



**JACOBS LEVY EQUITY  
MANAGEMENT CENTER**  
FOR QUANTITATIVE FINANCIAL RESEARCH

# Information Release and the Fit of the Fama-French Model

Thomas Gilbert   **Christopher Hrdlicka**   Avraham Kamara

Michael G. Foster School of Business  
University of Washington

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# Risk and Return Resolution at the Casino

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- ▶ Returns occur when risk is resolved

# Risk and Return Resolution in Financial Markets

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- ▶ Financial markets operate similarly, but with positive expected returns
- ▶ Returns accrue unevenly throughout the year
- ▶ Big price and return movements on information events
  - ▶ Earnings announcements (Beaver 1968)
  - ▶ Dividend announcements (Kalay and Lowenstein 1985)
  - ▶ Macro announcement days (Savor and Wilson 2013)
  - ▶ Firm specific events, e.g., mergers announcements
- ▶ Traditional models treat returns as earned uniformly
- ▶ We show how lumpy information releases affect
  - ▶ Return patterns
  - ▶ How we properly measure risk

# Overview

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## Model of lumpy information release:

- ▶ Two types of announcers: early and late
- ▶ No difference in risk
  - ▶ Assume same terminal cash flow distribution
  - ▶ Endogenously earn the same expected return
- ▶ CAPM supplemented with early-minus-late factor prices assets
- ▶ Alpha reduction primarily in early announcement period

## Empirical Results:

- ▶ Systematic differences in earnings announcement timing
- ▶ Fama French 3-factor model improvement concentrated in earnings announcement months
- ▶ Early v. late announcers have the same average returns
- ▶ Announcement timing affects SMB and HML exposure

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# Section 1

## Model / Theory

Based on

“Daily data is bad for beta: Opacity and Frequency-Dependent Betas” by Gilbert, Hrdlicka, Kalodimos, Siegel (RAPS 2014)

# Model Setup

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- ▶ Continuum of agents  $j$  with utility over terminal wealth

$$u[W_{j,T}] = -\exp[-\gamma W_{j,T}]$$

- ▶ Three trading dates 0, 1, 2 with consumption at 2
- ▶  $N$  risky assets  $i$  that pay terminal cash flow

$$C_{i,T} = \frac{1}{N} \left( \tilde{b}_{i,1} \tilde{f}_1 + \tilde{b}_{i,2} \tilde{f}_2 \right)$$

- ▶  $\tilde{f}_T$  is an economy wide systematic shock (event or news)
- ▶  $\tilde{b}_{i,t}$  is the asset specific exposure to the shock
- ▶  $M$  early announcing firms and  $N-M$  are late announcing firms

# Information Structure

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$$C_{i,T} = \frac{1}{N} \left( \tilde{b}_{i,1} \tilde{f}_1 + \tilde{b}_{i,2} \tilde{f}_2 \right)$$

- ▶ Systematic shock  $\tilde{f}_\tau$  revealed at each date
- ▶ Firm specific exposure  $\tilde{b}_{i,\tau}$ 
  - ▶ Early announcers: revealed immediately at date  $\tau$
  - ▶ Late announcers: revealed with a lag of one period
- ▶ Agents infer information about the late announcers' cash flows from the information released by early announcers
- ▶ Early and late announcers have same risk
  - ▶ Identical cash flow distributions
  - ▶ Endogenously identical expected returns

# Model Results

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▶ Parameter choices

- ▶ Risk aversion  $\gamma = 5$
- ▶ Number of sub-periods  $T = 3$
- ▶ Fraction of early announcers is 60%
- ▶  $f^u = 1$  and  $f^d = 0$  with  $P_f^u = P_f^d = 0.5$
- ▶  $b^H = 1$  and  $b^L = 0$  with  $P_b^H = P_b^L = 0.5$

▶ Average absolute alphas

|                     | First Period | Second Period |
|---------------------|--------------|---------------|
| CAPM                | 0.13         | 0.08          |
| Market & Early-Late | 0.00         | 0.00          |
| Improvement         | -0.13        | -0.08         |



# Model Intuition

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- ▶ Betas
  - ▶ Late announcers have time-varying conditional risk
  - ▶ Resulting discount rate effect dampens covariance with market
  - ▶ Biases their beta down:  $\beta_i = \beta_{i,true} + \text{error}$
- ▶ Expected market returns
  - ▶ More information released in first period
  - ▶ Expected market return is higher in first period
- ▶ Expected asset returns:  $E[r_{i,t}] = \beta_{i,true} \times E[r_{mkt,t}]$
- ▶ Alphas
  - ▶  $\alpha_{i,t} = E[r_{i,t}] - (\beta_{i,true} + \text{error}) \times E[r_{mkt,t}]$   
 $= \text{error} \times E[r_{mkt,t}]$
  - ▶ In first period, higher market return leads to higher alphas

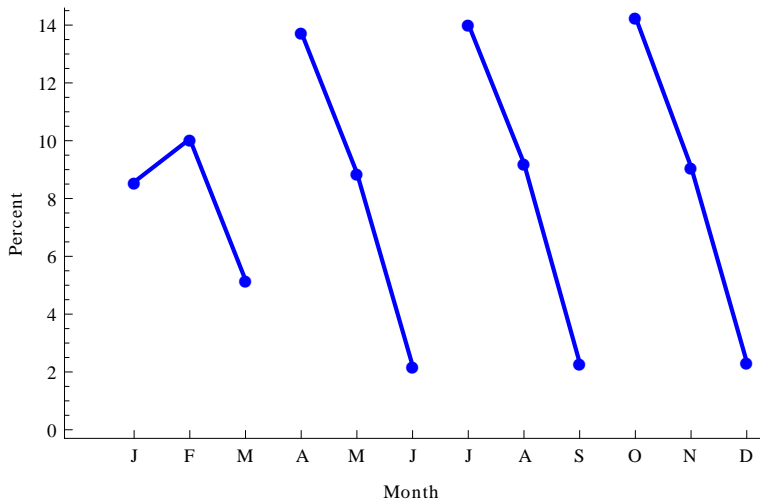
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## Section 2

# Earnings Announcements

# Earnings Announcements by Month (1975-2012)

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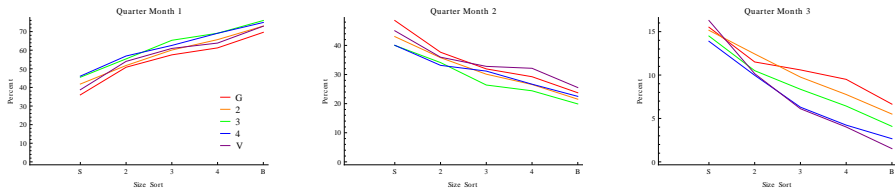
# Announcement Patterns for Stocks by Characteristics

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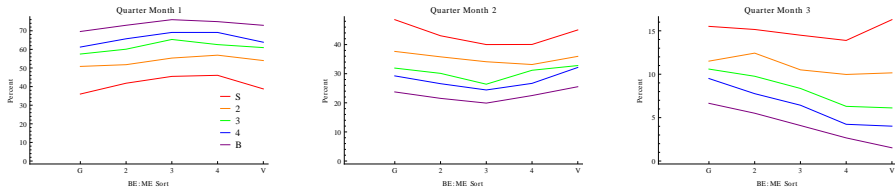
- ▶ Each quarter, each firm assigned label of month 1, month 2 or month 3 announcer
  - ▶ Assignment is based on the first announcement for that firm in a given quarter
  - ▶ Firm must have at least four announcements in the current year to be included
- ▶ Tabulate the fraction of the stocks within each of the 25 Fama French size and book-to-market sorted portfolios that announce in each month
  - ▶ Aggregate across all quarters

# Announcement Patterns for Stocks by ME and BE/ME

## Across ME per BE/ME quintile:



## Across BE/ME per ME quintile:



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## Section 3

### Alphas

# Testing Asset Pricing Models

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- ▶ Standard time series regression:

$$r_{i,t}^e = \alpha_i^{CAPM} + \beta_{rmrf,i} r_{rmrf,t}^e + \epsilon_{i,t}$$

$$r_{i,t}^e = \alpha_i^{FF3M} + \beta_{rmrf,i} r_{rmrf,t}^e + \beta_{smb,i} r_{smb,t} + \beta_{hml,i} r_{hml,t} + \epsilon_{i,t}$$

- ▶ Alphas for each month:

$$r_{i,t}^e = \alpha_{i,Jan}^{CAPM} + \alpha_{i,Feb}^{CAPM} + \dots + \alpha_{i,Dec}^{CAPM} + \beta_{rmrf,i} r_{rmrf,t}^e + \epsilon_{i,t}$$

$$r_{i,t}^e = \alpha_{i,Jan}^{FF3M} + \alpha_{i,Feb}^{FF3M} + \dots + \alpha_{i,Dec}^{FF3M} + \beta_{rmrf,i} r_{rmrf,t}^e \\ + \beta_{smb,i} r_{smb,t} + \beta_{hml,i} r_{hml,t} + \epsilon_{i,t}$$

# Fit Statistics

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- ▶ For each model: Mean absolute alpha per month  $m$ 
  - ▶  $i = 1 \dots N$  test assets

$$\frac{1}{N} \sum_i \left| \alpha_{i,m}^{model} \right|$$

- ▶ Across models: Difference in mean absolute alphas

$$\frac{1}{N} \sum_i \left| \alpha_{i,m}^{FF3M} \right| - \frac{1}{N} \sum_i \left| \alpha_{i,m}^{CAPM} \right|$$

- ▶ Monthly returns (1950-2010)



# Mean Absolute Alphas using 30 FF Industry Portfolios

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|      | Jan   | Feb   | Mar  | Apr  | May   | Jun  | Jul   | Aug  | Sep   | Oct   | Nov   | Dec   | Totals      |
|------|-------|-------|------|------|-------|------|-------|------|-------|-------|-------|-------|-------------|
| CAPM | 0.66  | 0.46  | 0.39 | 0.53 | 0.42  | 0.52 | 0.52  | 0.38 | 0.50  | 0.72  | 0.49  | 0.50  | JAJ0 -0.42  |
| FF3M | 0.50  | 0.35  | 0.40 | 0.55 | 0.42  | 0.54 | 0.43  | 0.42 | 0.50  | 0.53  | 0.49  | 0.47  | JFAJO -0.53 |
| Chng | -0.16 | -0.11 | 0.02 | 0.01 | -0.00 | 0.02 | -0.09 | 0.04 | -0.01 | -0.19 | -0.00 | -0.04 | All -0.51   |

- ▶ 82% of improvement occurs in Jan-Apr-Jul-Oct
- ▶ No/small improvements in other months except Feb
- ▶ Expectation is 33% improvement in 4 random months
- ▶ Standard errors generated by bootstrapping

# Mean Absolute Alphas using 25 FF Portfolios

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|      | Jan   | Feb   | Mar   | Apr   | May  | Jun  | Jul   | Aug   | Sep   | Oct   | Nov   | Dec   | Totals      |
|------|-------|-------|-------|-------|------|------|-------|-------|-------|-------|-------|-------|-------------|
| CAPM | 1.60  | 0.58  | 0.38  | 0.40  | 0.14 | 0.20 | 0.45  | 0.28  | 0.31  | 0.88  | 0.32  | 0.37  | JAJ0 -2.20  |
| FF3M | 0.52  | 0.23  | 0.20  | 0.15  | 0.14 | 0.20 | 0.27  | 0.20  | 0.19  | 0.17  | 0.31  | 0.23  | JFAJO -2.54 |
| Chng | -1.07 | -0.35 | -0.19 | -0.24 | 0.00 | 0.00 | -0.18 | -0.08 | -0.12 | -0.70 | -0.01 | -0.14 | All -3.08   |

- ▶ 71% of improvement occurs in Jan-Apr-Jul-Oct
- ▶ Assess effect of each factor by looking at FF2M
  - ▶ SMB is main driver of improvement in Jan and Oct
  - ▶ HML is main driver of improvement in Apr and Jul

# What Does Not Drive The Improved Fit

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- ▶ Monthly conditional betas
  - ▶ Monthly dummies interacted with market returns
  - ▶ No overall improvement
  - ▶ Consistent with Lewellen and Nagel (2006)
  
- ▶ Extremely bad returns in reporting months (e.g., October)
  - ▶ Censor worst 10, 20, or 30 returns
  - ▶ Overall improvement and monthly concentration unchanged

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## Section 4

# Expected Returns

# Factor Returns

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- ▶ Average return for each month of the quarter
  - ▶ E.g., Month 1 is average of Jan, Apr, Jul, Oct

|         | RMRF | SMB  | HML  |
|---------|------|------|------|
| Month 1 | 0.75 | 0.06 | 0.76 |
| Month 2 | 0.61 | 0.22 | 0.17 |
| Month 3 | 0.42 | 0.25 | 0.20 |

- ▶ Market return is highest in first month
- ▶ SMB is highest when small firms tend to announce
- ▶ HML is highest when value firms tend to announce

# Early v. Late Returns

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- ▶ Classify firms by announcement month in each quarter
- ▶ Rebalance quarterly
- ▶ Calculate average return across all months

|                | Early<br>Announcers | Late<br>Announcers | Difference | t-stat |
|----------------|---------------------|--------------------|------------|--------|
| Equal Weighted | 0.87                | 0.95               | -0.08      | -0.20  |
| Value Weighted | 0.51                | 0.60               | -0.09      | -0.29  |

- ▶ Early and late announcers have the same average returns
- ▶ Therefore early and late announcers have same riskiness
- ▶ Holds after controlling for risk by matching on FF size and book-to-market characteristics

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## Section 5

# Risk Exposures and Announcement Timing

# SMB and HML Beta Exposures

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- ▶ SMB and HML exposures should vary based on when a firm announces
- ▶ Small stocks that announce early should have SMB exposures like big stocks
- ▶ Big stocks that announce late should have SMB exposures like small stocks
  - ▶ H1: SMB betas should increase across months within quarter
- ▶ Growth stocks that announce early should have HML exposures like value stocks
- ▶ Values stocks that announce late should have HML exposures like growth stocks
  - ▶ H2: HML betas should decrease across months within quarter



# Methodology

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- ▶ Each firm-year, calculate SMB and HML exposures using backward looking 60-month windows starting in December
- ▶ Triple sort stocks based on size, book-to-market and reporting month within each quarter to form portfolios
- ▶ Portfolio betas

# SMB Beta Exposures

|    | Quarter 1 |       |       | Quarter 2 |       |       | Quarter 3 |       |       | Quarter 4 |       |       |
|----|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|-----------|-------|-------|
|    | Mo. 1     | Mo. 2 | Mo. 3 | Mo. 1     | Mo. 2 | Mo. 3 | Mo. 1     | Mo. 2 | Mo. 3 | Mo. 1     | Mo. 2 | Mo. 3 |
| SL | 1.43      | 1.32  | 1.46  | 1.29      | 1.43  | 1.59  | 1.38      | 1.29  | 0.99  | 1.24      | 1.48  | 1.20  |
| S2 | 1.24      | 1.41  | 1.18  | 1.26      | 1.41  | 1.03  | 1.28      | 1.41  | 1.01  | 1.24      | 1.48  | 1.02  |
| S3 | 0.91      | 1.23  | 1.16  | 1.01      | 1.21  | 1.09  | 1.02      | 1.29  | 1.22  | 1.05      | 1.19  | 1.15  |
| S4 | 0.99      | 1.00  | 1.03  | 1.02      | 0.94  | 1.17  | 1.02      | 1.01  | 1.10  | 0.98      | 1.08  | 1.18  |
| SH | 1.09      | 1.02  | 1.12  | 1.05      | 1.07  | 1.23  | 1.04      | 1.08  | 1.31  | 1.02      | 1.09  | 1.34  |
| 2L | 0.91      | 0.92  | 1.03  | 0.90      | 0.92  | 1.12  | 0.88      | 1.04  | 0.98  | 0.86      | 1.01  | 0.90  |
| 22 | 0.83      | 0.96  | 0.91  | 0.87      | 0.97  | 0.82  | 0.85      | 1.08  | 0.94  | 0.86      | 1.01  | 1.07  |
| 23 | 0.69      | 0.77  | 0.89  | 0.72      | 0.83  | 0.74  | 0.73      | 0.81  | 0.80  | 0.74      | 0.79  | 0.79  |
| 24 | 0.75      | 0.69  | 0.85  | 0.76      | 0.67  | 0.83  | 0.77      | 0.78  | 0.72  | 0.73      | 0.88  | 0.83  |
| 2H | 0.75      | 0.85  | 0.90  | 0.82      | 0.82  | 0.83  | 0.86      | 0.78  | 0.85  | 0.84      | 0.77  | 0.96  |
| 3L | 0.87      | 0.61  | 0.67  | 0.80      | 0.54  | 0.66  | 0.75      | 0.66  | 0.64  | 0.77      | 0.54  | 0.53  |
| 32 | 0.48      | 0.51  | 0.67  | 0.48      | 0.57  | 0.59  | 0.50      | 0.59  | 0.75  | 0.54      | 0.46  | 0.89  |
| 33 | 0.40      | 0.44  | 0.57  | 0.39      | 0.43  | 0.73  | 0.40      | 0.56  | 0.51  | 0.41      | 0.44  | 0.62  |
| 34 | 0.32      | 0.40  | 0.64  | 0.39      | 0.36  | 0.52  | 0.41      | 0.37  | 0.44  | 0.38      | 0.48  | 0.48  |
| 3H | 0.49      | 0.49  | 0.66  | 0.50      | 0.52  | 0.61  | 0.48      | 0.59  | 0.47  | 0.51      | 0.57  | 0.72  |
| 4L | 0.46      | 0.44  | 0.38  | 0.44      | 0.48  | 0.17  | 0.44      | 0.57  | 0.06  | 0.43      | 0.58  | 0.56  |
| 42 | 0.24      | 0.31  | 0.22  | 0.22      | 0.32  | 0.28  | 0.20      | 0.40  | 0.41  | 0.22      | 0.22  | 0.52  |
| 43 | 0.20      | 0.15  | 0.25  | 0.19      | 0.15  | 0.37  | 0.21      | 0.11  | 0.49  | 0.20      | 0.19  | 0.37  |
| 44 | 0.17      | 0.08  | 0.74  | 0.09      | 0.26  | 0.84  | 0.15      | 0.14  | 0.93  | 0.12      | 0.26  | 0.84  |
| 4H | 0.14      | 0.24  | 0.27  | 0.20      | 0.24  | 0.59  | 0.21      | 0.20  | 0.49  | 0.18      | 0.25  | 0.82  |
| BL | -0.31     | -0.23 | 0.16  | -0.31     | -0.10 | 0.12  | -0.32     | -0.11 | 0.18  | -0.33     | -0.08 | 0.13  |
| B2 | -0.28     | -0.20 | -0.08 | -0.26     | -0.10 | -0.24 | -0.27     | -0.10 | -0.37 | -0.26     | -0.06 | -0.32 |
| B3 | -0.26     | -0.16 | -0.11 | -0.25     | -0.05 | -0.25 | -0.24     | -0.01 | -0.18 | -0.25     | -0.06 | -0.09 |
| B4 | -0.19     | -0.13 | -0.07 | -0.17     | -0.09 | -0.16 | -0.15     | -0.05 | -0.16 | -0.16     | -0.11 | 0.14  |
| BH | -0.28     | 0.06  | 0.09  | -0.11     | 0.01  | -0.35 | -0.08     | -0.21 | 0.35  | -0.08     | -0.16 | 0.53  |

# HML Beta Exposures

|    | Quarter 1   |             |             | Quarter 2    |              |              | Quarter 3    |              |              | Quarter 4    |              |              |
|----|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|    | Mo. 1       | Mo. 2       | Mo. 3       | Mo. 1        | Mo. 2        | Mo. 3        | Mo. 1        | Mo. 2        | Mo. 3        | Mo. 1        | Mo. 2        | Mo. 3        |
| SL | -0.38       | -0.40       | -0.19       | -0.39        | -0.31        | -0.27        | -0.40        | -0.28        | -0.13        | -0.41        | -0.24        | -0.37        |
| S2 | 0.02        | -0.08       | 0.14        | 0.02         | -0.07        | 0.22         | 0.03         | -0.09        | 0.25         | 0.01         | -0.09        | 0.24         |
| S3 | 0.37        | 0.21        | 0.31        | <b>0.36</b>  | <b>0.18</b>  | <b>0.18</b>  | <b>0.33</b>  | <b>0.17</b>  | <b>0.20</b>  | 0.32         | 0.14         | 0.33         |
| S4 | 0.49        | 0.46        | 0.50        | <b>0.49</b>  | <b>0.50</b>  | <b>0.32</b>  | 0.46         | 0.47         | 0.44         | <b>0.46</b>  | <b>0.50</b>  | <b>0.32</b>  |
| SH | <b>0.78</b> | <b>0.73</b> | <b>0.66</b> | 0.75         | 0.71         | 0.70         | 0.73         | 0.70         | 0.68         | 0.73         | 0.70         | 0.68         |
| 2L | -0.43       | -0.42       | -0.34       | -0.45        | -0.41        | -0.29        | -0.46        | -0.26        | -0.42        | -0.47        | -0.33        | -0.38        |
| 22 | 0.18        | 0.08        | 0.17        | 0.16         | 0.09         | 0.19         | 0.19         | 0.03         | 0.15         | 0.15         | 0.11         | 0.10         |
| 23 | 0.43        | 0.37        | 0.37        | 0.40         | 0.44         | 0.36         | <b>0.43</b>  | <b>0.39</b>  | <b>0.26</b>  | 0.41         | 0.41         | 0.40         |
| 24 | 0.59        | 0.55        | 0.60        | <b>0.60</b>  | <b>0.58</b>  | <b>0.45</b>  | <b>0.62</b>  | <b>0.52</b>  | <b>0.43</b>  | <b>0.61</b>  | <b>0.53</b>  | <b>0.41</b>  |
| 2H | 0.84        | 0.88        | 0.96        | <b>0.87</b>  | <b>0.92</b>  | <b>0.64</b>  | <b>0.86</b>  | <b>0.90</b>  | <b>0.64</b>  | 0.85         | 0.92         | 0.79         |
| 3L | -0.37       | -0.42       | -0.28       | -0.44        | -0.34        | -0.37        | -0.44        | -0.37        | -0.28        | -0.45        | -0.33        | -0.20        |
| 32 | 0.20        | 0.24        | 0.20        | 0.23         | 0.13         | 0.28         | 0.22         | 0.14         | 0.21         | <b>0.23</b>  | <b>0.16</b>  | <b>0.09</b>  |
| 33 | 0.49        | 0.47        | 0.48        | 0.49         | 0.49         | 0.50         | 0.48         | 0.46         | 0.55         | 0.47         | 0.54         | 0.36         |
| 34 | 0.65        | 0.61        | 0.68        | <b>0.64</b>  | <b>0.68</b>  | <b>0.30</b>  | <b>0.68</b>  | <b>0.66</b>  | <b>0.50</b>  | 0.67         | 0.62         | 0.54         |
| 3H | 0.91        | 0.73        | 0.75        | 0.78         | 0.88         | 0.60         | 0.78         | 0.80         | 0.61         | 0.77         | 0.85         | 0.93         |
| 4L | -0.44       | -0.39       | -0.22       | -0.39        | -0.46        | -0.28        | -0.38        | -0.44        | -0.36        | -0.41        | -0.39        | -0.39        |
| 42 | <b>0.30</b> | <b>0.18</b> | <b>0.02</b> | <b>0.30</b>  | <b>0.09</b>  | <b>-0.23</b> | 0.30         | 0.11         | 0.15         | <b>0.30</b>  | <b>0.19</b>  | <b>-0.17</b> |
| 43 | <b>0.56</b> | <b>0.50</b> | <b>0.28</b> | 0.53         | 0.43         | 0.44         | <b>0.58</b>  | <b>0.37</b>  | <b>0.38</b>  | 0.55         | 0.33         | 0.43         |
| 44 | <b>0.66</b> | <b>0.58</b> | <b>0.18</b> | <b>0.65</b>  | <b>0.54</b>  | <b>0.15</b>  | <b>0.65</b>  | <b>0.51</b>  | <b>0.20</b>  | <b>0.63</b>  | <b>0.55</b>  | <b>0.19</b>  |
| 4H | 1.01        | 0.84        | 1.05        | 0.92         | 0.79         | 0.92         | 0.93         | 0.90         | 0.96         | 0.91         | 0.83         | 0.89         |
| BL | -0.33       | -0.38       | -0.44       | <b>-0.32</b> | <b>-0.42</b> | <b>-0.52</b> | <b>-0.32</b> | <b>-0.38</b> | <b>-0.64</b> | <b>-0.32</b> | <b>-0.42</b> | <b>-0.64</b> |
| B2 | 0.15        | 0.12        | 0.34        | 0.17         | 0.12         | 0.03         | 0.18         | -0.04        | 0.02         | <b>0.15</b>  | <b>0.16</b>  | <b>-0.08</b> |
| B3 | 0.31        | 0.30        | 0.44        | 0.31         | 0.32         | 0.39         | 0.32         | 0.25         | 0.24         | <b>0.30</b>  | <b>0.37</b>  | <b>0.04</b>  |
| B4 | <b>0.75</b> | <b>0.67</b> | <b>0.20</b> | <b>0.76</b>  | <b>0.50</b>  | <b>0.06</b>  | <b>0.76</b>  | <b>0.55</b>  | <b>0.12</b>  | 0.76         | 0.51         | 0.51         |
| BH | 0.77        | 0.86        | 0.49        | 0.91         | 0.59         | 0.51         | 0.92         | 0.47         | 0.57         | 0.92         | 0.47         | 0.57         |

# Conclusion

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- ▶ Model: Lumpy information release
  - ▶ Creates a factor structure in returns
  - ▶ Even among equally risky firm
- ▶ Evidence:
  - ▶ Fama-French 3-factor model reduces alphas mainly in key earnings announcement months
  - ▶ Big firms announce before small firm
  - ▶ Value firms announce before growth firms
  - ▶ Early and late announcing firms have same risk
  - ▶ SMB and HML exposures vary with announcement timing
- ▶ Conclusion:
  - ▶ Information structure *and* risk jointly determine factor structure
  - ▶ Explanations of SMB and HML must match these seasonality
  - ▶ We show how characteristics can generate covariances