Event Studies

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Origin of event studies

What is the effect of an event on the value of a firm?

- Ball and Brown (1968)
- Fama, Fisher, Jensen, Roll (1969)

Literature in accounting and finance, looking at events like: mergers & acquisitions, Earnings announcements, macroeconomic announcements,…

KEY idea: given investor rationality, effect will be *reflected immediately in stock prices*. In fact prices reflect the present discounted value of the long-run stream of cash flows generated by the asset.

Key methodological references

- Campbell, J., A. Lo, and C. MacKinlay (1997), *The econometrics of financial markets*, Princeton University Press, ch. 4
- MacKinlay, C. (1997), “Event studies in economics and finance”, *Journal of Economic Literature*.

PART 1 - METHODOLOGY

Need to disentangle price reactions due to “normal” factors (e.g., general market conditions) from reactions induced by the event

- Specify “normal” model
- Estimate deviations from such model (“abnormal”)
- Test if these deviations are statistically significant

Models for measuring normal performance

Statistical models

- Constant-mean-return model
- Market model

Economic models

- Capital Asset Pricing Model (CAPM)
- Arbitrage Pricing Theory (APT)

Most commonly used in event studies is Market model.

Market model

r_{it} : period t return on security i

r_t^M : period t return on market portfolio

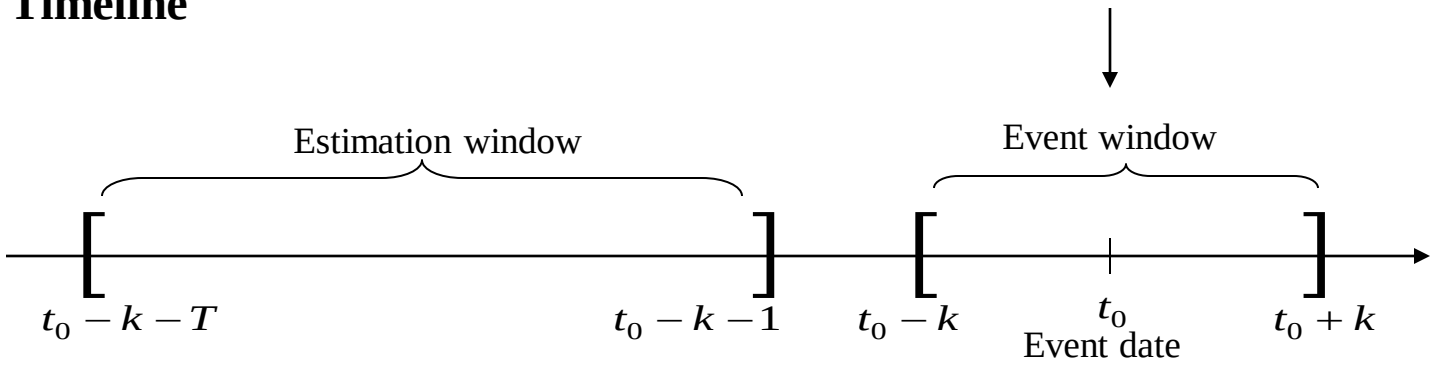
Assm. vector $\{r_{it}\}$ independently multivariate normally distributed

For each security we can model r_{it} as

$$r_{it} = \alpha + \beta r_t^M + \varepsilon_{it}$$

where r_{it} has mean 0 and variance σ_ε^2

Timeline



- Estimate market model in estimation window

$$\longrightarrow \quad \hat{\alpha}, \hat{\beta}$$

- Predict residual in event window: "abnormal" return

$$e_{it} = r_{it} - \hat{\alpha} - \hat{\beta} r_t^M$$

- Cumulative abnormal return: $CAR_{it} = \sum_{j=t_0-k}^{t} e_{ij}$

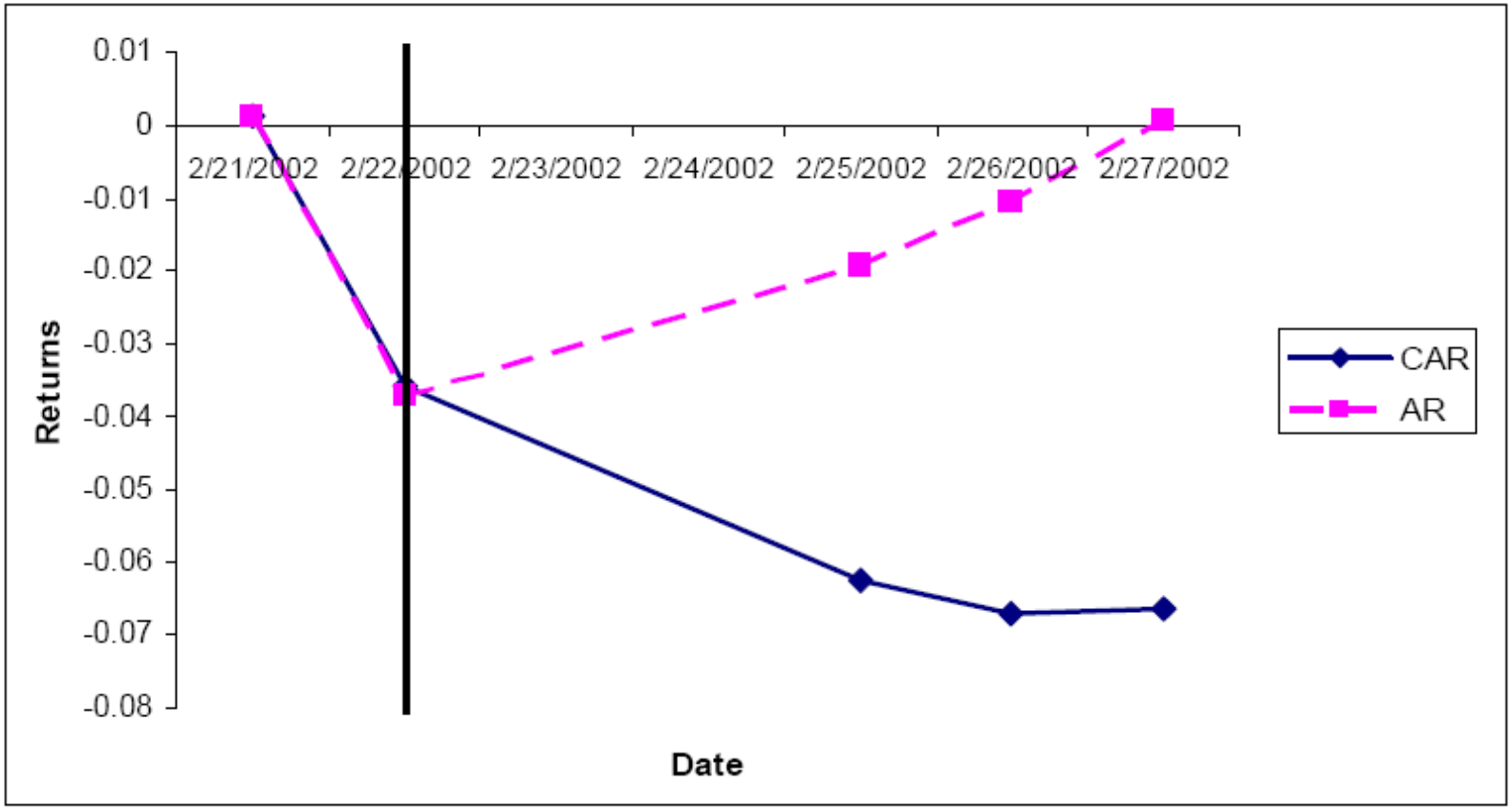
Visual inspection

If event has no effect, abnormal return e_{it} should have mean 0, and so should CAR_{it}

If event has positive (negative) effect, abnormal return e_{it} will be >0 (<0), and CAR_{it} will be upward (downward) sloping

→ Plot AR & CAR over the event window

Example


0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
-0.07
-0.08
Returns
2/21/2002
2/22/2002
2/23/2002
2/24/2002
2/25/2002
2/26/2002
2/27/2002
Date
CAR
AR

Formal tests

Parametric

H0: CAR=0

can be tested exploiting the fact that under the null the standardized CAR has a known small sample distribution: *Student t* with T-2 degrees of freedom, where T is the length of the estimation window.

Nonparametric

Sign test

Assm. AR are independent across securities

Under the null, expected proportion of positive AR is 0.5

Let N+ be the # cases with positive AR.

Test statistic

$$\left[\frac{N^{+}}{N} - 0.5\right]\frac{N^{1/2}}{0.5} \quad \sim \mathrm{N}(0,1)$$

Rank test

Rank all AR from 1 to L (where L is the total number of periods available, incl. estimation window)

Under the null, expected rank of AR on event date is (L+1)/2

Can construct a test statistic that is ~ $\mathrm{N}(0,1)$

(Corrado 1989)

Alternative: Dummy regression tests

Often also called event studies.

Use the *entire sample* and estimate

$$r_{it} = \alpha + \beta r_t^M + \gamma D_t + \varepsilon_{it}$$

where D_{it} is a dummy taking value 1 on event dates

PART 2 - APPLICATIONS

Strategic choices

- Choose sample of firms

  Often dictated by economic theory (e.g., a specific sector of stock market)

- Choose events

  Must be exogenous and unanticipated

- Choose estimation & event windows

  Event window should be narrow!

Application 1

R. Fisman (2000), "Estimating the value of political connections", AER

Dummy regression approach

"When Suharto catches a cold, shares in Bimantara Citra catch pneumonia" (Financial Times, Jan. 1998)

Diff-in-diff idea:

-Events related to health of President Suharto

-Indonesian companies more or less connected to Suharto's family

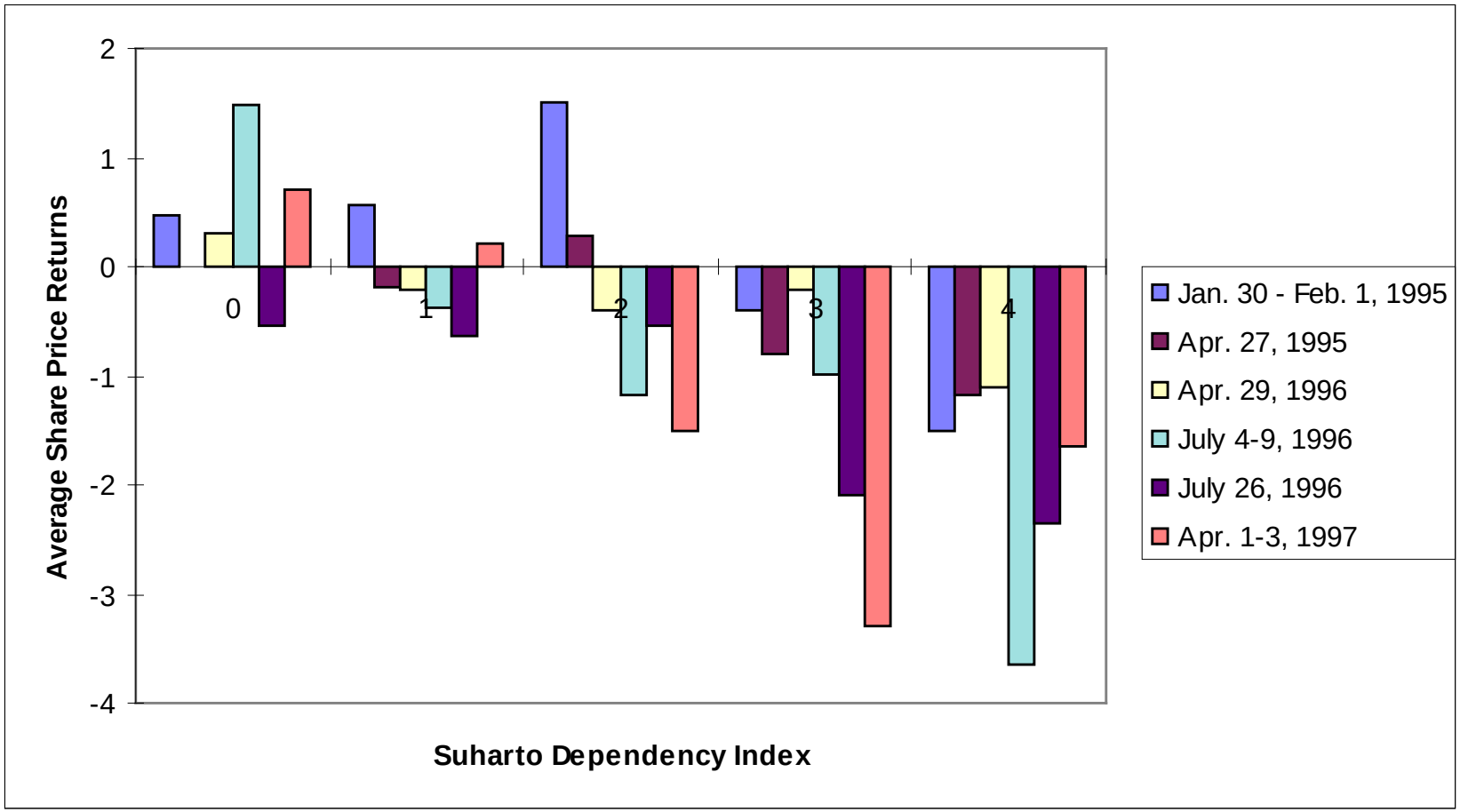
Fisman (cont'd)

Event selection:

•January 30, 1995 - Rumors of illness sparked by Suharto's failure to attend inauguration of oil refinery
•April 27, 1995 - Rumors of illness spark dollar buying against the rupiah
•April 29, 1996 - Suharto's wife dies
•July 4, 1996 - Announcement that Suharto will go to Germany for a health check-up
•July 26, 1996 - 'Fresh rumors about Suharto's health send jitters through the markets
•April 1, 1997 - Rumors circulate that Suharto has been hospitalized for heart problems

Result

Well connected firms have lower returns when Suharto gets sick



Application 2

M. Guidolin and E. La Ferrara (2007), "Diamonds are forever, wars are not. Is conflict bad for private firms?", AER

Event study à la McKinlay

Exploits sudden death of Jonas Savimbi as an exogenous change in the probability of continuation of the Angolan civil war.

Includes "control" group of non-affected companies

(as in Abadie-Gardeazabal 2003)

Selection of companies

Sample: 1 Jan. 1998 – 28 Jun. 2002

Companies operating in Angola

1. **America Mineral Field (AMF)**. Listed in Canada.
2. **Ashton Mining Ltd.** Listed in Australia. (From January 17th, 2001: Rio Tinto)
3. **Caledonia Mining**. Listed in Canada
4. **De Beers Consolidated Mines Ltd**. Listed in South Africa. (From June 1st, 2001: Anglo American).
5. **Diamondworks Ltd**. Listed in Canada.
6. **Southernera**. Listed in Canada.
7. **Trans Hex International**. Listed in South Africa.

Mkt indexes

Southafrica: **JOHMKT**; Canada: **TS300**; Australia: **AS30**; World: **MSCIworld**

Control companies

Take an equally weighted "Angolan" portfolio and build a "Non-Angolan" portfolio to serve as a control group

Universe of potential companies :

1) Listed in same markets
2) Continuously traded in sample period
3) Without concessions in Angola

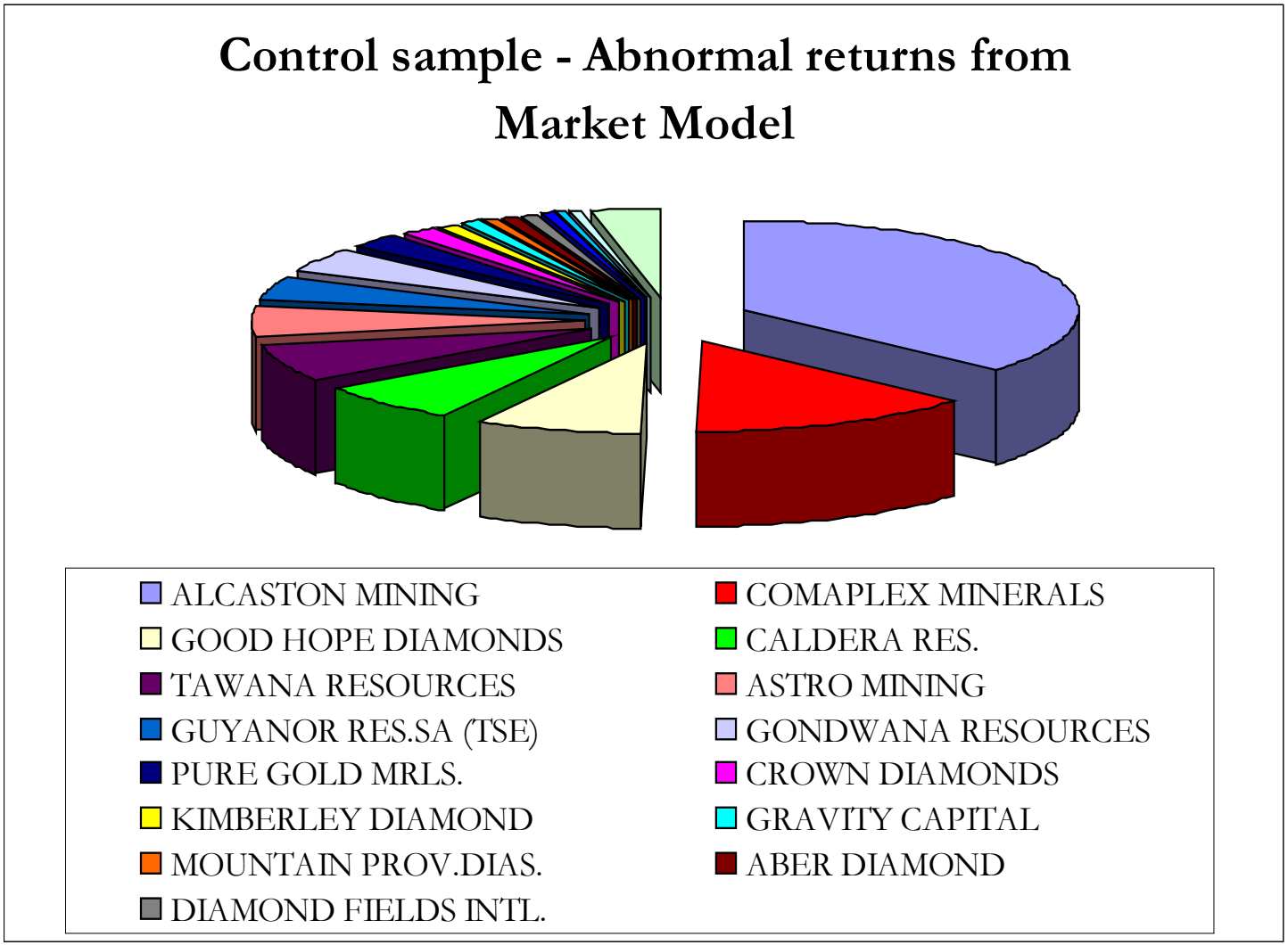
Control portfolio

$$e_t^C = \sum_{j=1}^{J} we_{j,t}$$

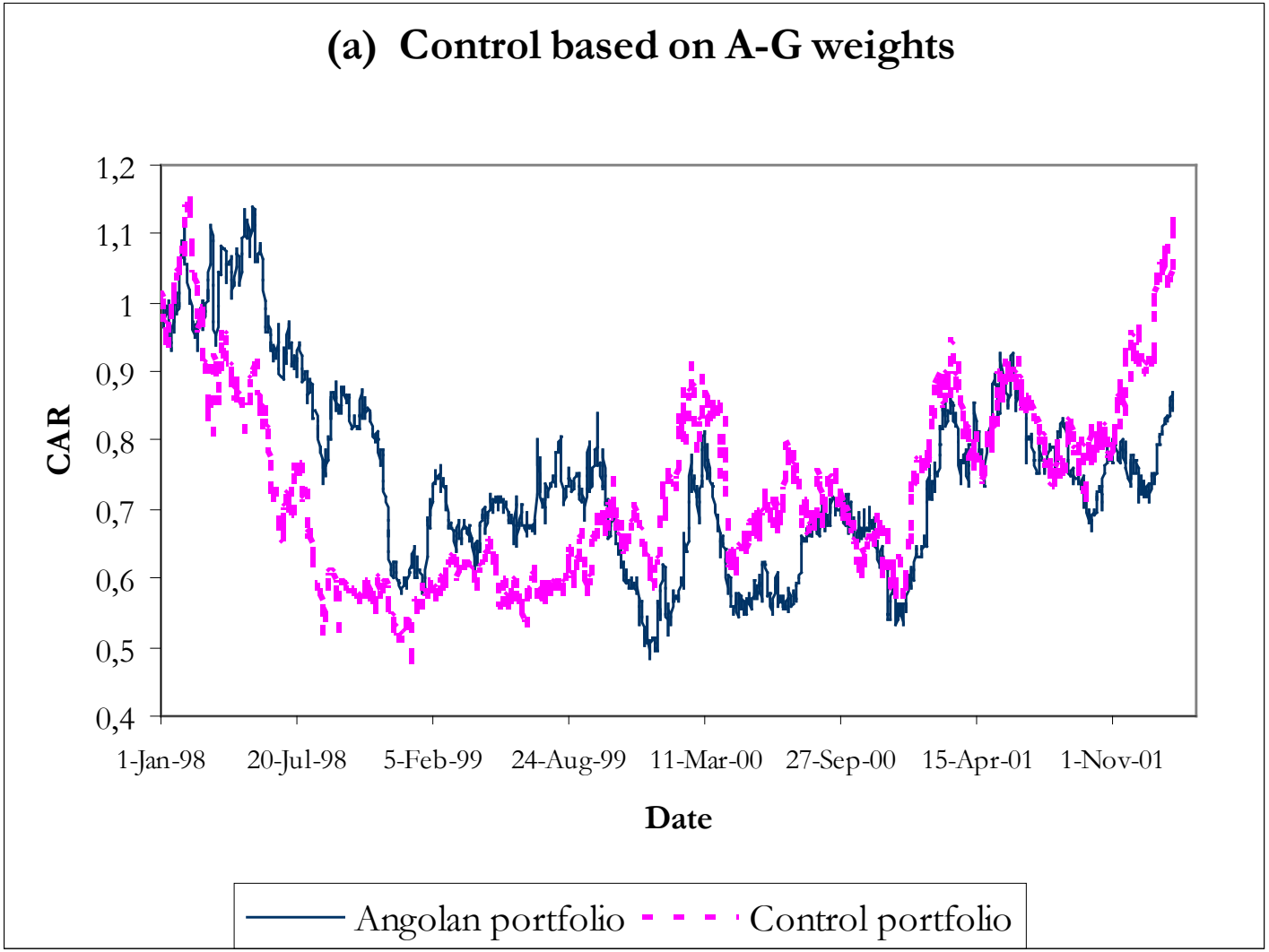
Weights *w* chosen so that, *before event*, portfolio C matches 3 properties of portfolio A:

1. Mean of abnormal return e^A
2. Variance of abnormal return e^A
3. β from market model

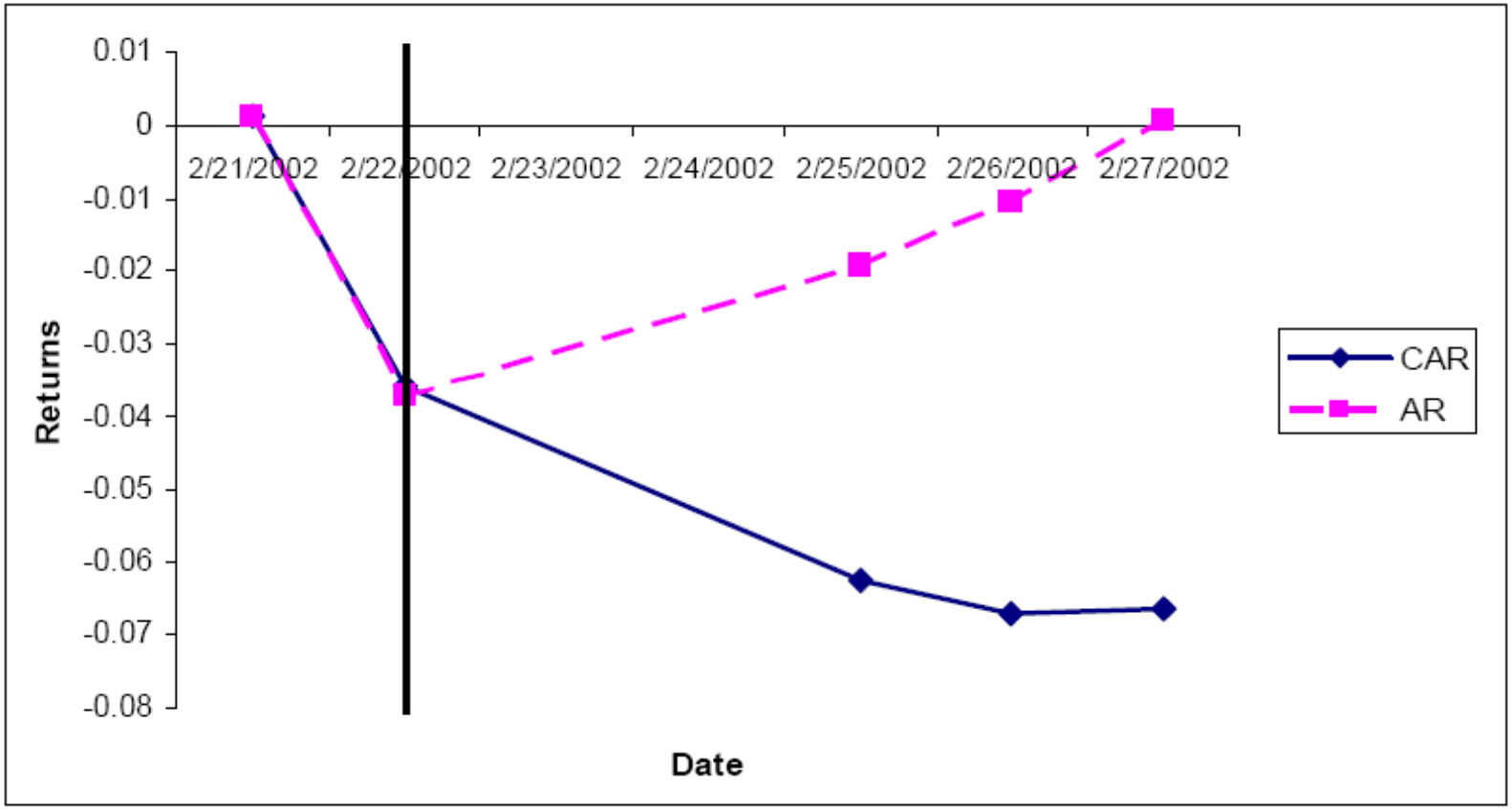
Control Portfolio: weights



Control Portfolio: tracking

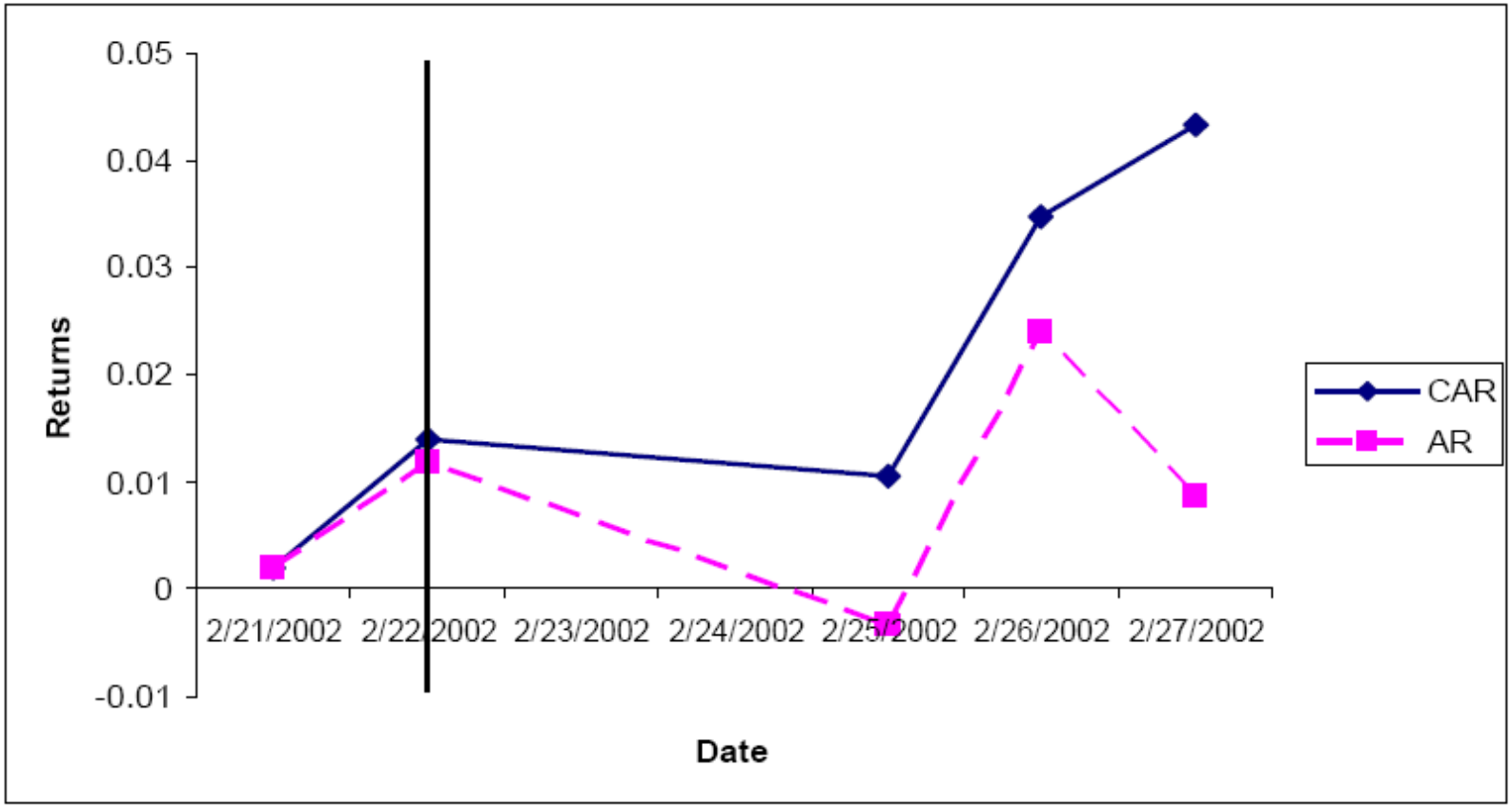


Savimbi's death (cont'd)



(a) Angolan portfolio

Savimbi's death (cont'd)



(b) Control portfolio

Application 3

DellaVigna, S. And E. La Ferrara, "Detecting Illegal Arms Trade", AEJ Economic Policy, forthcoming

"Forensic economics" type of application

Reverse engineer from stock price reaction to news to firm's involvement

Useful example for event selection

Basic idea

Arms embargoes systematically violated. Direct evidence hard to find →

Use *financial market reactions* to news about conflict

to *indirectly* assess the presence of illegal transactions

- Take all countries subjected to embargoes and collect news about evolution of conflict before & during embargo
- Test if stock returns of arms producing companies respond to unexpected conflict events during embargo

Hypothesis

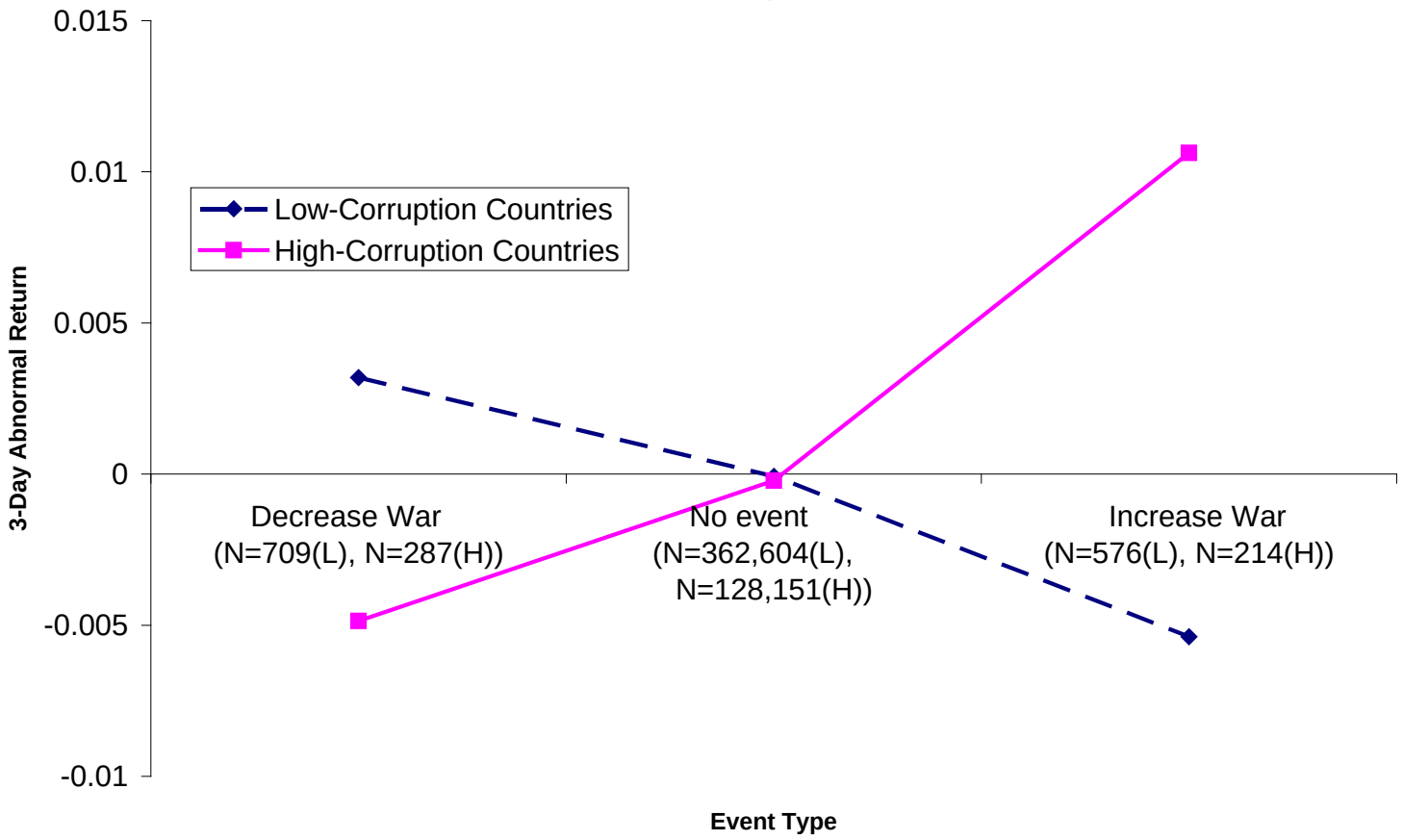
How does an unexpected increase in conflict during embargo affect stock returns?

- Effect = 0 for companies engaging in no trading
- Effect < 0 for companies previously engaged in legal trading

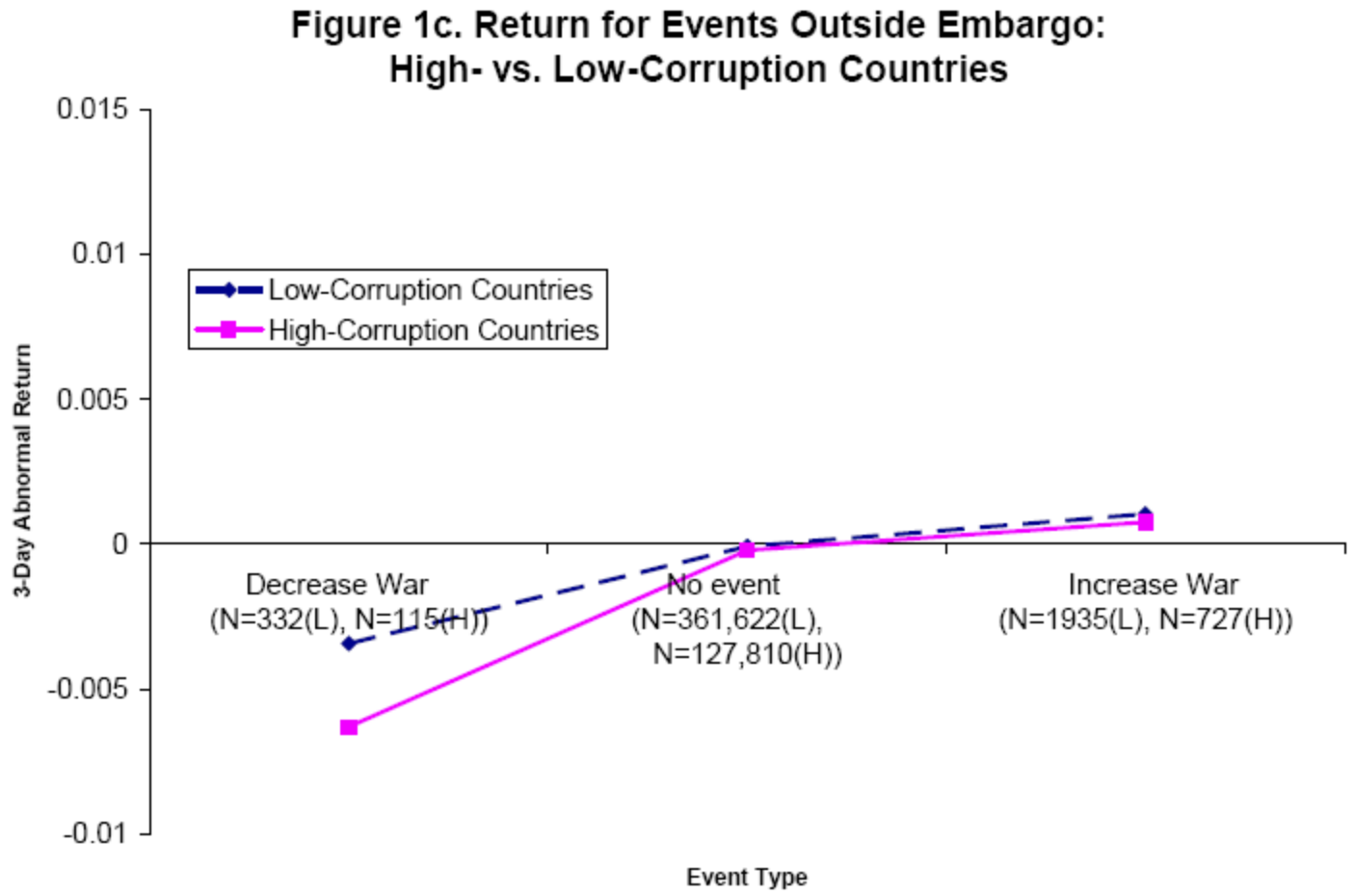
  [*End of war -and of embargo- is postponed*]
- Effect > 0 for companies engaging in illegal trading

  [*Longer war means higher sales*]

Figure 1b. Return for Events During Embargo: High- vs. Low-Corruption Countries



Separate firms based on costs of breaching embargoes. During embargo, pattern for companies in High-Corruption countries is consistent w/ illegal trade!



Outside embargo, no difference between the two sets of companies

Data: Conflicts and Events

Country	First event	Last event
Ethiopia	6 May 1998	15 May 2001
Liberia	15 Oct 1985	11 Aug 2003
Somalia	4 Apr 1988	30 Jan 2004
Sierra Leone	1 Oct 1985	17 May 2000
Rwanda	19 Dec 1988	16 Jul 1994
Sudan	6 Apr 1985	29 Mar 2005
Angola	22 Dec 1988	4 Apr 2002
Yugoslavia	9 Oct 1988	17 Mar 2004

Event selection:

- Event salient enough to attract attention of media and investors
- Event unambiguously increases or decreases conflict
- Event unanticipated (see Lexis-Nexis)

Conflicts (cont'd)

Lexis-Nexis academic:
Newswires, All available wire reports.
Terms=country name AND (column) in Headline, Lead Paragraph, Terms

Example – Sierra Leone

Date	Type of Event	Description	Conflict Intensity	Lexis-Nexis	t+2	t+1	t=Event	t-1	t-2	t-3	t-4	Unexpected?
05/25/1997	Coup	General Koroma deposes President Kabbah in a military coup. Kabbah flees to Guinea.	+	Coup	47	44	45	0	0	0	0	Yes
10/08/1997	UN Embargo	UN places oil and arms embargo on Sierra Leone	-	Embargo	2	4	9	2	3	1	0	
03/10/1998	Truce	The elected president of Sierra Leone, Kabbah, returns home.	-	President	9	12	45	13	3	5	2	Yes
01/06/1999	Coup Attempt	Unsuccessful coup attempt by Revolutionary United Front	+	Coup	21	31	25	8	3	0	2	Yes
01/08/1999	Major Battle	Rebels besiege and capture Freetown. Over 4,000 dead.	+	Coup	14	12	21	31	25	8	3	No
05/17/2000	Leader Captured	Rebel leader Foday Sankoh captured. Capture was unanticipated: passerby spotted Sankoh near the house he had been staying in.	-	Sankoh	15	21	62	9	7	7	10	Yes

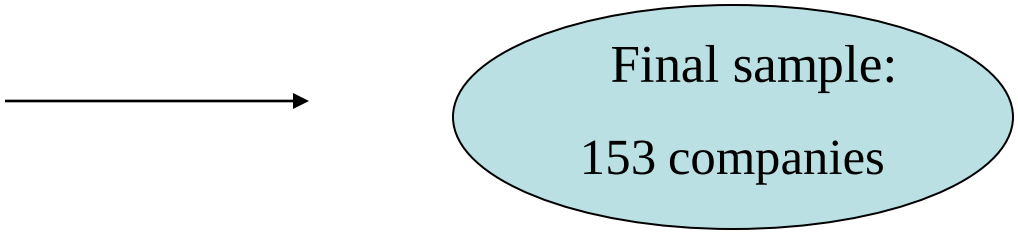
Data: Companies

Criteria for inclusion

1. Traded on a world stock market (Datastream-Worldscope matched data)
2. Belong to SIC code in arms production

   (3482-3484, 3489, 3761, 3764, 3769, 3795, 2892)

3. OR Belong to list of Top-100 Arms Companies by SIPRI



A. Dummy regression results

Get abnormal returns from market model

$$r_{it} = \alpha + \beta r_{it}^{M} + \varepsilon_{it} \longrightarrow e_{it} = r_{it} - \hat{\alpha} + \hat{\beta} r_{it}^{M}$$

Form 3-day abnormal returns $e_{i,t}^{(-1,1)}$

Estimating equation

$$e_{i,t}^{(-1,1)} = \alpha + \gamma Emb_t + \alpha_D D_i + \gamma^D Emb_t D_i + \eta_{i,t}.$$

where:

Emb_t = +1 if event that increases conflict occurs at t during embargo

= 0 if nothing happens

= -1 if event that decreases conflict occurs at t during embargo

D_t = 1 indicator variable for high-corruption country

…

Table 3: Other proxies for cost of embargo violation

Dep. Var.:	Abnormal 3-Day Stock Return (-1,1)					
Measure of Cost of Embargo Violation:	*High Corruption Percept. Index*	*Low Transparency of Arms Trade*	*Non-OECD Member*	*Low Press Freedom*	*High Bribe-Payer Index*	*High Self-Dealing Index*
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A -- Indicators for Cost of Embargo Violation						
Event During Embargo (1=Increase War, -1=Decrease, 0=No Event)	-0.0042	-0.0043	-0.0031	-0.0023	-0.0027	-0.0025
	(0.0018)**	(0.0020)**	(0.0017)*	(0.0017)	(0.0017)	(0.0016)
Event During Embargo* (Low Cost of Embargo Violation, Indicator)	0.0115	0.0114	0.015	0.0061	0.0058	0.0055
	(0.0041)***	(0.0042)***	(0.0056)***	(0.0045)	(0.0046)	(0.0040)
Low Cost of Embargo Violation - Indicator	-0.0001	-0.0001	-0.0002	-0.0002	0	-0.0002
	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
Constant	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001	0
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)

B. Detecting individual violations

One company & event at a time

Get abnormal returns from market model

$$r_{it} = \alpha + \beta r_{it}^{M} + \varepsilon_{it} \longrightarrow e_{it} = r_{it} - \hat{\alpha} + \hat{\beta} r_{it}^{M}$$

- Test if e_{it} >0 (<0) and significant when conflict increases (decreases) during embargo.
- Get *p*-values from *t*-tests (Campbell-Lo-McKinlay)

Detection methodology

- Take set of all statistically significant reactions (p-values <.10)

- Outside embargo:
  (+) conflict → CAR>0 "*Consistent_out*"

- Inside embargo:
  (+) conflict → CAR>0 "*Illegal_in*"
  (+) conflict → CAR<0 "*Legal_in*"

- Potentially **illegal** companies:
  Consistent_out, Illegal_in … or
  Illegal_in, Illegal_in …

Detection methodology (cont'd)

Table 9. Detection methodology, An Example

Company (1)	Country (2)	Event Date (3)	Event Type (4)	UN Embargo (5)	Event and Conflict Intensity (6)	Cumulative 3-day Abnormal Return (7)	P-value of Test CAR=0 (8)
Company A	Ethiopia	02/06/1999	Major Battle	No	+	+0.11	0.031
Company A	Ethiopia	05/12/2000	Major Battle	No	+	+0.03	0.116
Company A	Ethiopia	12/12/2000	Peace Treaty	Yes	-	-0.05	0.039
Company A	Yugoslavia	06/25/1991	Independence	No	+	-0.04	0.111
Company A	Yugoslavia	03/30/2001	Leader Captured	Yes	-	-0.12	0.015
Company A	Yugoslavia	03/12/2003	Assassination	No	+	+0.12	0.015
Company A	Yugoslavia	03/17/2004	Start Fighting	No	+	+0.03	0.161

CONCLUSIONS

Too much investor rationality?

Example: Maloney-Mulherin (2003)

- Jan. 28, 1986: Challenger shuttle explodes

  All rocket makers are down. Hardest hit: Morton Thiokol

- Weeks later: O-ring (produced by Morton Thiokol) found responsible for explosion

- Someone knew and invested... (NYT, 11/3/2006)

Challenger example (cont'd)

Daily stock market behavior around the challenger crash

Variable	Morton Thiokol	Lockheed	Martin Marietta	Rockwell International
Panel A. Daily stock returns				
January 28	– 11.86%	– 2.14%	– 3.25%	– 2.48%