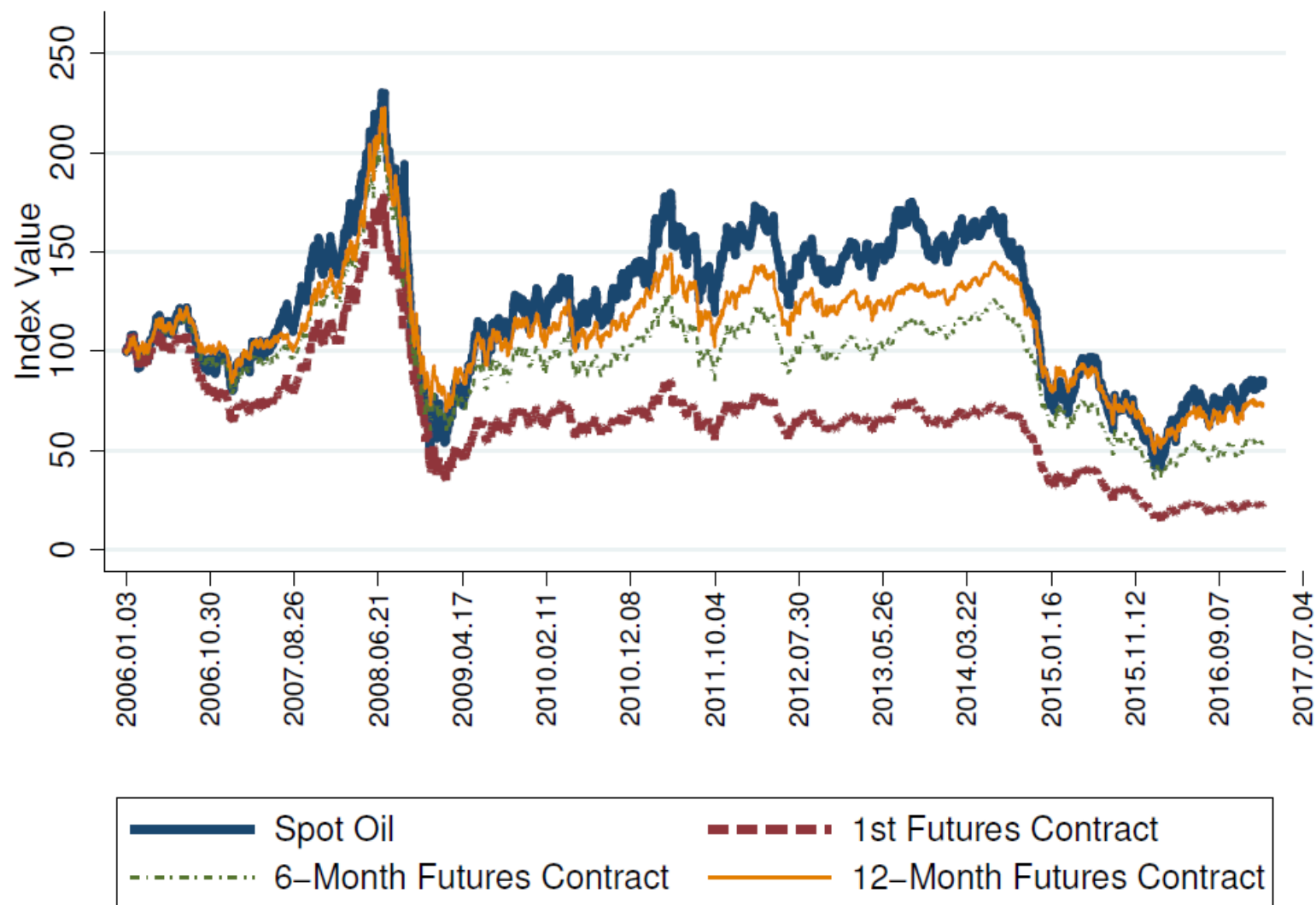
3. Contango and Tracking Error

3. Contango and Tracking Error

- Contango has become dominant situation in oil futures market and part of the problem
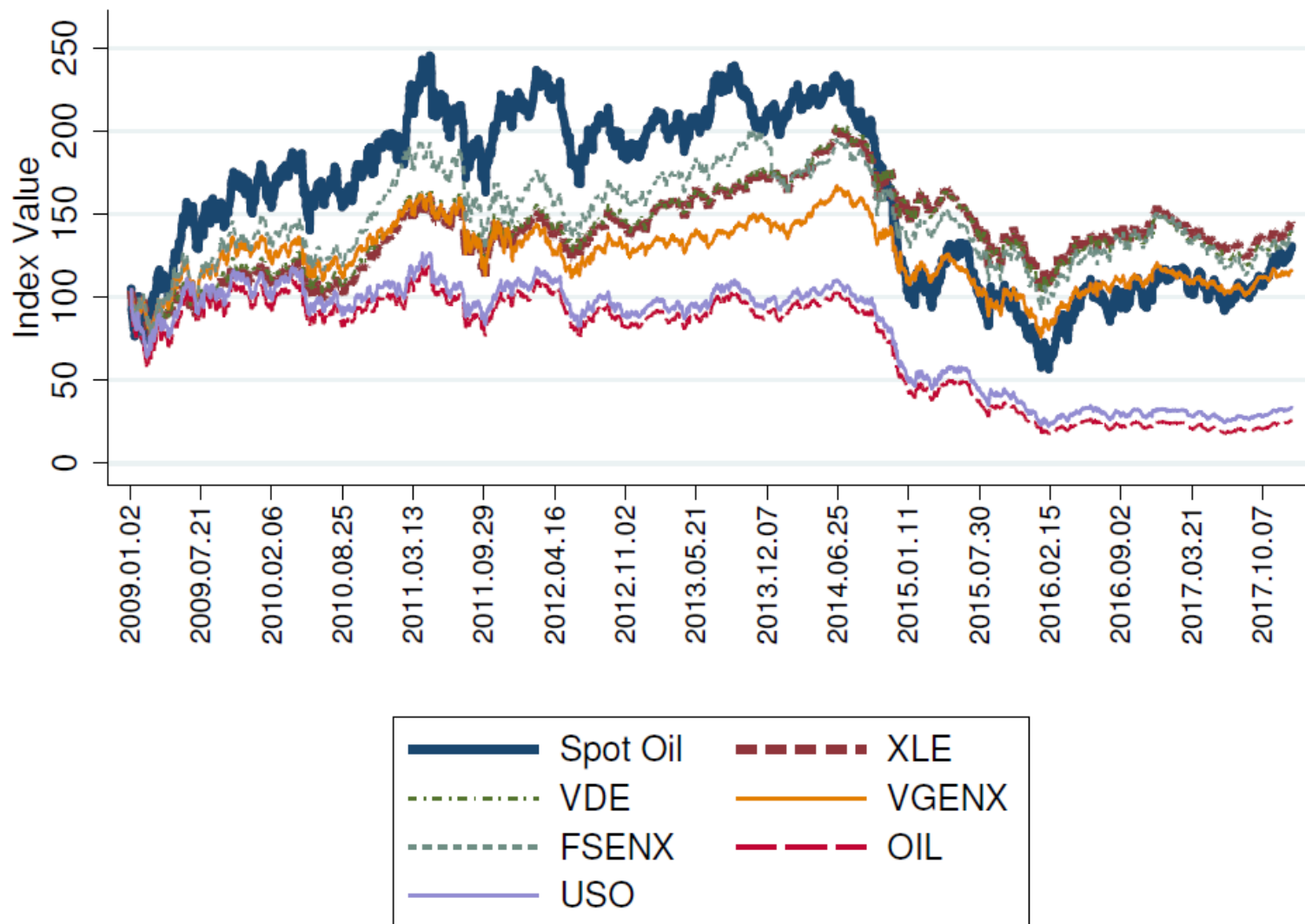
Table 2: Summary Statistics about Contango and Backwardation in the Oil Market

Strategy	Mean	Contango (%)				Days	nobs	Avg. Volume
		Median	S.D.	Max	Min			
Investment Period: 1994 - December 2005								
Fut1Roll0	-2.43	-0.53	54	5.63	-24.11	42	3001	67242
Fut2Roll0	-4.46	-2.28	15	0.95	-1.32	42	3001	43821
Fut6Roll0	-5.62	-5.44	11	0.39	-0.59	31	3001	2488
Fut12Roll0	-5.34	-5.34	9	0.22	-0.31	28	3001	640
Investment Period: 2006 - February 10, 2017								
Fut1Roll0	2.10	0.36	16	1.99	-3.52	56	2797	298998
Fut2Roll0	7.03	4.34	12	1.34	-0.53	82	2797	135657
Fut6Roll0	5.10	4.59	8	0.54	-0.17	77	2797	14461
Fut12Roll0	3.07	3.19	6	0.29	-0.11	74	2797	4190

Note: The table presents the various statistics with respect to the contango in the futures market. For each futures contract, the first number indicates the specific futures contract, either 1, 2, 6, or 12 depending on whether the nearest-term, 2nd, 6th, or 12th contract is used. The second number represents the roll date. Thus, a "0" indicates the contract was theoretically rolled on the expiration date of the front contract. Mean represents the annualized mean daily contango in percentage terms for the particular contract and roll. Median represents the annualized median contango, S.D. represents the standard deviation of daily contango annualized by multiplying by $\sqrt{250}$ in percentage terms, Max and Min represent the maximum and minimum annualized daily contango. Days represents the percentage of days that the market is in contango as opposed to backwardation. nobs represents the number of daily observations used for the calculations, and Avg. Volume represents the average daily volume of the representative contracts. The calculation of contango is explained in Appendix E.

3. Contango and Tracking Error

- Returns have been hurt by "roll" into contango market

Table 5: Summary Statistics from Rolling Future Strategies and Oil ETFs and Mutual Funds

Strategy	Futures Mean	"Roll"	"Spot"	S.D.	Sharpe	Cash Mean	Spot Mean	S.D.	Sharpe	Tracking Error Excess	T.E.	β
Investment Period: 1994 - December 2005
Fut1Roll0	26.96	3.15	23.76	34.55	0.66	3.72	19.58	38.47	0.40	11.12	18.54	0.98
Fut2Roll0	25.06	6.40	18.68	31.69	0.66	3.72	19.58	38.47	0.40	9.22	19.74	1.04
Fut6Roll0	22.42	8.23	14.25	24.97	0.74	3.72	19.58	38.47	0.40	6.80	23.10	1.26
Fut12Roll0	18.61	7.83	10.88	21.54	0.68	3.72	19.58	38.47	0.40	3.09	26.32	1.35
Investment Period: 2006 - February 10, 2017
Fut1Roll0	-5.73	-3.53	-2.20	37.63	-0.18	1.02	6.44	38.99	0.14	-11.12	11.46	0.99
Fut2Roll0	-6.11	-10.30	4.19	35.39	-0.20	1.02	6.44	38.99	0.14	-11.50	14.50	1.02
Fut6Roll0	-0.10	-7.45	7.36	31.69	-0.03	1.02	6.44	38.99	0.14	-5.49	17.44	1.11
Fut12Roll0	1.56	-4.48	6.04	28.24	0.02	1.02	6.44	38.99	0.14	-3.86	19.88	1.21
Investment Period: 2009 - February 10, 2017
Fut1Roll0	-2.26	-3.72	1.46	36.29	-0.06	0.07	9.18	37.18	0.25	-11.32	9.64	0.99
Fut2Roll0	-4.30	-10.54	6.24	34.15	-0.13	0.07	9.18	37.18	0.25	-13.36	12.78	1.02
Fut6Roll0	0.83	-7.83	8.66	30.40	0.03	0.07	9.18	37.18	0.25	-8.24	16.41	1.10
Fut12Roll0	1.50	-4.73	6.23	26.75	0.05	0.07	9.18	37.18	0.25	-7.61	19.16	1.21
ETFs using Oil Futures Contracts
USO	-7.27	.	.	33.67	-0.22	0.07	9.18	37.18	0.25	-16.41	15.37	1.01
OIL	-9.79	.	.	35.76	-0.28	0.07	9.18	37.18	0.25	-18.93	18.81	0.90
UCO	-17.72	.	.	65.29	-0.27	0.07	9.18	37.18	0.25	-26.86	35.44	0.52
DBO	-4.35	.	.	29.73	-0.15	0.07	9.18	37.18	0.25	-13.49	19.00	1.08
SCO	10.62	.	.	65.77	0.16	0.07	9.18	37.18	0.25	1.48	100.77	-0.51
DWT	.	.	.	.	.	.	.	.	.	.	.	.
DBE	-1.55	.	.	25.99	-0.06	0.07	9.18	37.18	0.25	-10.69	20.89	1.20
UWT	.	.	.	.	.	.	.	.	.	.	.	.
UWTIF	.	.	.	.	.	.	.	.	.	.	.	.
BNO	.	.	.	.	.	.	.	.	.	.	.	.
Top 5 ETFs and Mutual Funds using Oil Stocks
XLE	8.26	.	.	24.53	0.33	0.07	9.18	37.18	0.25	-0.88	29.72	0.92
VDE	8.17	.	.	25.09	0.32	0.07	9.18	37.18	0.25	-0.96	29.40	0.91
XOP	10.12	.	.	35.49	0.28	0.07	9.18	37.18	0.25	0.98	31.40	0.66
IXC	4.67	.	.	23.91	0.19	0.07	9.18	37.18	0.25	-4.46	29.51	0.95
IYE	7.28	.	.	24.27	0.30	0.07	9.18	37.18	0.25	-1.86	29.52	0.94
VGENX	5.50	.	.	25.41	0.21	0.07	9.18	37.18	0.25	-3.64	29.23	0.91
FSENX	9.47	.	.	28.91	0.33	0.07	9.18	37.18	0.25	0.33	29.99	0.79
FAGNX	10.78	.	.	28.69	0.37	0.07	9.18	37.18	0.25	1.64	29.65	0.81
VENAX	8.15	.	.	25.22	0.32	0.07	9.18	37.18	0.25	-0.98	29.49	0.90
FSTEX	5.53	.	.	29.40	0.19	0.07	9.18	37.18	0.25	-3.61	29.22	0.81

3. Contango and Tracking Error

- Cumulative Returns are even worse

Table 6: Cumulative Returns from Futures Rolling

Strategy	"Roll"	"Spot"	Futures	Cash	Fut & Cash	Spot	Excess Return
Investment Period: 1994 - December 2005							
Fut1Roll0	51.66	1085.81	1140.60	56.34	1714.34	330.30	1384.03
Fut2Roll0	189.18	817.57	1005.81	56.34	1518.58	330.30	1188.28
Fut6Roll0	236.49	679.13	913.57	56.34	1420.87	330.30	1090.56
Fut12Roll0	185.00	423.61	606.21	56.34	972.19	330.30	641.89
Investment Period: 2006 - February 10, 2017							
Fut1Roll0	-19.83	-56.28	-76.11	12.04	-73.04	-11.82	-61.22
Fut2Roll0	-60.90	-14.07	-74.97	12.04	-71.76	-11.82	-59.94
Fut6Roll0	-60.44	16.84	-43.60	12.04	-36.45	-11.82	-24.62
Fut12Roll0	-39.64	15.86	-23.78	12.04	-14.40	-11.82	-2.57
Investment Period: 2009 - February 10, 2017							
Fut1Roll0	-27.02	-24.41	-51.42	0.60	-50.79	20.72	-71.51
Fut2Roll0	-64.95	8.65	-56.30	0.60	-55.73	20.72	-76.45
Fut6Roll0	-55.84	29.17	-26.67	0.60	-25.80	20.72	-46.52
Fut12Roll0	-32.24	16.61	-15.63	0.60	-14.91	20.72	-35.63
Largest ETFs and Mutual Funds using Oil Stocks or Futures							
USO	.	.	.	0.60	-65.25	20.72	-85.96
OIL	.	.	.	0.60	-73.41	20.72	-94.13
UCO	.	.	.	0.60	-95.91	20.72	-116.63
DBO	.	.	.	0.60	-51.16	20.72	-71.88
SCO	.	.	.	0.60	-59.59	20.72	-80.30
DBE	.	.	.	0.60	-33.14	20.72	-53.85
XLE	.	.	.	0.60	53.44	20.72	32.73
VDE	.	.	.	0.60	50.66	20.72	29.95
XOP	.	.	.	0.60	36.49	20.72	15.77
IXC	.	.	.	0.60	15.93	20.72	-4.79
IYE	.	.	.	0.60	42.39	20.72	21.67
VGENX	.	.	.	0.60	20.26	20.72	-0.45
FSENX	.	.	.	0.60	53.87	20.72	33.15
FAGNX	.	.	.	0.60	72.15	20.72	51.43
VENAX	.	.	.	0.60	50.04	20.72	29.32
FSTEX	.	.	.	0.60	10.16	20.72	-10.55

4. Crowding and Oil Investing

- Could crowding from the long-side of oil investing be altering the equilibrium risk premia in the market place?

In recent years, a phenomena known as crowding has been noted as an important consideration when investing into securities (Chincarini (1998), Chincarini (2012), Cahan and Luo (2013), Ibbotson and Idzorek (2014), Menkveld (2014), Chue (2015), Blitz (2017), Zhong et al. (2017), Bruno et al. (2018), Chincarini (2018), Kinlaw et al. (2018), Baltas (2019), Brown et al. (2019), and Marks and Shang (2019)). Crowding occurs when there is an abnormal concentration of investors on one particular side of a market. Crowding matters because can distort the risks and returns of an investment strategy. The same sort of distortions

4. Crowding and Oil Investing

- How do we test whether crowding is to blame? Very difficult – data hard to obtain.

- We obtain aggregate data on weekly positions from the COT (commitment of traders report)

- We also use daily AUM and flow data from ETFs that invest in oil

4. Crowding and Oil Investing

- What's the relationship between oil returns and the oil futures curve?

We know that the difference in futures returns, r_f and spot returns, r_s is related to the cost of carry $\Psi_t = r_t + u_t - y_t$ and therefore to the interest rates, storage costs, and convenience yields (see Appendix F) according to the following equation:

$$r_{f,t} - r_{s,t} = (m-1)\Delta\Psi - \Psi_{t-1} = m\Delta\Psi - \Psi_t \tag{3}$$

where $\Delta\Psi = \Psi_t - \Psi_{t-1}$. We posit that the crowding of the futures market affects the

4. Crowding and Oil Investing

- We estimate the following equation using DAILY and WEEKLY data to see if CROWDING might be the cause of the contango and/or the tracking problem.

$$Y_t = \alpha + \gamma CROWD_{t-1} + \Lambda X_{t-1} + Y_{t-1} + \epsilon_t \qquad (4)$$

where Y_t is either the futures return, contango, or the difference between futures and spot returns. $CROWD_{t-1}$ is a variety of proxies for crowding and X_{t-1} are control variables thought to affect the dependent variable.

4. Crowding and Financialization

- Large literature on the financialization of commodities
- Irwin and Sanders (2011) and Boyd et al. (2018) review the literature:
  - Little evidence that commodity index investing leads to price distortions in the futures and spot commodity markets.

- For oil more debate:
  - Singleton (2013) a measure of change in index-fund holdings predicts oil futures returns contracts from 2006 to 2010
  - Hamilton and Wu (2015) find that Singleton's (2013) finding breaks down out of sample.

- New in this paper:
  - Consider the effect of the financialization non only on future returns but also on contango and the difference between futures and spot returns.
  - Use measure of crowding by combining daily data on oil-focused ETF flows and assets with COT data

4. Crowding and Oil Investing

- Proxies for CROWD (crowding)

Table 7: Proxy Measures of Crowding in the Oil Market

Number	Measure	Computation	Purpose
1.	Volume as Fraction of Open Interest	$\frac{Volume}{OI}$	Measures whether an abnormal amount of volume is putting pressure on the futures market. Source: Exchanges and Bloomberg.
2.	Net Concentration of 4 Largest Players	$C_L^4 - C_S^4$	Measures the percentage of futures market long by top 4 participants minus the percentage of market short by same participants. Source: COT
3.	Net Concentration of 4 Largest Players	$C_L^8 - C_S^8$	Measures the percentage of futures market long by top 8 participants minus the percentage of market short by same participants. Source: COT
4.	Producer Pressure	$\frac{PL-PS}{OI}$	Measures the difference between producer longs minus producer shorts as a percentage of total open interest. Producer longs are defined to be producers, processors, merchants or dealers. This is not an investment crowding variable. Source: COT
5.	Money Manager Pressure	$\frac{MMCL-MMCS}{OI}$	Measures the difference between money manager longs minus money manager shorts as a percentage of total open interest. We exclude swap dealers and other reportables contained in the COT database. Source: COT
6.	Commercial Pressure	$\frac{CL-CS}{OI}$	Measures the difference between commercial longs minus commercial shorts as a percentage of total open interest. Commercial longs are defined to entities involved in businesses that require futures or options for hedging as per form CFTC Form 40. This is not an investment crowding variable. Source: COT
7.	Non-Commercial Pressure	$\frac{NCL-NCS}{OI}$	Measures the difference between non-commercial longs minus non-commercial shorts as a percentage of total open interest. Non-Commercial longs are defined as those that are not commercial. We exclude swap dealers and other reportables contained in the COT database. Source: COT
8.	ETF Fund Flows as Fraction of Open Interest	$\frac{ETF\ Flows}{OI}$	Measures the total inflows or outflows in ETFs that invest in oil futures minus the ones that are short oil futures divided by total open interest. Source: Bloomberg
9.	Change in AUM	ΔAUM	Measures the total change in assets under management of ETFs that invest in oil futures. Source: Bloomberg
10.	Change in AUM as Fraction of Open Interest	$\frac{\Delta AUM}{OI}$	Measures the total change in assets under management of ETFs that invest in oil futures minus the ones that are short oil futures divided by total open interest. Source: Bloomberg

4. Crowding and Oil Investing

- **RESULTS SUMMARY:**

1. Weekly crowding measures have no effect on futures returns, but negative effect on $r(f) - r(s)$ and positive effect on contango. That is, first principle component of crowding causes futures to underperform spot and increases the contango in market place.

2. Effects continue along entire oil future maturity spectrum (averages).

3. Most important crowding variable is concentration of top 4 and top 8 futures players.

4. Crowding and Oil Investing

- Proxies for CROWD (crowding) – WEEKLY DATA

Table 8: Regressions of Various Measures of Futures Returns and Contango on Crowding Principal Components

Indep. Variables	Ret fut	Ret diff	Contango	Ret diff avg	Contango avg
	(1)	(2)	(3)	(4)	(5)
			Time Frequency: Weekly		
First PC	0.442*	-0.288***	0.031***	-0.369***	0.012**
	(0.236)	(0.085)	(0.010)	(0.137)	(0.005)
Second PC	-0.009	-0.355	0.007	-0.288	0.000
	(0.310)	(0.224)	(0.014)	(0.251)	(0.003)
Δ Inventory	-0.616***	-0.002	0.004	0.200*	0.006**
	(0.209)	(0.092)	(0.005)	(0.105)	(0.002)
Δ Repo Transactions	-0.033	0.179***	0.003	0.104	0.001
	(0.231)	(0.061)	(0.007)	(0.106)	(0.001)
MSCI Asia Ret	-0.467	-0.040	-0.018	0.146	0.002
	(0.366)	(0.138)	(0.011)	(0.197)	(0.003)
SP&500 Ret	-0.035	0.311	0.012	0.371	0.001
	(0.402)	(0.273)	(0.011)	(0.268)	(0.004)
Lag Ret Futures	-0.082				
	(0.361)				
Lag Ret diff		-0.226			
		(0.171)			
Lag Contango			0.005		
			(0.017)		
Lag Ret diff avg				-0.393	
				(0.446)	
Lag Contango avg					0.064***
					(0.008)
Constant	-0.039	-0.353***	0.030***	-0.268**	0.012***
	(0.246)	(0.115)	(0.010)	(0.134)	(0.004)
R-sqr	0.033	0.116	0.043	0.093	0.775
Obs	423	423	423	423	423

4. Crowding and Oil Investing

- **RESULTS SUMMARY:**

1. Daily crowding measures (Change in AUM/Open Interest and Daily ETF Flows/Open Interest) have no effect on futures returns, but negative effect on r(f) − r(s) pretty consistently.

2. We can't use COT data − not daily interval.

3. Most important crowding variable is concentration of top 4 and top 8 futures players.

4. Crowding and Oil Investing

- Proxies for CROWD (crowding) – DAILY DATA

Table 9: Regressions of Various Measures of Futures Returns and Contango on Crowding Measures

Indep. Variables	Ret fut	Ret diff	Contango	Ret diff avg	Contango avg	Ret fut	Ret diff	Contango	Ret diff avg	Contango avg
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					Time Frequency: Daily					
$\frac{\Delta AUM}{OI}$	0.086	-0.067***	0.009	-0.099**	-0.001					
	(0.100)	(0.021)	(0.008)	(0.046)	(0.001)					
$\frac{ETF\ Flows}{OI}$						0.049	-0.021	0.016*	-0.078	0.001
						(0.084)	(0.026)	(0.010)	(0.057)	(0.001)
$\frac{Volume}{OI}$	0.104**	-0.044**	0.019***	-0.053*	0.002	0.104**	-0.046**	0.019***	-0.054**	0.002*
	(0.048)	(0.019)	(0.006)	(0.027)	(0.001)	(0.048)	(0.019)	(0.006)	(0.027)	(0.001)
MSCI Asia Ret	-0.011	0.062*	-0.004	0.114***	0.002*	-0.012	0.058*	-0.003	0.106***	0.002*
	(0.069)	(0.034)	(0.006)	(0.041)	(0.001)	(0.069)	(0.033)	(0.006)	(0.041)	(0.001)
SP&500 Ret	0.088	-0.000	-0.006	0.040	-0.000	0.095	-0.020	-0.002	0.010	-0.001
	(0.087)	(0.017)	(0.005)	(0.042)	(0.001)	(0.087)	(0.017)	(0.004)	(0.040)	(0.001)
Lag Ret Futures	-0.187					-0.132				
	(0.122)					(0.091)				
Lag Ret diff		-0.088					-0.090			
		(0.118)					(0.118)			
Lag Contango			0.058*					0.057*		
			(0.031)					(0.030)		
Lag Ret diff avg				0.080					0.101	
				(0.098)					(0.090)	
Lag Contango avg					0.078***					0.077***
					(0.002)					(0.002)
Constant	-0.573**	0.162*	-0.080***	0.235*	-0.008	-0.573**	0.171*	-0.082***	0.246*	-0.009
	(0.235)	(0.091)	(0.026)	(0.131)	(0.006)	(0.235)	(0.091)	(0.026)	(0.132)	(0.006)
R-sqr	0.005	0.030	0.134	0.026	0.905	0.005	0.024	0.140	0.024	0.905
Obs	2062	2062	2062	2062	2062	2062	2062	2062	2062	2062

Note: This table reports the regressions of various daily measures of returns and contango on crowding variables for the period from November 25, 2008 to February 7, 2017 and controls. The dependent variable include the first futures returns, the difference between the first future returns and spot returns, contango, the futures–spot difference computed using the average return of the first fifteen futures contracts, and contango in the average first 15 contracts. The control variables include the daily returns on the MSCI Emerging Market Asia and the SP&500 indices. The standard errors of coefficients are listed directly under the parameter estimates in parenthesis. *, **, *** indicate statistical significance at the 10%, 5% and 1% level respectively using robust standard errors.

4. Crowding and Oil Investing

- **RESULTS SUMMARY:**

1. We construct a VAR (vector autoregression) to test whether crowding "granger-causes" returns and contango.

2. CROWDING granger causes r(f) – r(s) & contango with weekly data.

3. Daily data also shows strong effect of granger causality.

4. Crowding and Oil Investing

- P-Values from Granger Causality Tests

Table 10: Granger Causality Tests

Indep. Var. \ Dep. Var.	Ret fut	Ret diff	Contango	Ret diff avg	Contango avg
	(1)	(2)	(3)	(4)	(5)
Weekly data without controls					
First PC	0.152	0.000	0.000	0.000	0.026
Second PC	0.473	0.000	0.426	0.012	0.675
# of lags	1	2	1	3	3
Weekly data with controls					
First PC	0.089	0.000	0.000	0.002	0.000
Second PC	0.902	0.000	0.381	0.025	0.621
# of lags	1	1	1	1	1
Daily data without controls					
$\frac{\Delta AUM}{OI}$	0.000	0.000	0.031	0.000	0.000
$\frac{ETF\ Flows}{OI}$	0.000	0.000	0.000	0.000	0.000
$\frac{Volume}{OI}$	0.149	0.013	0.000	0.041	0.018
# of lags	3	3	2	2	2
Daily data with controls					
$\frac{\Delta AUM}{OI}$	0.000	0.000	0.006	0.000	0.000
$\frac{ETF\ Flows}{OI}$	0.000	0.000	0.000	0.000	0.000
$\frac{Volume}{OI}$	0.087	0.008	0.000	0.030	0.012
# of lags	2	2	2	2	2

4. Crowding and Oil Investing

▪ **Financialization of Oil Market**

1. Regressions of oil returns on Fama-French factors.

2. Major change since 2006 in this relationship.

4. Crowding and Oil Investing

- Financialization of Oil Market

Table 11: Exposures of Oil Market to the Fama-French Factors

Instrument	α	β_{RMRF}	β_{SMB}	β_{HML}	R^2
Investment Period: 1994 - December 2005					
Spot	0.00	0.04	0.25	0.17	0.00
	(1.58)	(0.81)	(3.25)	(1.65)	
Fut1Roll0	0.00	0.04	0.29	0.21	0.01
	(2.48)	(0.81)	(4.21)	(2.25)	
Fut2Roll0	0.00	0.04	0.27	0.18	0.01
	(2.52)	(0.83)	(4.28)	(2.18)	
Fut6Roll0	0.00	0.03	0.20	0.16	0.01
	(2.88)	(0.83)	(4.00)	(2.43)	
Fut12Roll0	0.00	0.03	0.15	0.14	0.00
	(2.77)	(0.86)	(3.58)	(2.50)	
Investment Period: 2006 - February 10, 2017					
Spot	0.00	0.63	-0.10	0.07	0.11
	(0.09)	(16.17)	(-1.32)	(1.04)	
Fut1Roll0	-0.00	0.62	-0.08	0.09	0.11
	(-1.05)	(16.66)	(-1.10)	(1.25)	
Fut2Roll0	-0.00	0.62	-0.06	0.13	0.13
	(-1.17)	(17.80)	(-0.94)	(2.01)	
Fut6Roll0	-0.00	0.57	-0.05	0.10	0.14
	(-0.58)	(18.60)	(-0.83)	(1.75)	
Fut12Roll0	-0.00	0.52	-0.04	0.07	0.14
	(-0.38)	(18.83)	(-0.80)	(1.39)	
Investment Period: 2009 - February 10, 2017					
Spot	-0.00	0.71	0.07	0.44	0.16
	(-0.17)	(13.96)	(0.78)	(5.15)	
Fut1Roll0	-0.00	0.73	0.07	0.45	0.18
	(-1.20)	(14.87)	(0.80)	(5.48)	
Fut2Roll0	-0.00	0.72	0.08	0.49	0.21
	(-1.46)	(15.76)	(0.97)	(6.46)	
Fut6Roll0	-0.00	0.67	0.08	0.42	0.22
	(-1.04)	(16.66)	(1.16)	(6.31)	
Fut12Roll0	-0.00	0.61	0.08	0.35	0.23
	(-0.99)	(17.28)	(1.26)	(6.03)	

4. Crowding and Oil Investing

▪ **Oil Market and Macro Surprises**

1. Macro Surprises have bigger effect on oil market post 2006.

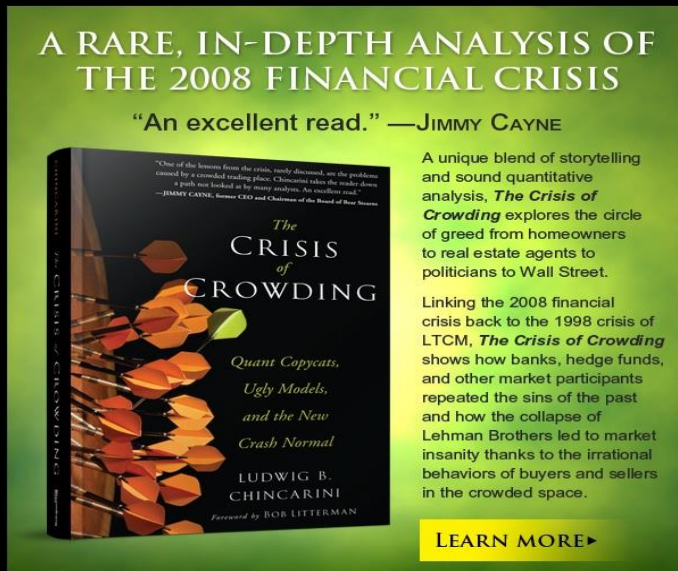# Thank you

- Dr. Ludwig Chincarini , CFA
- University of San Francisco
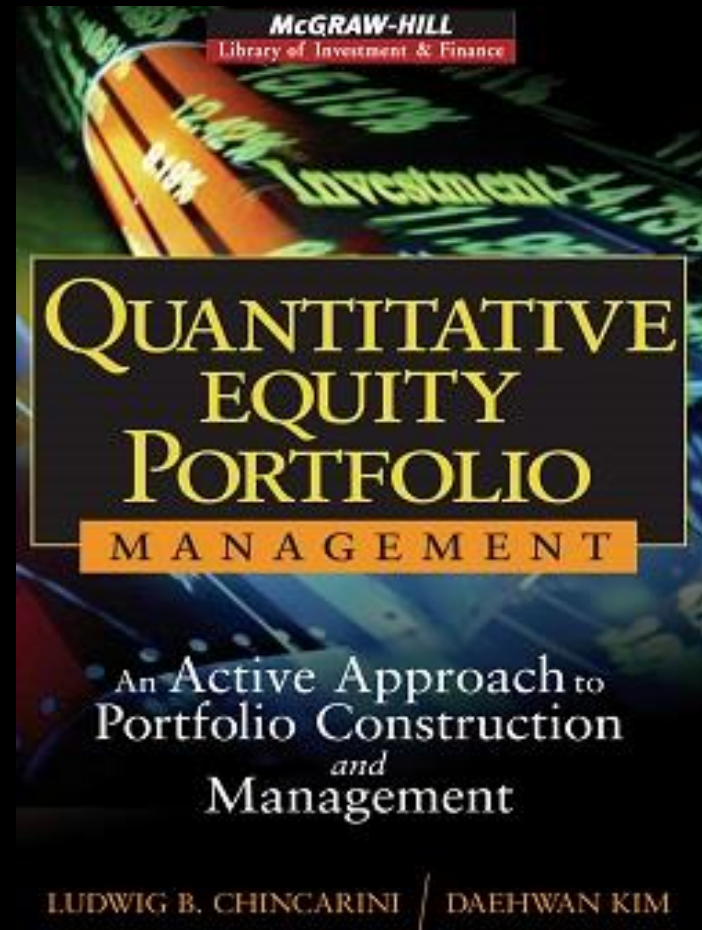- United States Commodity Funds

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Thanks

Open Discussion

1. TBA