

# Does speculation affect returns in commodities futures markets?

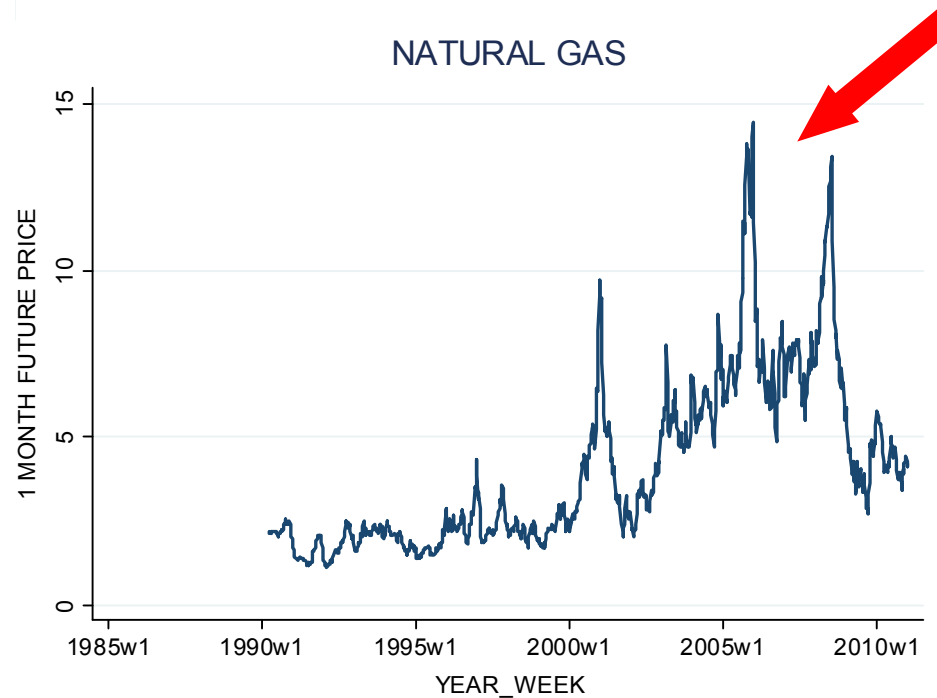
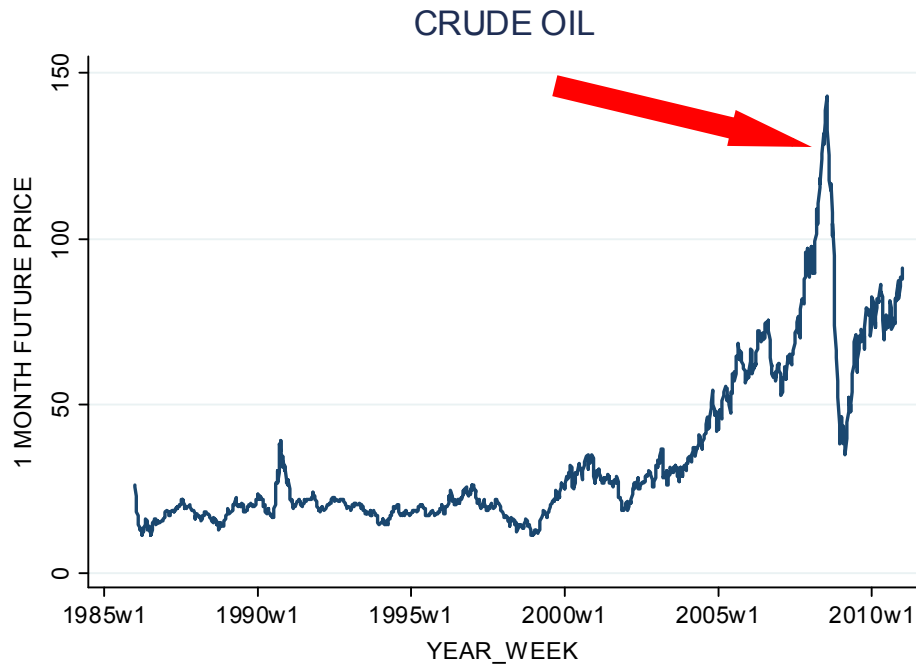
Joint with Matteo Manera and Ilaria Vignati

Fondazione Eni Enrico Mattei

29/09/2011

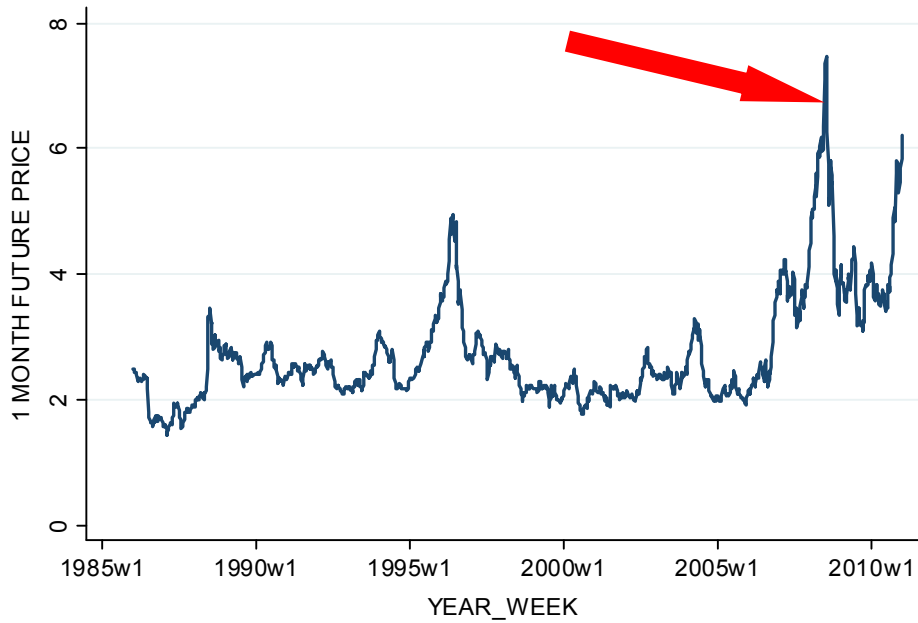
- From 2000 onwards we observe a number of severe changes in financial markets. There has been a sharp increase (at least until the crisis) in:
  - Energy prices
  - Food prices
  - The numbers of financial participants (both hedgers and speculators) in the futures markets.
- These stylized facts have lead to claims that:
  - speculators drive energy and food prices
  - speculators affect commodities' volatility
  - oil price/energy prices induced an increase in food prices

# Energy futures prices



# Food futures prices

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**The aim of these papers is to answer the following research questions:**

- Does data frequency affect the relationship between speculation and futures prices?
- Is financial speculation significantly related to returns in energy and non-energy commodities?
- Do macroeconomic factors explain returns in energy and non-energy commodities?
- Are there spillovers between energy and non-energy markets?

The economic theory suggests few factors that should affect commodities futures returns:

- Treasury bill yields
- Equity dividend yields
- Junk bond premium

(Sadorsky 2002, Chevallier 2009)

- Several papers suggest that the increasing presence of speculators in oil future markets could explain the spike in prices in 2007-2008 (Masters White 2008, Medlock III and Myers Jaffe, 2009)
- However, empirical evidence generally shows that there is not a relationship between the two phenomena (Irwing Sanders 2010, Büyükkşahin Harris, 2011)

- **Dependent variable:** returns of continuous series of futures in:
  - 4 energy commodities (oil, gasoline, heating oil, natural gas)
  - 9 non-energy commodities (cocoa, coffee, corn, cotton, oats, soybean oil, soybeans, sugar, wheat)
- **Time period:** 1986-2010
- **Frequency:**
  - Paper 1: daily, weekly and monthly
  - Paper 2: weekly
- **Source:** Datastream, CFTC (U. S. Commodity Futures Trading Commission), FRED (Federal Reserve Economic Data)



- **Macroeconomic factors:**
  - Return on the annual yield on the 90-day T-bill
  - Returns of S&P 500 Index
  - Junk bond yield= (return on the annual yield on Moody's long-term-BAA-rated corporate bonds) – (return on the annual yield on Moody's long-term-AAA-rated corporate bonds)

- **Speculation:**

- Paper 1:

- Scalping = volume/open interest (Luu Martens 2003, Du Yu Hayes 2009)

- Paper 2:

- Working's T index (Working 1960) = proxies the excess of speculation relative to hedging

$$\left\{ \begin{array}{ll} 1 + \frac{SS}{HS + HL} & \text{if } HS \geq HL \\ 1 + \frac{SL}{HS + HL} & \text{if } HS < HL \end{array} \right.$$

SS = Speculation Short  
SL = Speculation Long  
HS = Hedging Short  
HL = Hedging Long

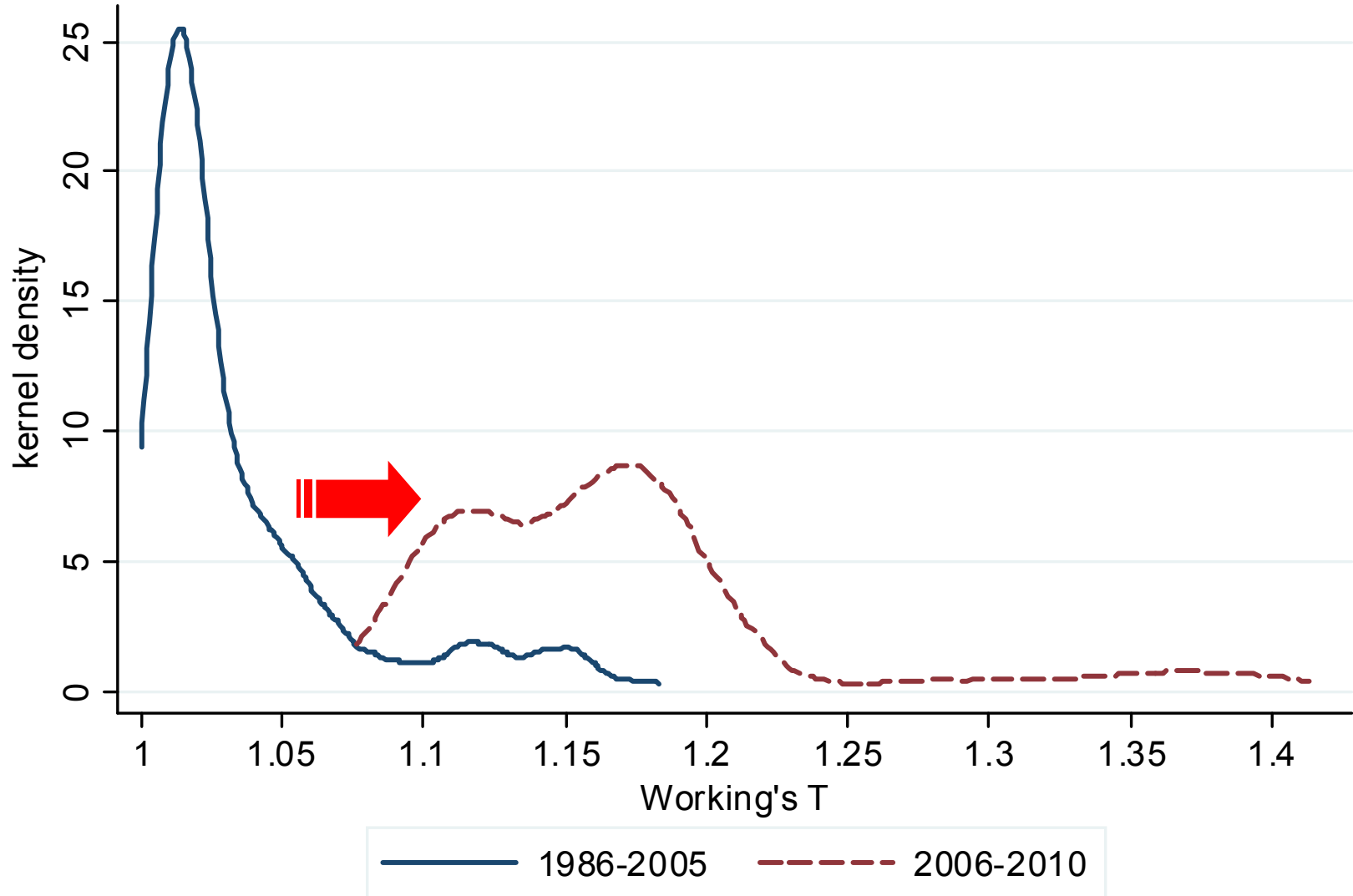
# Has speculation in crude oil futures market increased?

## CRUDE OIL



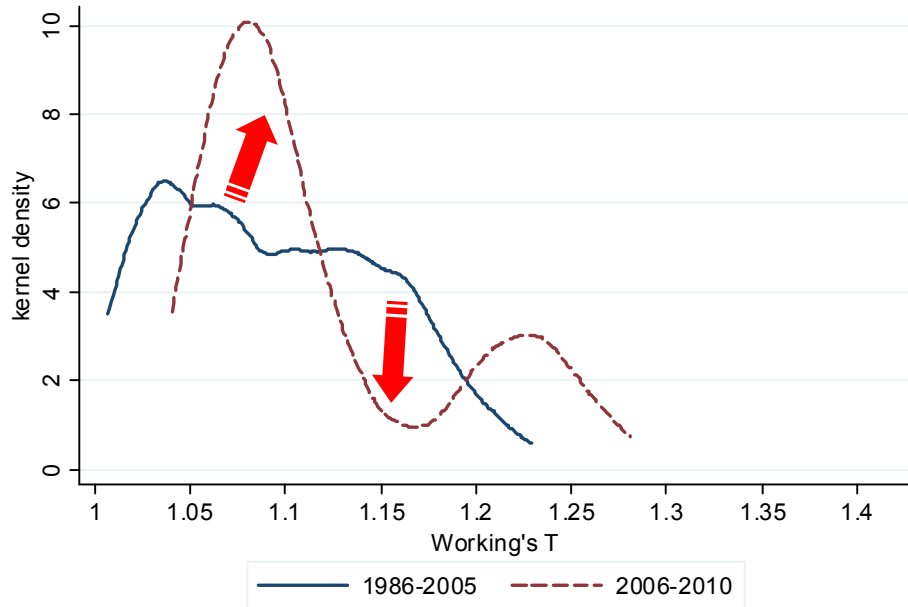
# Has speculation in natural gas futures market increased?

## NATURAL GAS



# Has speculation in grains futures market increased?

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# Speculation (Working's T index) across different commodities

Commodity	Obs		Mean		Std. Dev.		Min		Max		
	1986-2005	2006-2010	1986-2005	2006-2010	1986-2005	2006-2010	1986-2005	2006-2010	1986-2005	2006-2010	
ENERGY	Gasoline	1039	260	1.033	1.044	0.019	0.018	1.000	1.013	1.126	1.121
	Heating Oil	1018	260	1.043	1.065	0.032	0.022	1.001	1.020	1.178	1.134
	Natural Gas	819	260	1.037	1.168	0.039	0.067	1.000	1.076	1.184	1.413
	Crude Oil	1038	259	1.049	1.124	0.030	0.026	1.003	1.065	1.156	1.201
NON-ENERGY	Soybean Oil	1039	260	1.068	1.088	0.047	0.044	1.005	1.024	1.222	1.209
	Corn	1039	260	1.085	1.119	0.056	0.065	1.007	1.040	1.229	1.281
	Oats	1039	260	1.061	1.050	0.053	0.043	1.000	1.000	1.407	1.192
	Soybeans	1039	260	1.099	1.114	0.049	0.056	1.017	1.036	1.309	1.232
	Wheat	1039	260	1.050	1.101	0.042	0.061	1.000	1.025	1.196	1.291
	Cocoa	1038	260	1.066	1.121	0.041	0.049	1.007	1.035	1.210	1.228
	Coffee	1038	260	1.094	1.135	0.063	0.064	1.003	1.036	1.341	1.309
	Sugar	1038	260	1.050	1.072	0.039	0.041	1.000	1.015	1.331	1.188
Cotton	1039	260	1.072	1.137	0.045	0.051	1.007	1.049	1.280	1.262	

- **1986-2005: energy commodities have mean values lower than non-energy one**
- **2006-2010: means increase**
- **For oil and natural gas the increase is bigger than for other commodities**

# The econometric model

- The model specification: returns of each commodity are a function of
  - Treasury bill yields
  - Equity dividend yields
  - Junk bond premium
  - Measures of speculation (Scalping/Working's T index)
- The econometric strategy:
  1. Test for stationarity of series
  2. Estimate the model using OLS and test for autocorrelation and ARCH effects in the residuals
  3. If present, move to a GARCH (1,1) and/or ARMA specification
- We implement this procedure using daily, weekly and monthly data to investigate if frequency affects the results (Paper 1)
- We extend the analysis to a multivariate GARCH model (Paper 2)

- Macroeconomic variables and futures generally present a unit root, and are transformed taking the first difference of the logs to gain stationarity
- Scalping and Working's T index are stationary and considered in levels



# Results – Paper 1

## daily data: some results

	Gasoline	Heating Oil	Natural Gas	Crude Oil	Cocoa	Coffee	Corn	Cotton
Constant	0.000 (0.001)	0.001 * (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 *** (0.000)	0.002 *** (0.001)	0.000 (0.000)	0.000 (0.000)
Tbill	0.007 ** (0.003)	0.007 *** (0.001)	-0.003 (0.003)	0.006 *** (0.002)	-0.004 * (0.002)	0.000 (0.002)	0.000 (0.002)	0.002 (0.001)
Junk Bond Yield	-0.005 (0.012)	0.003 (0.012)	0.016 (0.021)	-0.006 (0.119)	-0.001 (0.011)	-0.016 (0.012)	0.000 (0.008)	-0.012 (0.012)
S&P 500	0.104 *** (0.024)	0.089 *** (0.021)	0.008 (0.032)	0.074 *** (0.021)	0.041 ** (0.018)	0.125 *** (0.020)	0.080 *** (0.015)	0.130 *** (0.021)
Scalping	0.000 (0.002)	-0.003 (0.002)	0.003 (0.003)	0.000 (0.002)	-0.013 *** (0.003)	-0.009 *** (0.002)	0.003 * (0.002)	-0.002 (0.003)
ARCH(1)	0.081 *** (0.004)	0.093 *** (0.004)	0.111 *** (0.005)	0.083 *** (0.004)	0.027 *** (0.002)	0.062 *** (0.003)	0.081 *** (0.002)	
GARCH(1)	0.907 *** (0.005)	0.893 *** (0.005)	0.890 *** (0.005)	0.910 *** (0.004)	0.968 *** (0.002)	0.924 *** (0.004)	0.894 *** (0.003)	
AR(1)	0.045 *** (0.013)		-0.055 *** (0.014)	0.862 *** (0.047)			0.057 *** (0.012)	
MA(1)				-0.890 *** (0.041)				
LM test for ARCH	45.873 ***	19.640 ***	19.659 ***	207.234 ***	15.725 ***	154.015 ***	78.126 ***	0.000
Ljung-Box Q test (lag 1)	0.851	1.025	0.079	0.039	0.016	0.189	0.203	1.325

## Comparison between daily, weekly and monthly results (scalping)

	Daily	Weekly	Monthly
Gasoline	0.000 (0.002)	0.022 * (0.013)	0.182 ** (0.071)
Heating Oil	-0.003 (0.002)	-0.010 (0.014)	-0.046 (0.087)
Natural Gas	0.003 (0.003)	0.076 *** (0.022)	0.304 * (0.165)
Crude Oil	0.000 (0.002)	0.000 (0.010)	0.044 (0.055)
Cocoa	-0.013 *** (0.003)	-0.001 (0.021)	0.041 (0.128)
Coffee	-0.009 *** (0.002)	0.005 (0.012)	-0.009 (0.088)
Corn	0.003 * (0.002)	0.030 *** (0.011)	-0.019 (0.071)
Cotton	-0.002 (0.003)	-0.019 (0.003)	-0.101 (0.113)
Oats	-0.001 (0.002)	0.006 (0.014)	0.017 (0.106)
Soybean Oil	0.002 (0.002)	0.020 * (0.011)	0.001 (0.065)
Soybeans	0.001 (0.001)	0.017 *** (0.006)	-0.014 (0.013)
Sugar	-0.002 (0.005)	0.012 (0.016)	0.210 ** (0.086)
Wheat	-0.006 *** (0.001)	0.010 (0.011)	0.000 (0.079)

- Data frequency affects the results
- Speculation (scalping) is generally not significant regardless of the frequency of data

# Results – Paper 2

## Univariate GARCH(1,1) – weekly data

	Gasoline	Heating Oil	Natural Gas	Crude Oil	Soybean Oil	Corn	Oats	Soybeans	Wheat	Cocoa	Coffee	Sugar	Cotton
Constant	0.151 ** (0.068)	0.032 (0.037)	0.049 (0.031)	-0.051 (0.032)	0.032 * (0.019)	0.038 ** (0.016)	-0.040 (0.027)	0.026 * (0.015)	0.024 (0.017)	-0.017 (0.025)	-0.022 (0.021)	0.039 (0.032)	0.014 (0.031)
Tbill	0.033 ** (0.016)	0.022 ** (0.011)	0.017 (0.019)	0.015 (0.015)	0.010 (0.010)	0.022 ** (0.011)	-0.011 (0.011)	0.010 (0.010)	0.009 (0.013)	-0.025 ** (0.012)	0.003 (0.013)	0.028 * (0.015)	0.023 * (0.012)
Junk Bond Yield	-0.043 (0.033)	-0.031 (0.024)	0.032 (0.053)	-0.027 (0.026)	-0.019 (0.019)	-0.006 (0.022)	-0.011 (0.033)	-0.027 (0.019)	0.004 (0.019)	-0.032 (0.028)	-0.053 * (0.030)	-0.002 (0.029)	-0.023 (0.036)
S&P 500	0.033 (0.056)	0.074 (0.046)	0.183 ** (0.087)	0.112 ** (0.050)	0.105 *** (0.038)	0.078 ** (0.038)	0.115 ** (0.050)	0.087 ** (0.036)	0.032 (0.039)	0.067 (0.046)	0.220 *** (0.055)	0.004 (0.057)	0.167 *** (0.054)
Working's T	-0.145 ** (0.066)	-0.029 (0.035)	-0.044 (0.028)	0.049 (0.030)	-0.029 (0.018)	-0.033 ** (0.015)	0.038 (0.026)	-0.023 * (0.014)	-0.022 (0.016)	0.016 (0.023)	0.019 (0.019)	-0.037 (0.031)	-0.012 (0.029)
ARCH(1)	0.119 *** (0.021)	0.176 *** (0.024)	0.148 *** (0.025)	0.129 *** (0.020)	0.068 *** (0.014)	0.161 *** (0.018)	0.104 *** (0.024)	0.172 *** (0.020)	0.098 *** (0.013)	0.053 *** (0.009)	0.114 *** (0.015)	0.150 *** (0.015)	
GARCH(1)	0.828 *** (0.029)	0.738 *** (0.035)	0.769 *** (0.039)	0.831 *** (0.026)	0.887 *** (0.026)	0.794 *** (0.020)	0.705 *** (0.063)	0.795 *** (0.021)	0.882 *** (0.015)	0.933 *** (0.011)	0.823 *** (0.027)	0.788 *** (0.023)	
AR(1)	0.196 *** (0.028)	0.181 *** (0.029)	0.211 *** (0.034)	0.172 *** (0.028)	0.219 *** (0.028)	0.207 *** (0.028)	0.185 *** (0.031)	0.198 *** (0.030)	0.203 *** (0.029)	0.189 *** (0.029)	0.208 *** (0.031)	0.183 *** (0.027)	0.248 *** (0.013)
LM test for ARCH	58.515 ***	149.335 ***	8.522 ***	54.849 ***	29.359 ***	21.932 ***	84.914 ***	30.870 ***	32.409 ***	4.211 **	10.886 ***	618.425 ***	1.498
Ljung-Box Q test (lag 1)	3.149 *	0.104	1.066	1.021	0.745	0.147	0.093	0.030	0.083	1.699	1.209	0.073	0.365

- Working's T index is poorly significant (and negative!)

- The analysis developed so far is univariate.
- It is interesting to estimate a system where returns for different commodities are jointly estimated, allowing for conditional variances and covariances
- Possible contribution of this econometric exercise:
  - Identify if and how returns on oil/energy futures prices are related to food/non-energy commodities futures prices
- Model implemented: Diagonal VECH multivariate GARCH, which allows for time-varying conditional correlations

# Results – Paper 2

## Multivariate GARCH(1,1) – Fuels group

Mean equation:

	Gasoline	Heating Oil	Natural Gas	Crude Oil	Soybean Oil
Constant	0.139 *	-0.049	-0.065	0.054	-0.027
	(0.078)	(0.069)	(0.110)	(0.069)	(0.048)
Tbill	0.021	0.010	0.005	0.010	0.007
	(0.014)	(0.011)	(0.022)	(0.013)	(0.010)
Junk Bond Yield	-0.037	-0.028	0.033	-0.058 *	-0.008
	(0.040)	(0.033)	(0.053)	(0.031)	(0.020)
S&P 500	0.080	0.102 *	0.192 **	0.100 *	0.157 ***
	(0.071)	(0.054)	(0.090)	(0.058)	(0.045)
Gasoline(-1)	0.047	-0.032	-0.071	-0.016	0.040
	(0.046)	(0.037)	(0.057)	(0.041)	(0.025)
Heating Oil(-1)	-0.138 **	-0.061	-0.039	-0.062	-0.024
	(0.054)	(0.050)	(0.081)	(0.051)	(0.031)
Natural Gas(-1)	0.036	0.072 ***	0.205 ***	0.065 ***	-0.034 ***
	(0.023)	(0.019)	(0.037)	(0.019)	(0.013)
Crude Oil(-1)	0.245 ***	0.258 ***	0.137 *	0.206 ***	-0.007
	(0.050)	(0.047)	(0.074)	(0.052)	(0.033)
Soybean Oil(-1)	0.011	-0.023	-0.025	-0.022	0.219 ***
	(0.049)	(0.040)	(0.065)	(0.044)	(0.034)
Working's T Gasoline	-0.212 ***	0.004	0.029	-0.104	-0.040
	(0.072)	(0.064)	(0.102)	(0.067)	(0.047)
Working's T Heating Oil	0.023	-0.024	0.008	-0.013	0.025
	(0.043)	(0.038)	(0.073)	(0.038)	(0.027)
Working's T Natural Gas	0.000	-0.021	-0.069	-0.024	-0.051 **
	(0.036)	(0.032)	(0.051)	(0.031)	(0.023)
Working's T Crude Oil	0.091	0.108 **	0.108	0.124 **	0.121 ***
	(0.062)	(0.053)	(0.088)	(0.052)	(0.036)
Working's T Soybean Oil	-0.037	-0.019	-0.012	-0.036	-0.029 *
	(0.028)	(0.023)	(0.038)	(0.024)	(0.016)

# Results – Paper 2

## Multivariate GARCH(1,1) – Fuels group

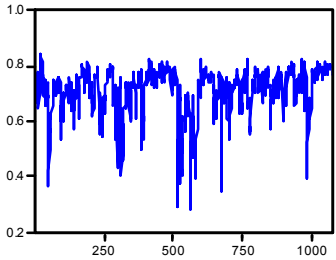
Conditional covariance equation:

	Gasoline	Heating Oil	Natural Gas	Crude Oil	Soybean Oil	
<b>Constant Matrix Coefficients</b>	Gasoline	0.000 *** (0.000)				
	Heating Oil	0.000 *** (0.000)	0.000 *** (0.000)			
	Natural Gas	0.000 *** (0.000)	0.000 ** (0.000)	0.000 *** (0.000)		
	Crude Oil	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)	
	Soybean Oil	0.000 * (0.000)	0.000 ** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)
<b>Coefficients Matrix for the ARCH Term</b>	Gasoline	0.118 *** (0.016)				
	Heating Oil	0.093 *** (0.012)	0.092 *** (0.012)			
	Natural Gas	0.006 *** (0.006)	0.044 *** (0.015)	0.126 *** (0.021)		
	Crude Oil	0.120 *** (0.015)	0.083 *** (0.012)	0.030 * (0.015)	0.124 *** (0.017)	
	Soybean Oil	0.032 ** (0.016)	0.087 *** (0.020)	0.015 *** (0.017)	0.045 ** (0.018)	0.123 *** (0.030)
<b>Coefficients Matrix for the GARCH Term</b>	Gasoline	0.761 *** (0.030)				
	Heating Oil	0.774 *** (0.031)	0.823 *** (0.023)			
	Natural Gas	0.974 *** (0.025)	0.856 *** (0.054)	0.805 *** (0.031)		
	Crude Oil	0.717 *** (0.033)	0.821 *** (0.025)	0.856 *** (0.085)	0.786 *** (0.026)	
	Soybean Oil	0.824 *** (0.063)	0.723 *** (0.073)	0.946 *** (0.072)	0.844 *** (0.068)	0.757 *** (0.059)

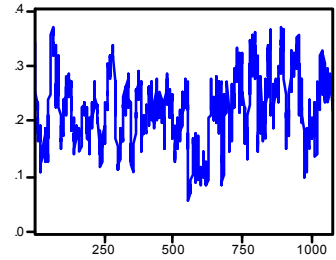
# Results – Paper 2

## Fuels group – Conditional Correlations

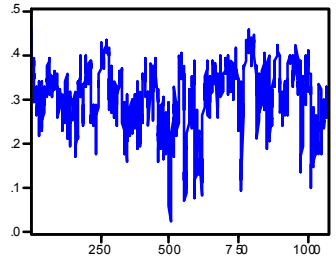
Cor(Gasoline, Heating Oil)



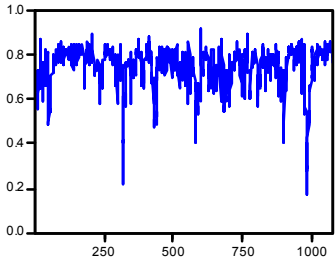
Cor(Gasoline, Natural Gas)



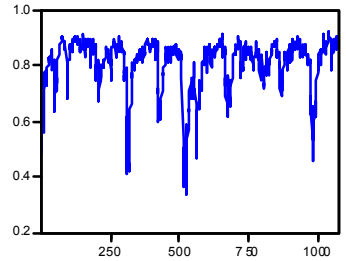
Cor(Heating Oil, Natural Gas)



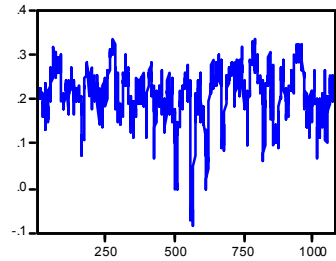
Cor(Gasoline, Crude Oil)



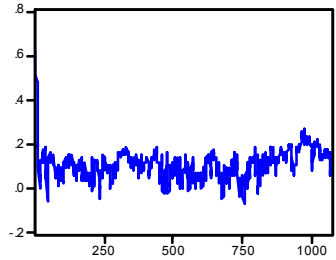
Cor(Heating Oil, Crude Oil)



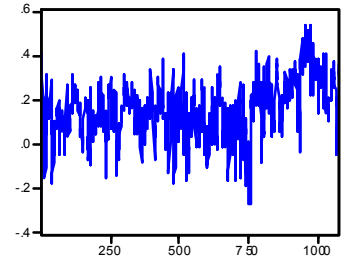
Cor(Natural Gas, Crude Oil)



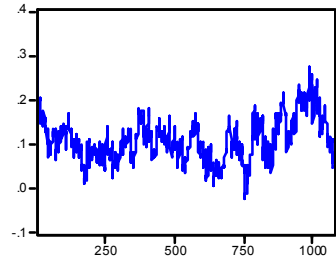
Cor(Gasoline, Soy bean Oil)



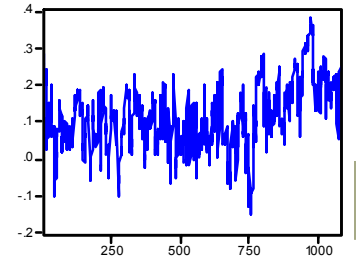
Cor(Heating Oil, Soy bean Oil)



Cor(Natural Gas, Soy bean Oil)



Cor(Crude Oil, Soy bean Oil)



# Results – Paper 2

## Multivariate GARCH(1,1) – Grains group

Mean equation:

	Corn	Oats	Soybeans	Wheat
Constant	0.002 (0.021)	-0.053 * (0.031)	0.031 * (0.018)	0.020 (0.020)
Tbill	0.010 (0.010)	-0.010 (0.010)	0.016 * (0.010)	0.011 (0.012)
Junk Bond Yield	-0.008 (0.022)	-0.017 (0.032)	-0.019 (0.019)	-0.001 (0.019)
S&P 500	0.055 (0.037)	0.091 * (0.051)	0.059 * (0.035)	0.019 (0.038)
Corn(-1)	0.179 *** (0.038)	0.006 (0.048)	0.037 (0.024)	-0.015 (0.031)
Oats(-1)	0.008 (0.021)	0.158 *** (0.033)	0.010 (0.016)	0.012 (0.019)
Soybeans(-1)	-0.006 (0.035)	-0.010 (0.048)	0.155 *** (0.033)	0.011 (0.031)
Wheat(-1)	-0.005 (0.029)	0.049 (0.043)	-0.028 (0.026)	0.189 *** (0.034)
Working's T Corn	-0.023 (0.016)	-0.036 (0.023)	-0.010 (0.013)	-0.018 (0.015)
Working's T Oats	0.018 (0.015)	0.047 ** (0.022)	-0.002 (0.014)	-0.007 (0.015)
Working's T Soybeans	0.011 (0.016)	0.017 (0.024)	-0.006 (0.013)	0.012 (0.014)
Working's T Wheat	-0.007 (0.018)	0.023 (0.026)	-0.011 (0.015)	-0.004 (0.016)



# Results – Paper 2

## Multivariate GARCH(1,1) – Grains group

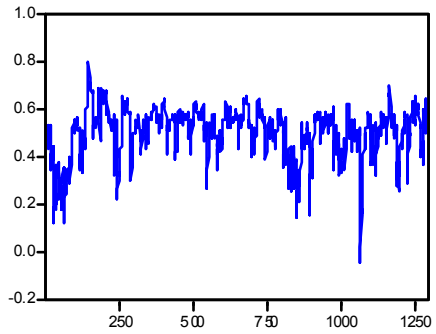
Conditional covariance equation:

		Corn	Oats	Soybeans	Wheat
Constant Matrix Coefficients	Corn	0.000 *** (0.000)			
	Oats	0.000 *** (0.000)	0.000 *** (0.000)		
	Soybeans	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)	
	Wheat	0.000 *** (0.000)	0.000 ** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)
Coefficients Matrix for the ARCH Term	Corn	0.122 *** (0.010)			
	Oats	0.057 *** (0.012)	0.113 *** (0.019)		
	Soybeans	0.070 *** (0.010)	0.054 *** (0.014)	0.120 *** (0.014)	
	Wheat	0.061 *** (0.010)	0.032 *** (0.012)	0.047 *** (0.013)	0.111 *** (0.013)
Coefficients Matrix for the GARCH Term	Corn	0.787 *** (0.017)			
	Oats	0.853 *** (0.027)	0.720 *** (0.044)		
	Soybeans	0.855 *** (0.017)	0.832 *** (0.046)	0.835 *** (0.019)	
	Wheat	0.877 *** (0.016)	0.918 *** (0.027)	0.890 *** (0.030)	0.843 *** (0.018)

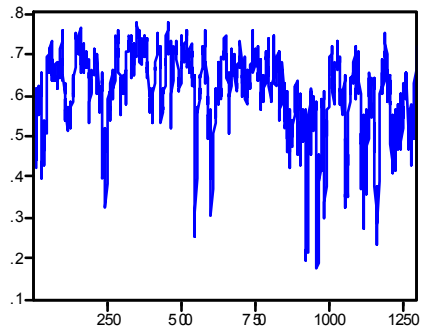
# Results – Paper 2

## Grains group – Conditional Correlations

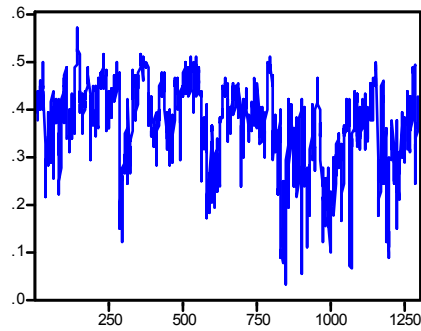
Cor(Corn,Oats)



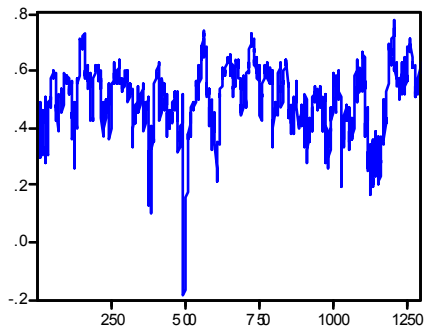
Cor(Corn,Soybeans)



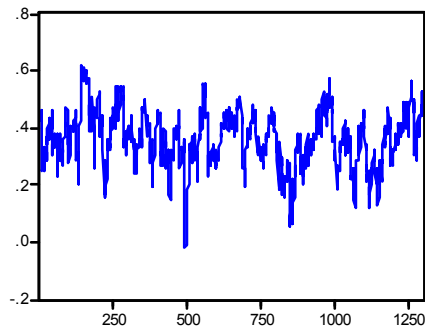
Cor(Oats,Soybeans)



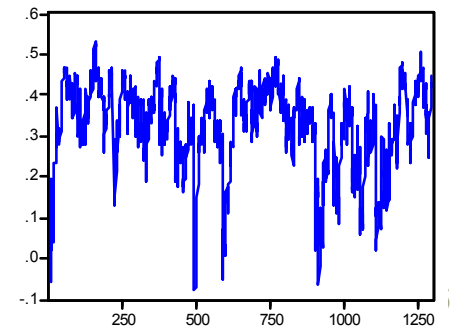
Cor(Corn,Wheat)



Cor(Oats,Wheat)



Cor(Soybeans,Wheat)



# Results – Paper 2

## Multivariate GARCH(1,1) – Breakfast group

Mean equation:

		Cocoa	Coffee	Sugar
Mean Equation	Constant	-0.026 (0.031)	-0.033 (0.039)	-0.030 (0.037)
	Tbill	-0.029 ** (0.012)	0.001 (0.014)	0.028 * (0.017)
	Junk Bond Yield	-0.026 (0.027)	-0.031 (0.029)	-0.016 (0.029)
	S&P 500	0.069 (0.047)	0.190 *** (0.058)	0.011 (0.060)
	Cocoa(-1)	0.184 *** (0.030)	-0.007 (0.031)	-0.009 (0.032)
	Coffee(-1)	0.018 (0.021)	0.223 *** (0.031)	0.025 (0.028)
	Sugar(-1)	-0.010 (0.019)	-0.060 *** (0.022)	0.174 *** (0.028)
	Working's T Cocoa	0.019 (0.020)	0.006 (0.024)	0.065 *** (0.023)
	Working's T Coffee	-0.002 (0.014)	0.016 (0.018)	-0.033 * (0.017)
	Working's T Sugar	0.007 (0.022)	0.008 (0.029)	-0.004 (0.030)

# Results – Paper 2

## Multivariate GARCH(1,1) – Breakfast group

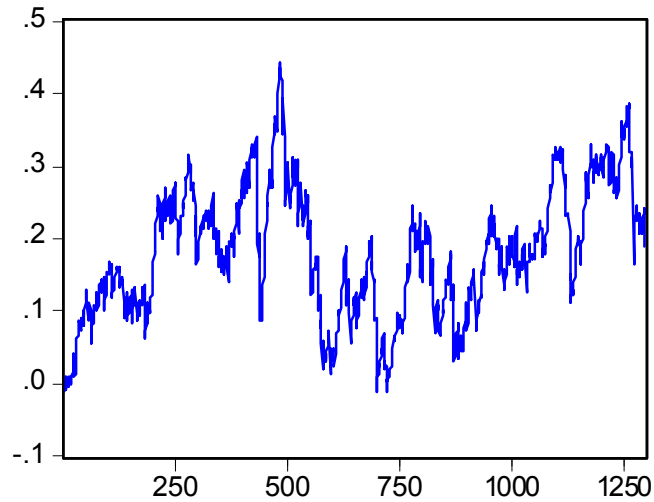
Conditional covariance equation:

			Cocoa	Coffee	Sugar
Constant Matrix Coefficients	Constant Matrix Coefficients	Cocoa	0.000 *** (0.000)		
		Coffee	0.000 (0.000)	0.000 *** (0.000)	
		Sugar	0.000 (0.000)	0.000 (0.000)	0.000 *** (0.000)
Coefficients Matrix for the ARCH Term	Coefficient Matrix for the ARCH Term	Cocoa	0.061 *** (0.012)		
		Coffee	0.012 * (0.006)	0.111 *** (0.015)	
		Sugar	0.032 (0.022)	0.016 (0.017)	0.144 *** (0.014)
Coefficients Matrix for the GARCH Term	Coefficient Matrix for the GARCH Term	Cocoa	0.914 *** (0.016)		
		Coffee	0.977 *** (0.013)	0.830 *** (0.027)	
		Sugar	0.887 *** (0.085)	0.917 *** (0.094)	0.793 *** (0.022)

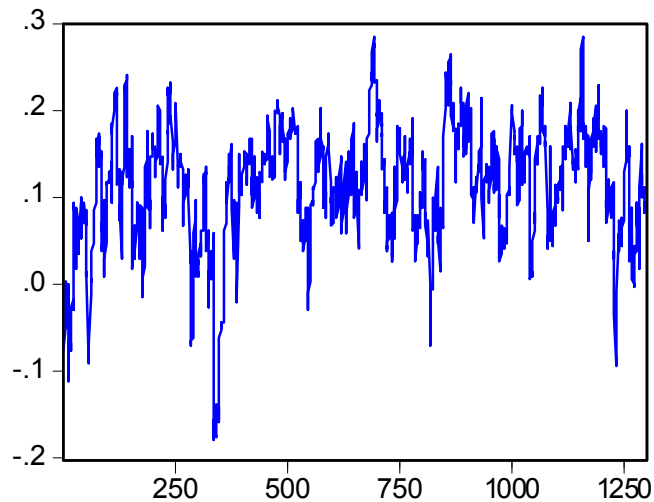
# Results – Paper 2

## Breakfast group – Conditional Correlations

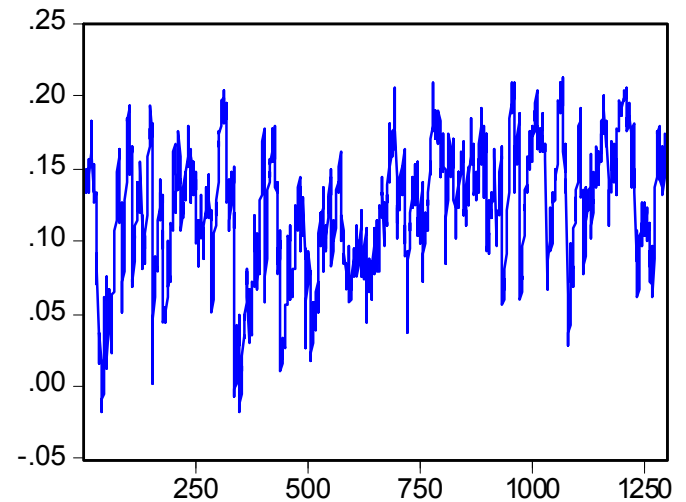
Cor(Cocoa,Coffee)



Cor(Cocoa,Sugar)



Cor(Coffee,Sugar)



# Do energy markets influence non-energy ones?

- It is not feasible to estimate jointly fuels and food markets due to the large number of parameters to be estimated (no convergence achieved)
- We summarize fuels markets into one variable (“fuels”) using principal factor analysis
- This allows to investigate if “fuels” influence food prices, as often claimed

# Results – Paper 2

## Multivariate GARCH(1,1) – Grains group + “fuels”

Mean equation:

	Corn	Oats	Soybeans	Wheat	Fuels
Constant	-0.085 (0.053)	-0.141 * (0.078)	-0.006 (0.049)	-0.065 (0.056)	2.427 (1.654)
Tbill	0.011 (0.012)	-0.012 (0.011)	0.016 (0.010)	0.014 (0.014)	0.831 ** (0.358)
Junk Bond Yield	0.008 (0.026)	-0.014 (0.037)	-0.008 (0.023)	-0.008 (0.026)	-0.280 (0.686)
S&P 500	0.090 * (0.047)	0.079 (0.060)	0.082 * (0.044)	-0.013 (0.051)	3.390 ** (1.449)
Corn(-1)	0.163 *** (0.043)	-0.014 (0.055)	0.038 (0.029)	0.023 (0.040)	0.617 (1.265)
Oats(-1)	-0.004 (0.026)	0.146 *** (0.040)	-0.008 (0.022)	-0.001 (0.024)	-0.475 (0.752)
Soybeans(-1)	-0.008 (0.040)	0.013 (0.054)	0.152 *** (0.038)	-0.002 (0.037)	-0.293 (1.184)
Wheat(-1)	0.001 (0.033)	0.054 (0.046)	-0.014 (0.028)	0.180 *** (0.041)	1.737 * (1.001)
Fuels(-1)	-0.001 (0.001)	-0.001 (0.001)	0.000 (0.001)	-0.002 * (0.001)	0.173 *** (0.035)
Working's T Corn	-0.033 * (0.018)	-0.038 (0.026)	-0.012 (0.016)	-0.028 (0.018)	-0.433 (0.501)
Working's T Oats	0.018 (0.017)	0.050 ** (0.025)	-0.004 (0.016)	0.001 (0.018)	0.634 (0.506)
Working's T Soybeans	0.005 (0.018)	0.012 (0.025)	-0.005 (0.015)	0.009 (0.018)	-0.755 (0.547)
Working's T Wheat	-0.010 (0.022)	0.025 (0.029)	-0.005 (0.018)	-0.005 (0.020)	0.228 (0.618)
Working's T Gasoline	0.036 (0.047)	0.060 (0.072)	0.004 (0.042)	0.057 (0.049)	-2.268 (1.513)
Working's T Heating Oil	0.021 (0.033)	-0.011 (0.048)	0.017 (0.027)	-0.017 (0.033)	-1.217 (0.945)
Working's T Natural Gas	-0.010 (0.025)	0.002 (0.037)	-0.023 (0.024)	0.001 (0.024)	-0.341 (0.763)
Working's T Crude Oil	0.058 (0.041)	0.014 (0.062)	0.061 * (0.034)	0.031 (0.043)	2.233 * (1.279)
Working's T Soybean Oil	0.000 (0.020)	0.020 (0.029)	-0.026 (0.016)	0.015 (0.021)	-0.388 (0.575)

Mean Equation



# Results – Paper 2

## Multivariate GARCH(1,1) – Grains group + “fuels”

Conditional covariance equation:

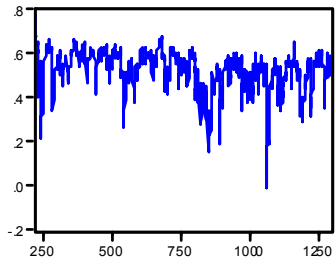
		Corn	Oats	Soybeans	Wheat	Fuels		
Constant Matrix Coefficients	Constant Matrix Coefficients							
	Corn	0.000 *** (0.000)						
	Oats	0.000 ** (0.000)	0.000 *** (0.000)					
	Soybeans	0.000 *** (0.000)	0.000 *** (0.000)	0.000 *** (0.000)				
	Wheat	0.000 *** (0.000)	0.000 ** (0.000)	0.000 ** (0.000)	0.000 *** (0.000)			
Fuels	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.042 *** (0.016)		
Coefficients Matrix for the ARCH Term	Coefficient Matrix for the ARCH Term							
	Corn	0.104 *** (0.015)						
	Oats	0.052 *** (0.014)	0.098 *** (0.021)					
	Soybeans	0.073 *** (0.013)	0.027 *** (0.011)	0.115 *** (0.017)				
	Wheat	0.059 *** (0.012)	0.035 ** (0.015)	0.051 *** (0.017)	0.105 *** (0.016)			
Fuels	0.010 (0.011)	0.005 (0.005)	0.031 * (0.018)	0.008 (0.006)	0.143 *** (0.025)			
Coefficients Matrix for the GARCH Term	Coefficient Matrix for the GARCH Term							
	Corn	0.821 *** (0.026)						
	Oats	0.848 *** (0.049)	0.773 *** (0.050)					
	Soybeans	0.817 *** (0.037)	0.900 *** (0.030)	0.822 *** (0.024)				
	Wheat	0.883 *** (0.020)	0.901 *** (0.037)	0.858 *** (0.052)	0.843 *** (0.024)			
Fuels	0.945 *** (0.058)	0.987 *** (0.011)	0.903 *** (0.058)	0.985 *** (0.015)	0.807 *** (0.037)			



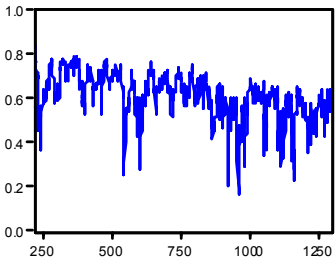
# Results – Paper 2

## Grains group + “fuels” – Conditional Correlations

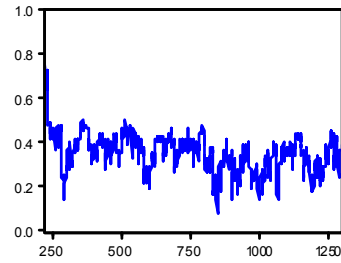
Cor(Corn,Oats)



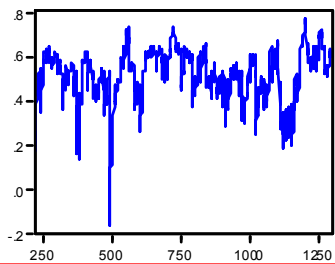
Cor(Corn,Soy beans)



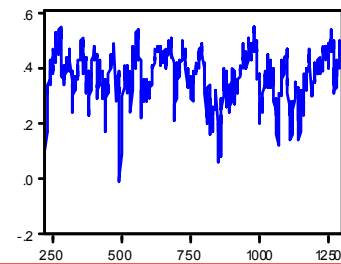
Cor(Oats ,Soy beans)



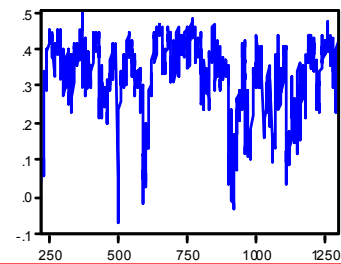
Cor(Corn,Wheat)



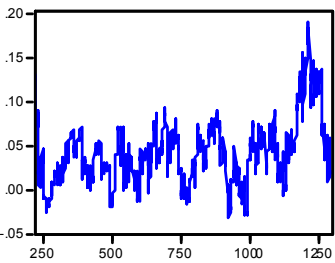
Cor(Oats,Wheat)



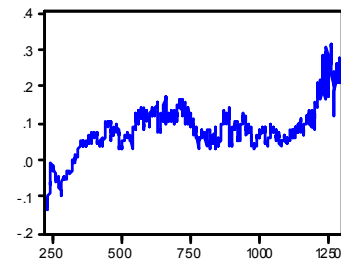
Cor(Soy beans,Wheat)



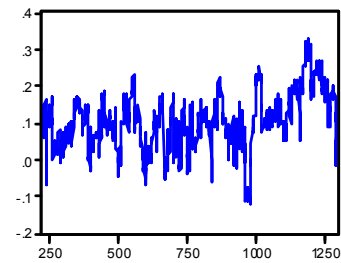
Cor(Corn,Fuels)



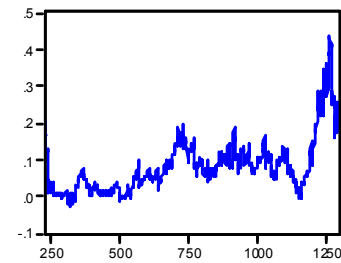
Cor(Oats,Fuels)



Cor(Soy beans,Fuels)



Cor(Wheat,Fuels)



# Results – Paper 2

## Multivariate GARCH(1,1) – Breakfast group + “fuels”

Mean equation:

	Cocoa	Coffee	Sugar	Fuels
Constant	-0.035 (0.064)	-0.021 (0.082)	-0.078 (0.085)	1.249 (1.669)
Tbill	-0.027 * (0.014)	0.000 (0.015)	0.029 * (0.017)	0.901 ** (0.361)
Junk Bond Yield	-0.048 (0.034)	-0.032 (0.032)	-0.002 (0.030)	-0.236 (0.698)
S&P 500	0.108 ** (0.054)	0.261 *** (0.069)	0.047 (0.066)	3.557 ** (1.430)
Cocoa(-1)	0.176 *** (0.035)	-0.004 (0.032)	-0.017 (0.034)	0.104 (0.696)
Coffee(-1)	0.018 (0.025)	0.194 *** (0.036)	0.020 (0.030)	-0.640 (0.604)
Sugar(-1)	0.006 (0.026)	-0.028 (0.029)	0.166 *** (0.036)	-0.275 (0.642)
Fuels(-1)	0.000 (0.001)	0.001 (0.001)	-0.001 (0.001)	0.204 *** (0.033)
Working's T Cocoa	0.029 (0.028)	-0.008 (0.030)	0.055 * (0.029)	0.139 (0.611)
Working's T Coffee	-0.006 (0.017)	0.033 * (0.020)	-0.049 *** (0.019)	-0.146 (0.415)
Working's T Sugar	-0.009 (0.025)	-0.019 (0.036)	-0.011 (0.037)	-0.003 (0.693)
Working's T Gasoline	-0.018 (0.045)	-0.017 (0.061)	-0.048 (0.063)	-1.881 (1.456)
Working's T Heating Oil	0.039 (0.034)	-0.010 (0.051)	-0.001 (0.059)	-0.369 (1.033)
Working's T Natural Gas	-0.025 (0.031)	-0.008 (0.034)	-0.027 (0.037)	-0.784 (0.707)
Working's T Crude Oil	0.012 (0.049)	0.065 (0.058)	0.116 * (0.060)	2.224 * (1.252)
Working's T Soybean Oil	0.010 (0.023)	-0.020 (0.026)	0.038 (0.028)	-0.394 (0.523)

Mean Equation



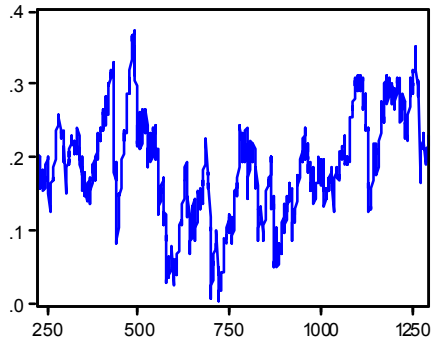
## Multivariate GARCH(1,1) – Breakfast group + “fuels”

Conditional covariance equation:

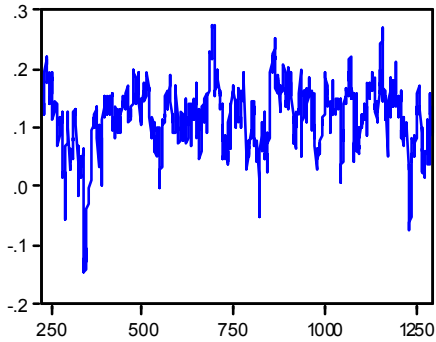
		Cocoa	Coffee	Sugar	Fuels
Constant Matrix Coefficients	Cocoa	0.000 ** (0.000)			
	Coffee	0.000 (0.000)	0.000 *** (0.000)		
	Sugar	0.000 (0.000)	0.000 (0.000)	0.000 *** (0.000)	
	Fuels	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.033 ** (0.013)
Coefficients Matrix for the ARCH Term	Cocoa	0.045 *** (0.012)			
	Coffee	0.010 (0.008)	0.107 *** (0.014)		
	Sugar	0.028 (0.025)	0.004 (0.003)	0.173 *** (0.021)	
	Fuels	-0.006 (0.004)	0.016 * (0.010)	0.014 (0.017)	0.123 *** (0.020)
Coefficients Matrix for the GARCH Term	Cocoa	0.927 *** (0.018)			
	Coffee	0.972 *** (0.026)	0.856 *** (0.023)		
	Sugar	0.878 *** (0.120)	0.993 *** (0.008)	0.711 *** (0.037)	
	Fuels	1.009 *** (0.006)	0.976 *** (0.016)	0.944 *** (0.062)	0.838 *** (0.030)

## Breakfast group + “fuels” – Conditional Correlations

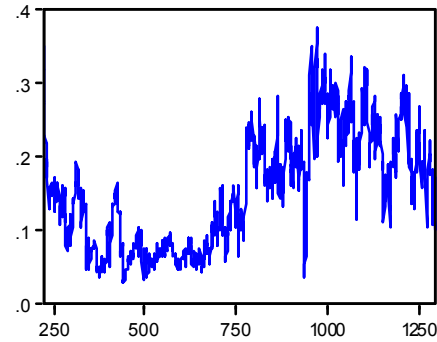
Cor(Cocoa,Coffee)



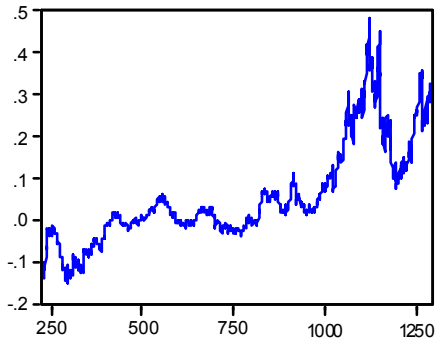
Cor(Cocoa,Sugar)



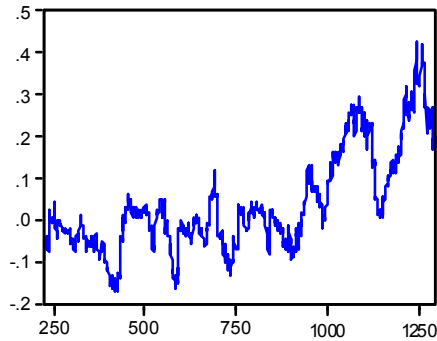
Cor(Coffee,Sugar)



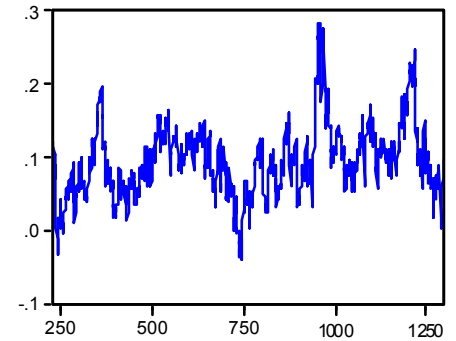
Cor(Cocoa,Fuels)



Cor(Coffee,Fuels)



Cor(Sugar,Fuels)



- Speculation
  - Paper 1:
    - Data frequency affects the sign and significance of scalping on commodities returns
    - Scalping is not significant in energy commodities, and poorly significant (and negative!) in non-energy commodities
  - Paper 2:
    - Working's T index is poorly significant in both univariate and multivariate models suggesting that speculation is not relevant in explaining commodities' returns
    - There are spillovers within the three groups of commodities
    - Between groups ("fuels" factor): spillovers mainly in the GARCH term (past volatility determines current volatility)
- Macroeconomic factors poorly explain returns in commodities futures (equity returns are generally positive and significant)

# Thanks!