

# **Major Hurricanes in the Gulf of Mexico: Their Potential Impact on the Oil and Gas Supply Chain and the Stock Market Response to their Anticipated Landfall**

by

Kirk Philipich

Young K. Ro

Vivek Sharma

All from University of Michigan - Dearborn

# Primary Findings

- **Major Oil Companies Experience Significantly Negative Abnormal Returns (ARs) (-.55%) One Day before Major Gulf Coast Hurricanes reach Land within the Primary Oil and Gas Production Region (POGPR).**
- **These ARs occur before any Firm Announcement of Damage to Facilities or Lost Production.**
- **These ARs vary in Size with Oil Price Volatility.**
- **These ARs are Significantly Different from those for Minor Gulf Coast Hurricanes that threaten the POGPR and for Hurricanes not reaching the POGPR.**
- **No Significant ARs are identified for the Minor Gulf Coast Hurricanes that threaten the POGPR.**

# Why We are Interested in Gulf Coast Hurricanes

- It is well established that when the accounting function delays the **reporting** of, or fails to **report** entirely, value relevant financial information to financial markets these markets attempt to identify alternative information sources (financial analysts, internet chat rooms, etc.). When alternative information sources are not available these decision-makers sometimes assume the worst possible outcome.

# Why We are Interested in Gulf Coast Hurricanes

- Accounting valuation models focus attention onto the firm's continuing operating activities and away from less persistent or less value relevant activities (extraordinary items, financing activities, etc.)
- Significant Abnormal Returns have been identified for a variety of supply chain disruption announcements

# Why We are Interested in Gulf Coast Hurricanes

Should the corporate reporting function provide information to capital markets pertaining to the potential damage that could or actual damage that did occur to the firm's continuing productive assets as quickly as possible or let the capital markets make their own estimates of the losses attributable to major Gulf Coast hurricanes? **These events are NOT a secret!**

# Saffir-Simpson Hurricane Scale

## Category One Hurricane (Winds 74-95 mph):

**No significant damage to building structures.** Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs.

## Category Two Hurricane (Winds 96-110 mph):

**Considerable damage to mobile homes, poorly constructed signs, and piers.** Considerable damage to shrubbery and trees with some trees blown down.

## Category Three Hurricane (Winds 111-130 mph):

**Some structural damage to small residences and utility buildings. Mobile homes and poorly constructed signs are destroyed.** Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris.

## Category Four Hurricane (Winds 131-155 mph):

**Complete destruction of mobile homes. Major damage to lower floors of structures near the shore.** Some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down.

## Category Five Hurricane (Winds greater than 155 mph):

**Some complete building failures with small utility buildings blown over or away. Complete destruction of mobile homes.** Complete roof failure on many residences and industrial buildings. All shrubs, trees, and signs blown down.

## Major Hurricanes (Category 3 and Higher at Landfall) – 1961 to 2005

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### Panel A – Landfalls within the Corpus Christi to Apalachicola Corridor:

<b>Hurricane</b>	<b>Date of Landfall</b>	<b>Landfall Category</b>	<b>Day of Landfall</b>	<b># Days as Gulf Hurricane</b>	<b># Firms in Portfolio</b>	<b>Portfolio Avg. Beta</b>
Carla	Sept. 11, 1961	4	Monday	4	19	0.88
Hilda	Oct. 3, 1964	3	Saturday	4	29	0.79
Betsy	Sept. 9, 1965	3	Thursday	2	28	0.89
Camille	Aug. 17, 1969	5	Sunday	3	25	1.04
Celia	Aug. 3, 1970	3	Monday	3	25	1.15
Carmen	Sept. 8, 1974	3	Sunday	3	27	1.06
Eloise	Sept. 23, 1975	3	Tuesday	2	27	0.91
Frederic	Sept. 13, 1979	3	Thursday	4	25	1.11
Alicia	Aug. 18, 1983	3	Thursday	2	22	0.93
Elena	Sept. 2, 1985	3	Monday	5	19	0.51
Andrew	Aug. 26, 1992	3	Wednesday	3	18	0.48
Opal	Oct. 4, 1995	3	Wednesday	3	19	0.47
Ivan	Sept. 16, 2004	4	Thursday	3	12	0.71
Dennis	July 10, 2005	3	Sunday	2	12	1.02
Katrina	Aug. 29, 2005	3	Monday	4	12	1.05
Rita	Sept. 24, 2005	3	Saturday	4	11	1.05

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### Panel B - Landfall south of Apalachicola:

<b>Hurricane</b>	<b>Date of Landfall</b>	<b>Landfall Category</b>	<b>Day of Landfall</b>	<b># Days as Gulf Hurricane</b>	<b># Firms in Portfolio</b>	<b>Portfolio Avg. Beta</b>
Charley	Aug. 13, 2004	4	Friday	1	11	0.65
Wilma	Oct. 24, 2005	3	Monday	2	11	0.99

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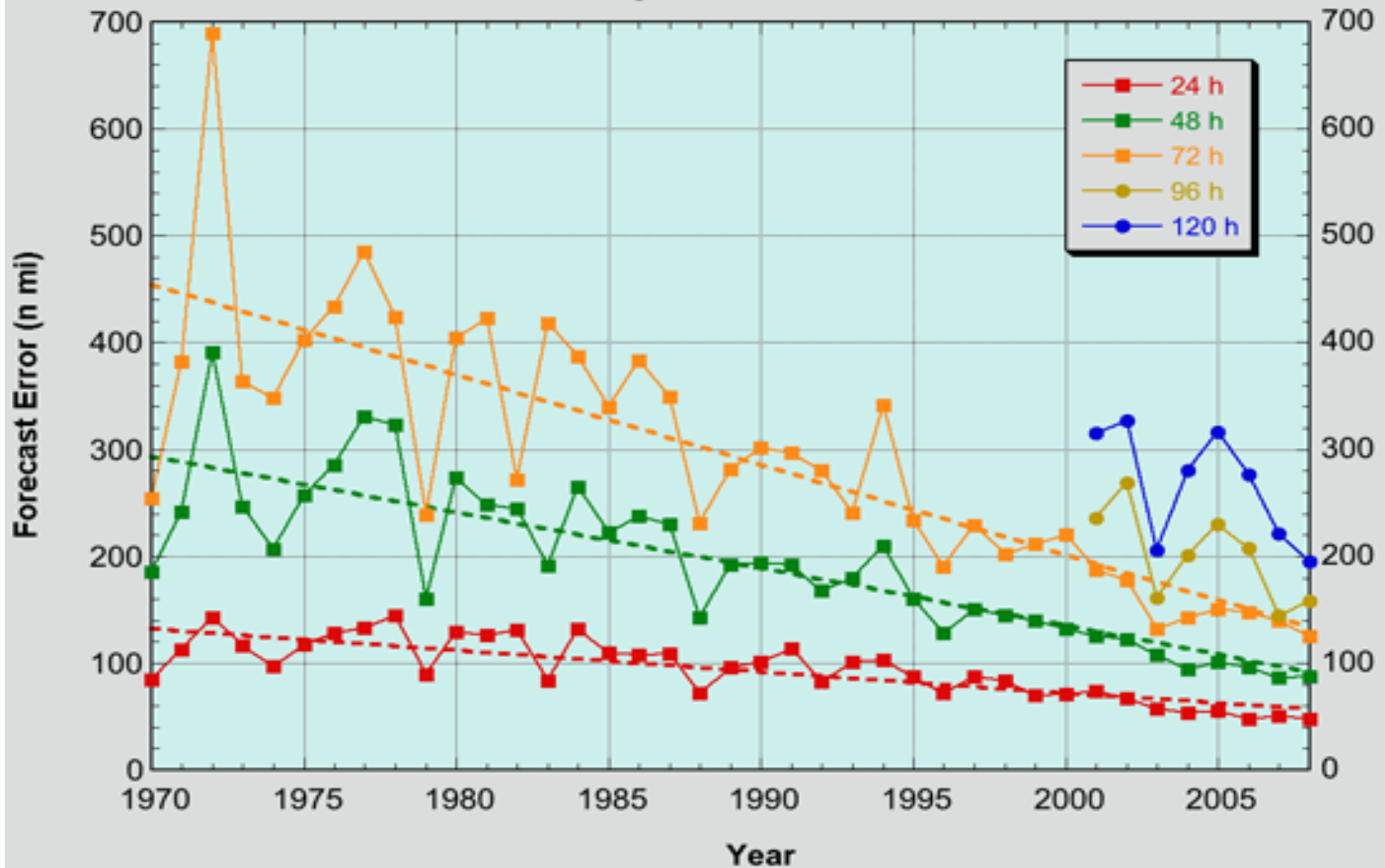
### Panel C - Landfall south of Corpus Christi:

<b>Hurricane</b>	<b>Date of Landfall</b>	<b>Landfall Category</b>	<b>Day of Landfall</b>	<b># Days as Gulf Hurricane</b>	<b># Firms in Portfolio</b>	<b>Portfolio Avg. Beta</b>
Beulah	Sept. 20, 1967	3	Wednesday	4	28	0.93
Allen	Aug. 10, 1980	3	Sunday	3	25	1.59
Bret	Aug. 23, 1999	3	Monday	4	17	0.47

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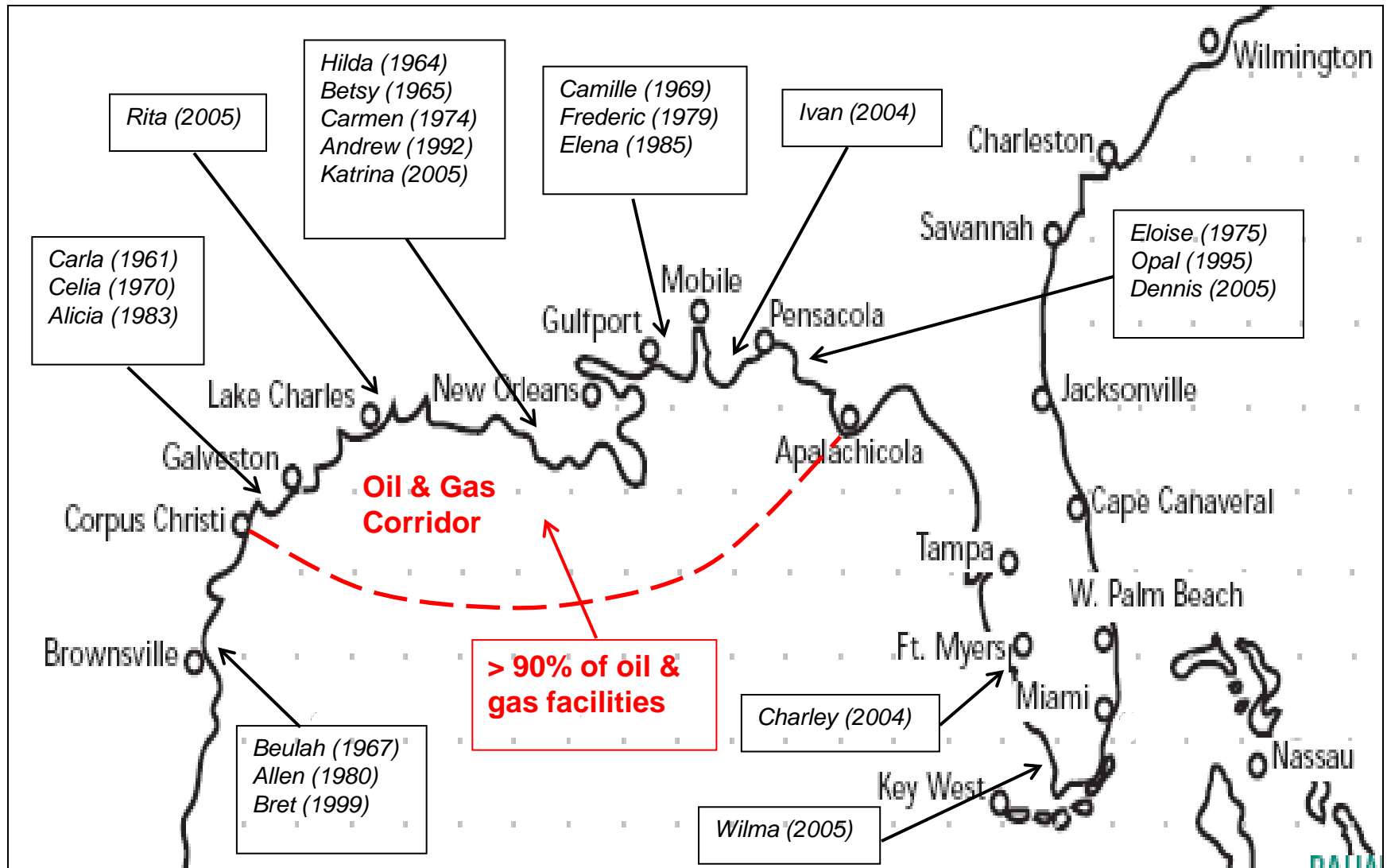
# 2009 National Hurricane Center Forecast Verification Report

## NHC Official Annual Average Track Errors Atlantic Basin Tropical Storms and Hurricanes





# Approximate Landfalls of Gulf Coast Major Hurricanes from 1961-2005 and Region in which Gulf Coast Oil and Gas Production Facilities are Concentrated



## PRELIMINARY REPORT ON HURRICANE CAMILLE

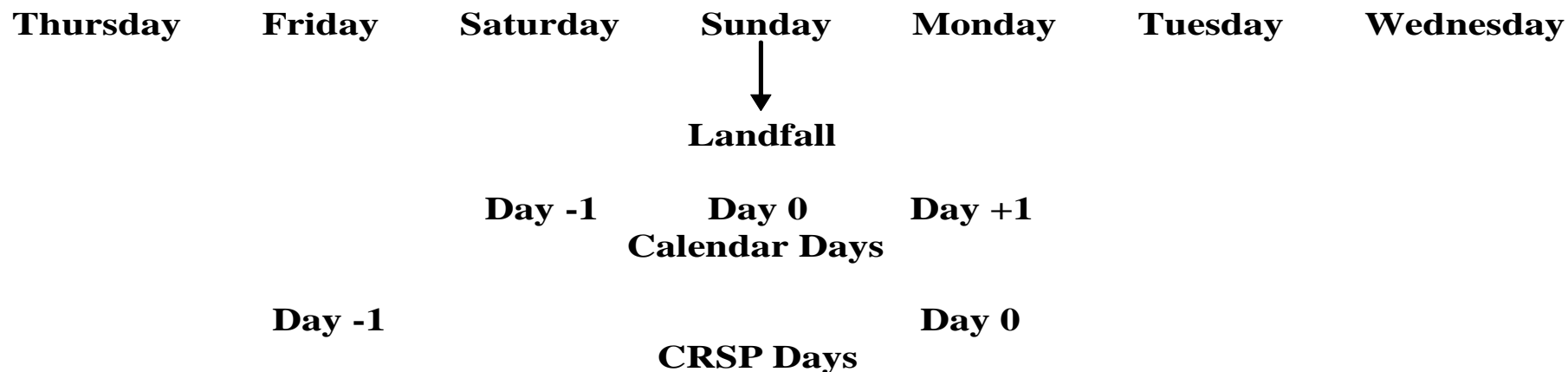
AUGUST 14 - 22, 1969

Late Saturday afternoon (16th) Reconnaissance aircraft indicated the storm had slowed but had deepened rapidly; maximum winds were estimated at 150 miles an hour near the center, which was located about 380 miles south of Fort Walton, Florida. Later that evening Camille began a north-northwestward trek at about 12 miles an hour. At this time she was generating 160 miles an hour winds near her center and hurricane force winds out to 50 miles in all directions.

Early Sunday morning (17th), with Camille 250 miles south of Mobile, Alabama, hurricane warnings, which were already in effect for the Florida Panhandle, were extended to include the coast of Alabama and the Mississippi coast to Biloxi. A few hours later warnings were issued for all of the Mississippi coast and as far west as New Orleans and Grand Isle; at this time Camille was about 200 miles southeast of New Orleans. Reconnaissance reports early Sunday afternoon (17th) indicated a central pressure of 901 mbs or 26.63 inches (second only to the Labor Day Hurricane of 1935) and maximum winds were estimated at 190 miles an hour near the center. Tides up to 20 feet above normal were forecast from Gulfport to Pascagoula and 8 to 10 inches of rain were predicted over southeastern Mississippi. By 7 p. m., with Camille some 60 miles east of New Orleans, the Weather Bureau Office at Boothville, Louisiana (about 60 miles southeast of New Orleans) was reporting wind gusts of 107 miles an hour. An offshore drilling rig was raked by gusts of 170 miles an hour.

Camille moved inland just east of Bay St. Louis, Mississippi, about Midnight on the 17th. It has been estimated that gusts of at least 190 miles an hour hit the Bay St. Louis area while gusts of 150 miles an hour or more raked an area of Ansley to Biloxi, Mississippi, along the coast and north to near Standard. At a NASA site near Picayune a 950-mbs pressure (28.06 inches) was recorded with estimated gusts up to 160 miles an hour. Tides ran 15 to 32 feet above normal just east of the storm's center and 3 to 5 feet above normal as far east as Apalachicola, Florida. Rainfall over southern Mississippi, southeastern Louisiana, and southwestern Alabama ranged from 3 to 6 inches with a maximum fall of more than 11 inches in Hancock County, Mississippi. Mobile, Alabama, recorded 6.05 inches while the Weather Bureau Office at New Orleans recorded only one inch. Northern areas of Mississippi, close to the storm's path received 2 to 4 inches.

## Noise Issue #2 – Day of Landfall



## Twenty-One Major Hurricanes – 1963 through 2008

	<b>Tuesday thru Saturday</b>	<b>Monday</b>	<b>Sunday and Labor Day</b>
<b>Outside the Corridor</b>	<b>2</b>	<b>2</b>	<b>1</b>
<b>Inside the Corridor</b>	<b>9*</b>	<b>3</b>	<b>4</b>

\* **Noise Issue #3:** Two of these Hurricanes, Alicia and Opal, had major WSJ stories 1-2 days prior to the hurricanes' landfalls citing future earnings increases for the industry naming several of the sample firms

# Significant Abnormal Returns

## Least Noisy Sample

**Seven Major Hurricanes with Landfalls within the Oil and Gas Corridor  
(Hurricanes with Landfalls on Tuesday through Saturday)**

### Significant Mean Percentage Market Model Abnormal Returns

**Day (-1) => -.63\***

**Days (-1,0) => -.63\***

### Significant Mean Percentage Market Adjusted Abnormal Returns

**Days (-1,0) => -.58\***

**Wilcoxon Two-Tail Significance Level: \* p = 5%; \*\* p = 1%**

# Significant Abnormal Returns

## Slightly Noisier Sample

**Ten Major Hurricanes with Landfalls within the Oil and Gas Corridor  
Hurricanes with Landfalls on Monday through Saturday  
(Excludes Labor Days)**

## Significant Mean Percentage Market Model Abnormal Returns

**Day (-1) => -.52\*\***

**Days (-1,0) => -.60\*\***

## Significant Mean Percentage Market Adjusted Abnormal Returns

**Days (-1,0) => -.52\*\***

**Wilcoxon Two-Tail Significance Level: \* p = 5%; \*\* p = 1%**

# Significant Abnormal Returns

## Noisiest Sample

**Fourteen Major Hurricanes with Landfalls within the Oil and Gas Corridor**

**Significant Mean Percentage Market Model Abnormal Returns**

**Days (-1,0) => -.58\***

**Significant Percentage Market Adjusted Abnormal Returns**

**Days (-1,0) => -.49\***

**Wilcoxon Two-Tail Significance Level: \* p = 5%; \*\* p = 1%**

# What Results might be expected from Regressions on Abnormal Returns?

- **Differentiate Abnormal Returns for Hurricanes within the Oil and Gas Corridor from those for Hurricanes outside the Oil and Gas Corridor**
- **Show a relationship between Abnormal Returns and Oil Price Volatility**
- **Differentiate Abnormal Returns for Major Hurricanes within the Oil and Gas Corridor from those for Minor Hurricanes within the Oil and Gas Corridor**

# Abnormal Return Regressions

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_3 (D_C)(OPV) + b_4 (D_{Day})(D_C)(OPV) + e$$

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_3 (D_C)(OPV) + b_4 (D_M)(D_C)(OPV) + e$$

**AR = Portfolio Abnormal Return**

**$D_{WSJ}$  = Dummy => Equals 1 for Hurricanes Alicia and Opal,  
0 otherwise**

**OPV = Oil Price Volatility => Standard Deviation (30 months) for  
Producer Prices prior to Hurricane**

**$D_C$  = Dummy => Equals 1 if Landfall was within the Oil and  
Gas Corridor, 0 otherwise**

**$D_{Day}$  = Dummy => Equals 1 if Landfall on Tuesday through  
Saturday, 0 otherwise**

**$D_M$  = Dummy => Equals 1 if Major Hurricane, 0 otherwise**



# Regression Results

## Regression Results – Market Model Abnormal Returns

All 21 Major Hurricanes with Landfalls on the U.S. Gulf Coast

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_3 (D_C)(OPV) + b_4 (D_{Day})(D_C)(OPV) + e$$

	<u>Day (-1)</u>	<u>Day (0)</u>
Constant	0.0012	-0.0035*
$D_{WSJ}$	0.0200**	0.0015
OPV	0.0002	0.0008**
$(D_C)(OPV)$	-0.0006**	-0.0006**
$(D_{Day})(D_C)(OPV)$	-0.0003	0.0003
F-Statistic	13.73**	6.45**
Adjusted R <sup>2</sup>	71.8%	52.1%

All t-tests are two-tail and significance levels are: \* p = 5%; \*\* p = 1%

# Regression Results

**Regression Results – Market Model Abnormal Returns**  
**Major Hurricanes (15 in total) with Landfalls on the U.S. Gulf Coast**  
**(Excludes Hurricanes before the 1973 Oil Embargo)**

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_3 (D_C)(OPV) + b_4 (D_{Day})(D_C)(OPV) + e$$

	<u>Day (-1)</u>	<u>Day (0)</u>
Constant	0.0042	-0.0054
$D_{WSJ}$	0.0180**	0.0027
OPV	0.0000	0.0009**
$(D_C)(OPV)$	-0.0006*	-0.0007*
$(D_{Day})(D_C)(OPV)$	-0.0003	0.0003
F-Statistic	10.55**	4.68*
Adjusted R <sup>2</sup>	73.2%	51.2%

All t-tests are two-tail and significance levels are: \* p = 5%; \*\* p = 1%

# Minor Hurricanes - Summary

- **27 Total => 23 had Landfalls Within the Oil and Gas Corridor**
- **No Significant Abnormal Returns – Some indication that the market reaction is smaller (half) and later, perhaps Day (0) and/or Day (+1), than observed for the major hurricanes**

## **Twenty-Seven Minor Hurricanes – 1963 through 2008**

	<b>Tuesday thru Saturday</b>	<b>Monday</b>	<b>Sunday and Labor Day</b>
<b>Outside the Corridor</b>	<b>4*</b>	<b>0</b>	<b>0</b>
<b>Inside the Corridor</b>	<b>18</b>	<b>4</b>	<b>1</b>

**\* Noise Issue #3: One Hurricane, Dolly, had a major Senate vote to put in place a windfall profits tax on integrated oil companies on the day of landfall**

# Regression Results

**Regression Results – Market Model Abnormal Returns  
All Hurricanes (Excluded Dolly) with Landfalls on the U.S. Gulf Coast**

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_3 (D_C)(OPV) + b_4 (D_M)(D_C)(OPV) + e$$

	<u>Day (-1)</u>	<u>Day (0)</u>
Constant	-0.0008	0.0019
$D_{WSJ}$	0.0204**	-0.0015
OPV	0.0003	0.0005
$(D_C)(OPV)$	-0.0001	-0.0011**
$(D_M)(D_C)(OPV)$	-0.0007**	0.0006*
F-Statistic	7.68**	11.49**
Adjusted R <sup>2</sup>	36.7%	47.7%

All t-tests are two-tail and significance levels are: \* p = 5%; \*\* p = 1%

# Regression Results

## Regression Results – Market Model Abnormal Returns

**All Hurricanes (34 in total, Excluding Dolly) with Landfalls on the U.S. Gulf Coast  
(Excludes Hurricanes before the 1973 Oil Embargo)**

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_3 (D_C)(OPV) + b_4 (D_M)(D_C)(OPV) + e$$

	<u>Day (-1)</u>	<u>Day (0)</u>
Constant	-0.0015	0.0041
$D_{WSJ}$	0.0209**	-0.0031
OPV	0.0003	0.0004
$(D_C)(OPV)$	-0.0001	-0.0011**
$(D_M)(D_C)(OPV)$	-0.0007**	0.0005*
F-Statistic	5.53**	8.97**
Adjusted R <sup>2</sup>	35.5%	49.1%

All t-tests are two-tail and significance levels are: \* p = 5%; \*\* p = 1%

# Regression Results

## Regression Results – Market Model Abnormal Returns

All Hurricanes (39 in total) with Landfalls within the Oil and Gas Corridor

$$AR = a + b_1 D_{WSJ} + b_2 OPV + b_4 (D_M)(OPV) + e$$

	<u>Day (-1)</u>	<u>Day (0)</u>
Constant	-0.0008	0.0021
$D_{WSJ}$	0.0204**	-0.0017
OPV	0.0002*	-0.0006**
$(D_M)(OPV)$	-0.0007**	0.0006**
F-Statistic	8.23**	10.67**
Adjusted R <sup>2</sup>	36.4%	43.3%

All t-tests are two-tail and significance levels are: \* p = 5%; \*\* p = 1%