

Introduction

Marriott 2018

Personal information for up to 500 million guests was involved, including:

- Names
- Contact details
- Passport numbers
- Encrypted payment card numbers

Encryption keys may also have been compromised.

Timeline:

- Marriott **detected** the malware attack on **Sep 8, 2018**.
- Marriott **announced** the database security incident on **Nov 30, 2018**.

Consequences:

- GDPR Fine: £ 18.4 M
- FTC/State Settlement: \$52 M, etc.

Given that mutual funds show preemptive behavior by:

- Trading before security class action announcements,
- Anticipating earnings surprises,
- Predicting ESG rating changes through ESG-focused fund trades.

Do funds trade before cyber attack announcement?

Mutual Funds' Preemptive Response to Major Cyber Attacks

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Research Question & Main Findings

1. Ahead of the announcement, do funds already trade high- or low-cyber-risk stocks?

- In the months before a major cyber attack announcement, active mutual funds reduced their holdings of high-cyber-risk stocks industry-wide. There is no clear evidence for index funds.

2. What kind of funds trade? Which stocks are being traded?

- Funds that mention cyber risk in their prospectuses trade more actively.
- Stocks in the attacked industry are traded the most (sell high-cyber-risk stocks, buy low-cyber-risk stocks).
- A better data privacy policy serves as a substitute for low cyber risk.

3. Do funds get flow rewarded?

- Yes, especially from institutional investors.

Methodology & Results

Do funds trade preemptively?

| Panel A: Active Mutual Funds | | | | | | | | |
|--------------------------------------|-------------------------------|-----------|--------------------------------|---------|---------|---------|---------|---------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | Time to Announcement (months) | | Position Change _{i,t} | | | | | |
| High Cyber Risk Dummy _{i,t} | 0.0006 | -0.0020** | 0.0010 | 0.0001 | -0.0009 | 0.0011 | -0.0005 | 0.0002 |
| Low Cyber Risk Dummy _{i,t} | | | | | (0.001) | (0.001) | (0.001) | (0.001) |
| Observations | 312,025 | 325,021 | 344,290 | 349,654 | 312,025 | 325,021 | 344,290 | 349,654 |
| Adj. R ² | 0.1344 | 0.1105 | 0.1205 | 0.1326 | 0.1344 | 0.0945 | 0.1063 | 0.1326 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fund × Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Stock FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

| Panel B: Index Funds | | | | | | | | |
|--------------------------------------|-------------------------------|---------|--------------------------------|---------|---------|---------|---------|---------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| | Time to Announcement (months) | | Position Change _{i,t} | | | | | |
| High Cyber Risk Dummy _{i,t} | 0.0014 | -0.0001 | 0.0009 | -0.0002 | -0.0002 | -0.0001 | -0.0007 | -0.0002 |
| Low Cyber Risk Dummy _{i,t} | | | | | (0.001) | (0.001) | (0.001) | (0.001) |
| Observations | 292,209 | 324,477 | 331,081 | 336,830 | 292,209 | 324,477 | 331,081 | 336,830 |
| Adj. R ² | 0.6597 | 0.6062 | 0.3688 | 0.6800 | 0.6597 | 0.6011 | 0.3610 | 0.6761 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fund × Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Stock FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

What kind of funds trade?

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|--------------------------------------|-------------------------------|-----------|--------------------------------|---------|---------|---------|---------|---------|
| | Time to Announcement (months) | | Position Change _{i,t} | | | | | |
| High Cyber Risk Dummy _{i,t} | 0.0009 | -0.0016** | 0.0012* | -0.0006 | -0.0013 | 0.0013 | -0.0008 | -0.0005 |
| Low Cyber Risk Dummy _{i,t} | | | | | (0.001) | (0.001) | (0.001) | (0.001) |
| Observations | 312,025 | 325,013 | 344,291 | 349,656 | 312,025 | 325,013 | 344,291 | 349,656 |
| Adj. R ² | 0.0514 | 0.0337 | 0.0468 | 0.0614 | 0.0514 | 0.0337 | 0.0468 | 0.0508 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fund × Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Stock FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Which stocks are being traded?

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|--------------------------------------|-------------------------------|-----------|--------------------------------|---------|---------|---------|---------|---------|
| | Time to Announcement (months) | | Position Change _{i,t} | | | | | |
| High Cyber Risk Dummy _{i,t} | 0.0007 | -0.0016** | 0.0012* | 0.0003 | -0.0011 | 0.0008 | -0.0002 | -0.0001 |
| Low Cyber Risk Dummy _{i,t} | | | | | (0.001) | (0.001) | (0.001) | (0.001) |
| Observations | 312,025 | 325,021 | 344,290 | 349,654 | 312,025 | 325,021 | 344,290 | 349,654 |
| Adj. R ² | 0.1345 | 0.1105 | 0.1205 | 0.1472 | 0.1345 | 0.0945 | 0.1063 | 0.1325 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fund × Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Stock FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|--------------------------------------|-------------------------------|-----------|--------------------------------|---------|-----------|---------|---------|---------|
| | Time to Announcement (months) | | Position Change _{i,t} | | | | | |
| High Cyber Risk Dummy _{i,t} | -0.0007 | -0.0016** | 0.0010 | -0.0002 | -0.0017** | 0.0011 | -0.0007 | 0.0006 |
| Low Cyber Risk Dummy _{i,t} | | | | | (0.001) | (0.001) | (0.001) | (0.001) |
| Observations | 312,138 | 325,099 | 344,372 | 349,745 | 312,138 | 325,099 | 344,372 | 349,745 |
| Adj. R ² | 0.1163 | 0.0936 | 0.1118 | 0.1304 | 0.1251 | 0.1004 | 0.1118 | 0.1370 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fund × Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Do funds get flow rewarded?

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|--------------------------------|-------------------------------|--------|-----------------------|---------|--------|----------|--------|---------|
| | Time to Announcement (months) | | Flow _{i,t+1} | | | | | |
| Sell High Dummy _{i,t} | -0.0022 | 0.0010 | 0.0008 | -0.0001 | | | | |
| Buy Low Dummy _{i,t} | | | | | 0.0007 | 0.0042** | 0.0000 | 0.0026* |
| Observations | 2,338 | 2,379 | 2,509 | 2,562 | 2,338 | 2,379 | 2,509 | 2,562 |
| Adj. R ² | 0.1937 | 0.3904 | 0.3006 | 0.4120 | 0.3646 | 0.3920 | 0.4436 | 0.2640 |
| Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Fund FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |