Opacity, Crash Risk and Option Smirk Curves

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Accounting discretion

Really bad outcomes

~~Opacity, Crash Risk~~ and ~~Option Smirk Curves~~

Sophisticated investor expectations

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Smirk curve

- A smirk is a skewed smile

- Differences in implied volatilities for same underlying
  - Mispricing or Bad model
- Is the smirk evidence of crash risk?
  - Crashes may be on investors' minds, but are not possible under the Black-Scholes assumptions. However, patterns of implied volatilities may be picking up the impact of potential crashes in options prices

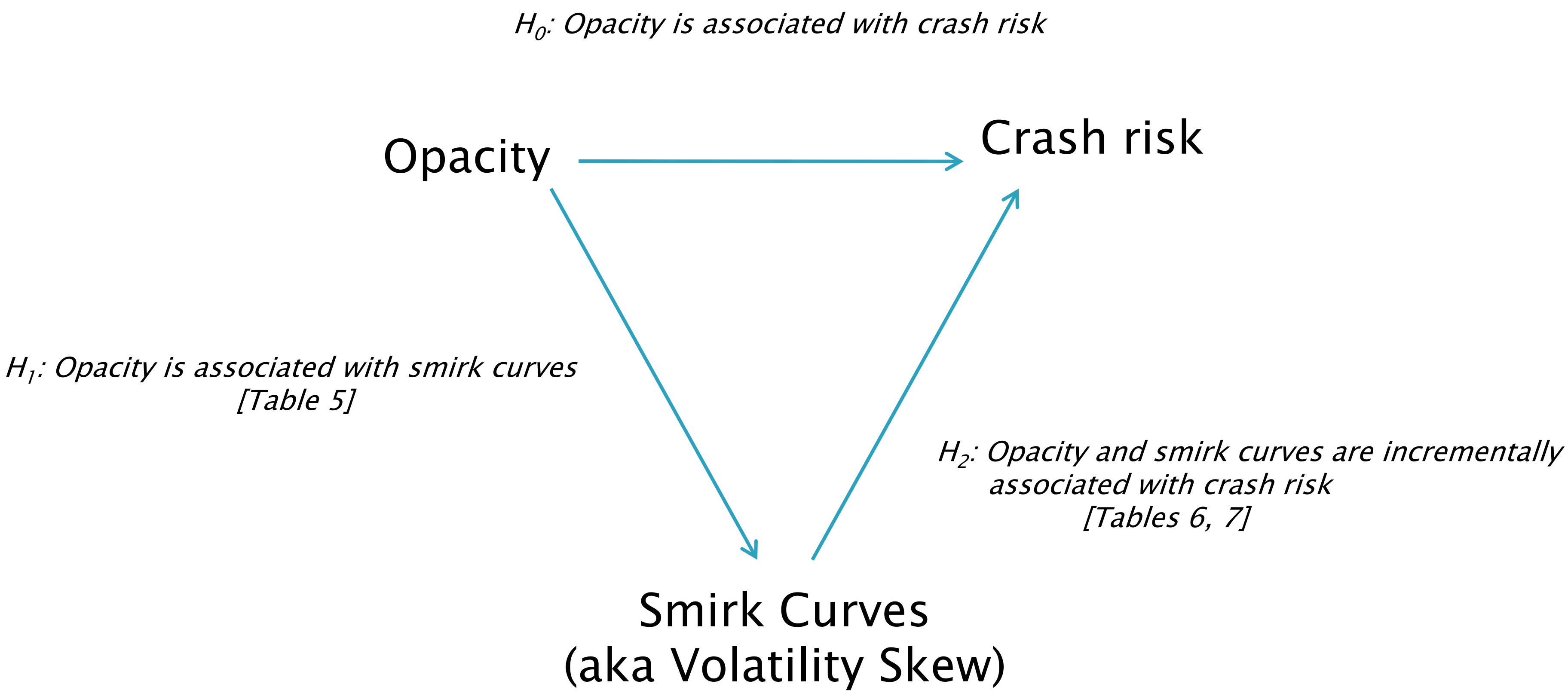
What we're looking at – in general

- Option smirk curves
  - "Climate of expectations" (Bates 1991)

- Crash risk (more appropriately, Crash incidence)
  - Large 3σ price drops (Skinner & Sloan 2002, Pan 2002)
    - Obvious recent interest in tail events

- Opacity
  - Financial reporting transparency; *stockpiled discretion*
    - (Kirschenheiter and Melumad 2002; Jin & Myers 2006; Hutton, Marcus & Tehranian 2009; Kothari, Shu & Wysocki 2009)

Research design



Why not focus on (+) jump risk?

- Obviously superior benefits
  - Easier to buy than short
  - Unlimited vs. limited upside
- However
  - Crashes much more common than jumps
    - French, Schwert and Stambaugh 1987
    - Our suspicion: Acquisition targets likely dominate
  - Our story is *not* symmetric
    - i.e., Greater financial reporting clarity increases probability of large, positive price jumps?

Defining a Crash as {0,1} variable

- Calculate residuals from a modified index model regression
  - Both market and Fama-French industry indexes included as RHS variables
  - Estimated annually for each firm using weekly returns, with one lead and one lag (Dimson 1979)
- A crash is defined as a residual return $<$ 3.09 standard deviations below the mean
  - If returns were normal, *Pr*(crash in any week) = 0.1%
  - Index model cleans out market crashes.

Defining Crash as continuous variable

- Expanded Index Model Regression:

$$r_{j,t} = a_j + b_{1,j} r_{m,t-1} + b_{2,j} r_{i,t-1} + b_{3,j} r_{m,t} + b_{4,j} r_{i,t} + b_{5,j} r_{m,t+1} + b_{6,j} r_{i,t+1} + \varepsilon_{j,t}$$

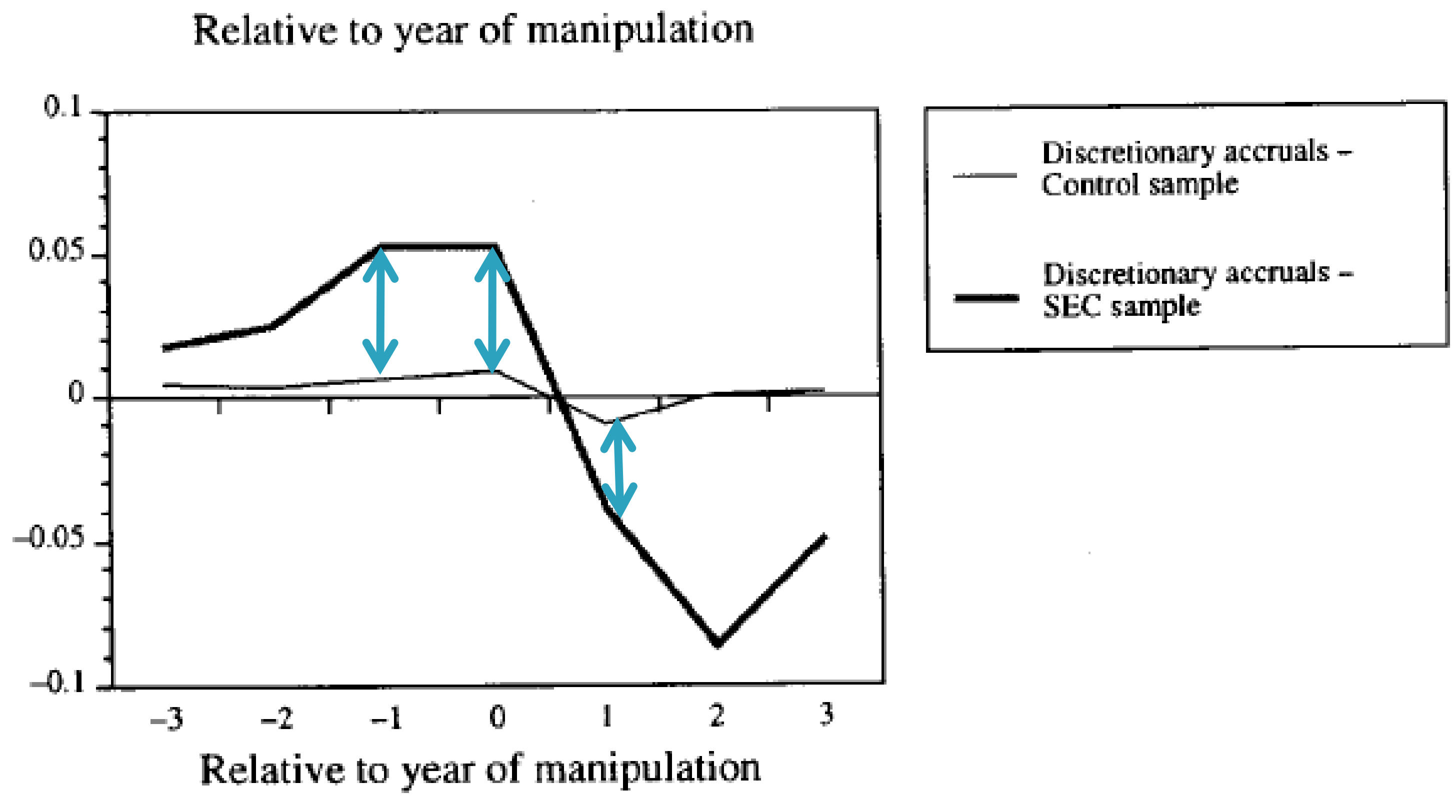
- *Firm Specific Weekly Return (FSWR) = ln (1 + ε)*

- $Extreme\_SIGMA = -\text{Min} \frac{Firm\ Specific\ Weekly\ Return - Mean(FSWR)}{Standard\ Deviation(FSWR)}$

Defining Opacity

- Our operational measure of opacity is based on earnings management theories
- Use the modified Jones model of "normal" accruals as a function of sales, PPE, and scaled by lagged assets
  - "Residuals" from this regression model are considered abnormal or "discretionary"
  - Estimate the modified Jones model by FF industry-year
- *OPAQUE* = 3-year moving <u>sum</u> of *absolute* discretionary accruals
  - Captures abnormal accruals *and* their reversals

Discretionary Accruals Patterns

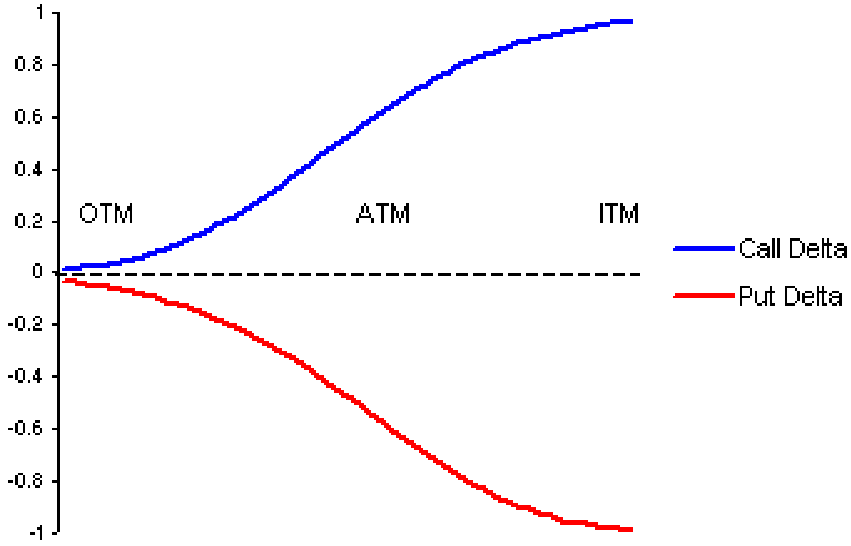


Average Discretionary Accruals of Firms Sanctioned by the SEC for Manipulating Earnings (Manipulation Occurred in Year 0)

Dechow, Hutton & Sloan (1996)

Research design choice: Option Delta

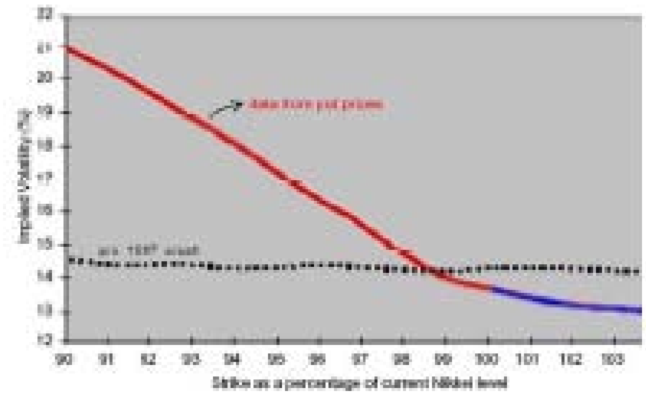
The delta of an option is the sensitivity of an option price relative to changes in the price of the underlying asset. It tells option traders how fast the price of the option will change as the underlying stock/future moves.



The above graph illustrates the behaviour of both call and put option deltas as they shift from being out-of-the-money (OTM) to at-the-money (ATM) and finally in-the-money (ITM). Note that calls and puts have opposite deltas - call option deltas are positive and put option deltas are negative.

Measuring the smirk

- Difference in implied volatility of at-the-money vs. low-strike-price options

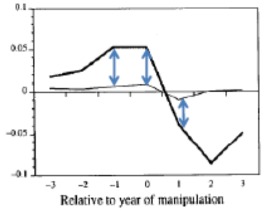


- Puts
  - At--the--money puts: $\Delta = -0.5$
  - Out--of-the--money puts: $\Delta = -0.2$
  - $Put\_SMIRK = IV_{OTM} \,/\, IV_{ATM}$
- Firm-specific or *excess* put smirk
  - $Put\_SMIRK\_FS = Put\_SMIRK$ ÷ Smirk of SPX puts (same deltas)
- We average the implied volatilities over the 10 trading days prior to the beginning of the firm’s fiscal year

Timeline

Fiscal Year of Interest –
when stock-returns are examined
and **CRASH RISK** is estimated

Measure **OPACITY** over the
three prior fiscal years



Measure the **SMIRK CURVE**
over the 10-trading days
prior to the start of the fiscal year,
examining IVs of 90-day options

Final sample (cont.)

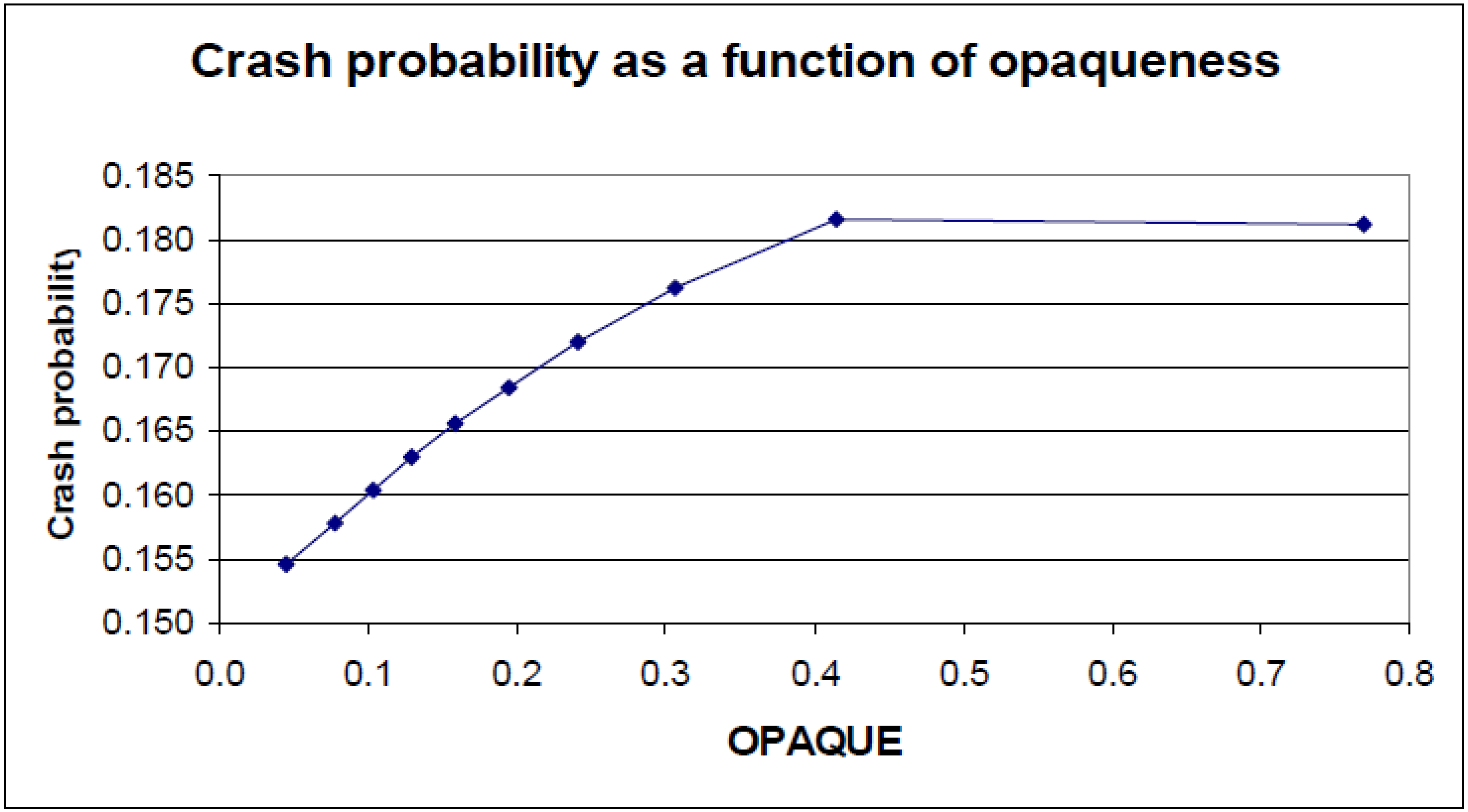
Panel C: Observations in each Fiscal Year

Fiscal Year	Number of Observations
1997	1,217
1998	1,373
1999	1,496
2000	1,433
2001	1,260
2002	1,408
2003	1,441
2004	1,433
2005	1,532
2006	1,583
2007	1,670
2008	1,697
	17,543

Option smirk data

	25%ile	Median	75%ile	IQ range	σ
Total smirk	1.022	1.067	1.114	.092	.080
Excess smirk	.818	.859	.903	.085	.072
Market smirk	1.207	1.242	1.274	.067	.044

H_0: Corr (CRASH, OPAQUE)



H_1: Put Smirk = f(Opacity) (Model 1, Table 5)

	Model 1 Coef Est	Std Error	t-stat
Intercept	0.8677	0.0050	172.19
OPAQUE	0.0032	0.0003	12.00
Signed_ACC	-0.0007	0.0003	-2.16
SALES_STREAK	-0.0023	0.0005	-4.27
EPS_STREAK	0.0000	0.0005	-0.07
AssetQ_i	0.00003	0.00001	4.99
Size (t-1)	0.0025	0.0006	4.48
M/B (t-1)	-0.0008	0.0002	-5.00
Leverage (t-1)	-0.0047	0.0033	-1.42
SD(lnres) (t-1)	-0.3620	0.0256	-14.12
R-Square (t-1)	0.0172	0.0038	4.49
R^2	0.060		
N	17,543		
No. of clusters	3,459		

H_2: Crash Risk , Smirk Curves and Opacity

(Model 1, Table 6 Logit Analysis, LHS = Crash)

	Model 1		
	Coef Est	Std Error	z-stat
Intercept	-1.8336	0.259	50.01
Put_SMIRK_FS	1.0982	0.250	19.27
OPAQUE	0.0264	0.007	16.09
Signed_ACC	-0.0048	0.008	0.39
SALES_STREAK	0.0876	0.016	30.61
EPS_STREAK	0.0033	0.015	0.05
AssetQ_i	0.0004	0.0004	0.82
ROE	-0.1847	0.036	25.85
Size (t-1)	-0.0197	0.016	1.56
M/B (t-1)	0.0083	0.005	3.08
Leverage (t-1)	-0.5036	0.091	30.39
SD(lnres) (t-1)	-0.7342	0.794	0.86
R-Square (t-1)	-0.5921	0.117	25.76
Wald ChiSq	187.49		
Pr > ChiSq	<.0001		
Crash = 1	4,088		
Crash = 0	13,455		

Thank you.