# Dividend Policy in the Era of Big Data

**Yancheng Qiu**

HKUST Business School

**Tao Shu**

School of Management and Economics
Shenzhen Finance Institute
Chinese University of Hong Kong, Shenzhen

**Shujing Wang**

School of Economics and Management
Tongji University

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# Alternative Data and Finance

- **Alternative data, or big data, refers to large and complex data that cannot be collected or processed by traditional methods.**

- **Existing literature shows that alternative data can play important role in financial markets and asset management.**
  - Chen et al. (2014): Seeking alpha.
  - Froot et al. (2017): Customer activity measured mobile devices.
  - Da et al. (2017): Industrial electricity usage.
  - Today, over half of global hedge funds use alternative data.

# Alternative Data and Corporate Policies

- **Alternative data can also have substantial impact on corporate policies.**
  - ➢ The severe information asymmetry between corporate insiders and outside investors has large impact on corporate policies.
  - ➢ Alternative data can help outside investors close their information gap relative to firm managers and more effectively monitor the firms' operations.
  - ➢ Only limited evidence to this date.

- **We examine if the emergence of alternative data affects firms' corporate policies through alleviated information asymmetry.**

# Satellite-Based Parking Lot Traffic

Parking lot of a Walmart store in Arizona at 2:29 pm on July 4, 2016. The number of cars on this Walmart store's parking lot is 129.
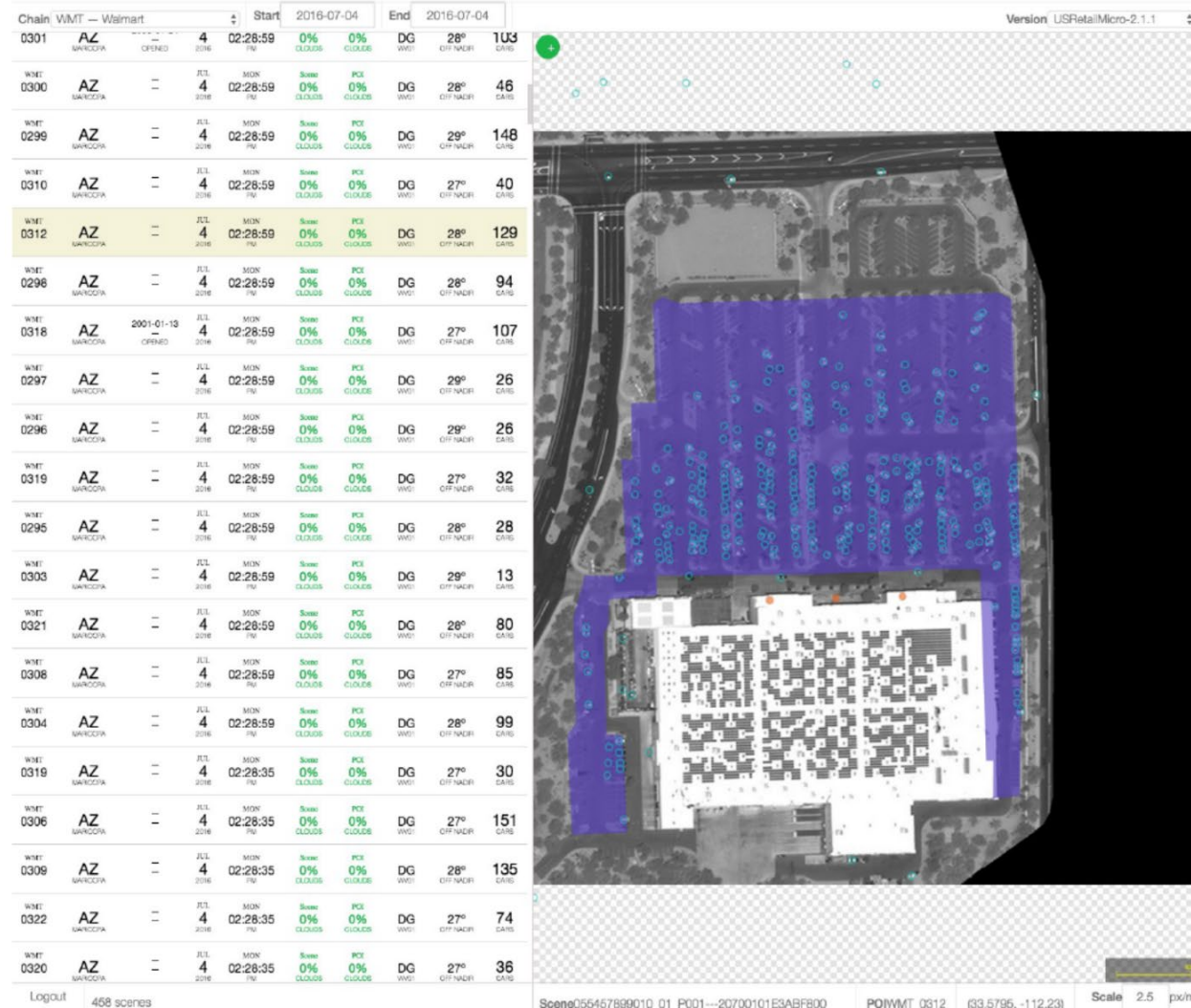
# Satellite Data and Dividend Policies

- **Staggered releases of satellite-based parking lot traffic data by two vendors, RS Metrics and Orbital Insight, for 142 public retail firms during 2011 to 2017.**

  - Zhu (2019) provides novel evidence that the satellite data contain value-relevant information, improve information transparency, and help outside investors monitor managers.

- **Why do we examine satellite data release and dividend policy?**

  - Dividend is major corporate policy and a puzzle especially for U.S. firms (Allen and Michaely 1997).

  - The three major dividend theories center on information asymmetry and agency costs.

  - Provides a unique setting for us to investigate both the effect of alternative data and the dividend theories.

# Main Findings

- **Difference-in-differences regressions show that retail firms substantially increase dividend payouts after their satellite-based traffic data are released.**
  - ➢ The increase in dividends is concentrated in firms with poor investment opportunities.
  - ➢ Support the "outcome model": Outside investors, concerned about agency problem, push managers to pay dividends which reduces the amount of free cash flows and in turn agency costs.

- **Further analyses also support the "outcome" model of dividend policy.**
  - ➢ The effect of satellite data release is stronger when firms have more entrenched managers, less severe financial constraints, or higher ownerships by sophisticated investors.
  - ➢ Firms finance the dividend increase by cutting general investment while their "good" investment (R&Ds) remains intact.

- **Satellite imagery data of parking lot traffic for U.S. retailers.**
  - ➤ RS Metrics (RS) is the first U.S. data vendor that releases real-time parking lot traffic data based on satellite image from the first quarter of 2011.
  - ➤ Orbital Insight (OB), RS' most prominent competitor, started to release similar data from the second quarter of 2015.
  - ➤ Daily store- and firm-level parking lot car counts and parking lot utilization for major U.S. retailers.

- **Zhu (2019): The satellite data releases increase the retail firms' stock price efficiency, reduce the profitability of insider trading, and reduce investment inefficiency**.
  - ➤ The satellite data serve as an additional mechanism for outside investors to monitor firm managers.
  - ➤ Katona et al. (2020) find that the satellite data contains value-relevant information about firm performance.
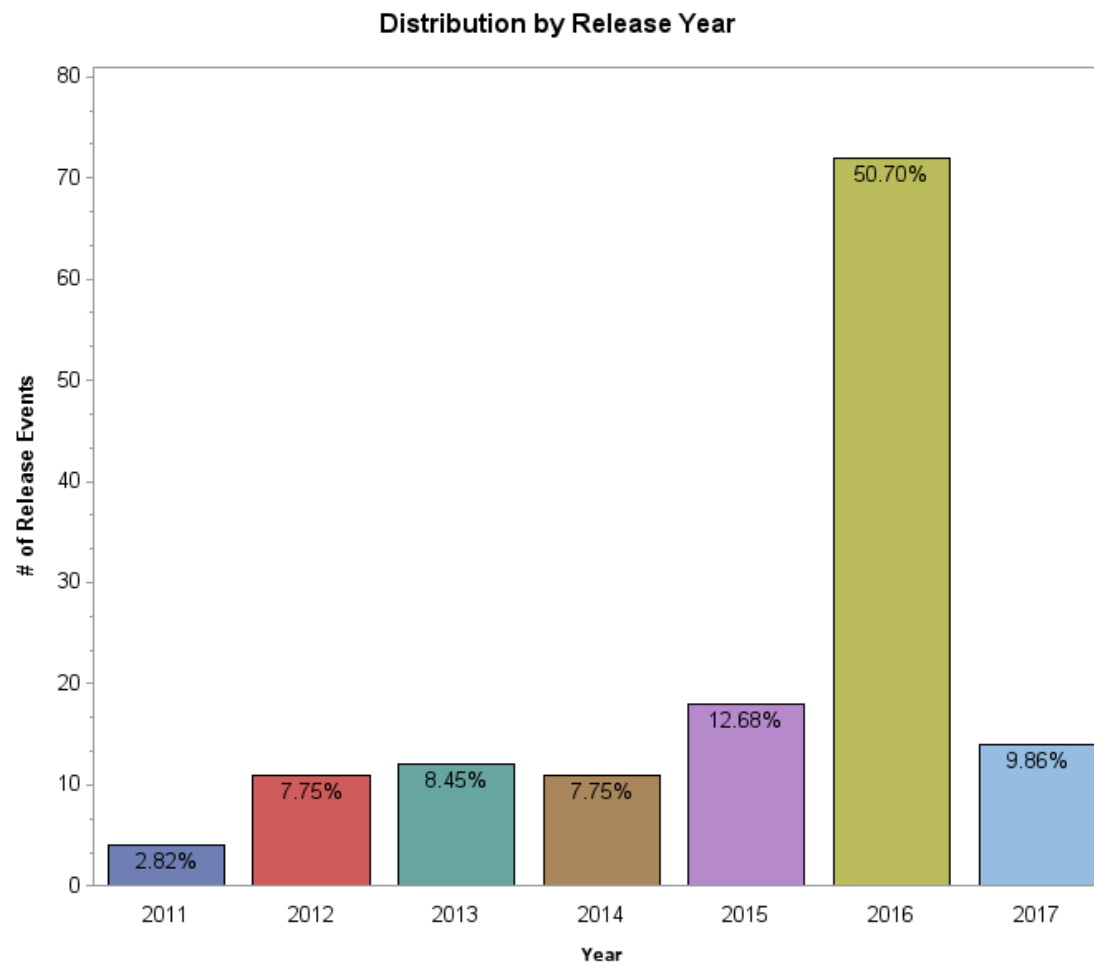  - ➤ We verify these findings in our sample (Appendix).

# Figure 2: Staggered Data Releases

Satellite data releases for 142 U.S. retail firms from 2011 to 2017.



Distribution by Release Year

## Data and Sample Construction

- **Difference-in-differences analysis.**
  - ➢ We select control firms as those in the same industry but not covered by either vendor.
  - ➢ Delete firms in the first two years from IPOs (Fama and French 1993).
  - ➢ Other data sources; CRSP, COMPUSTAT, Thomson Reuter's 13F, I/B/E/S, Execucomp, ISS/RiskMetrics.

- **6,323 firm-years from 2009 to 2018: 1,211 firm-years for treated firms; 5,112 firm-years for control firms.**
  - ➢ Dividend yield: Cash dividend scaled by market value of common equity, average 1.09% for sample firms.
  - ➢ Dividend payout ratio: Cash dividend scaled by earnings, average 21.6% for sample firms.
  - ➢ 43.4% of sample firms pay dividends.

- **In a frictionless world, dividend policy is irrelevant to firm value (Modigliani and Miller 1958).**
  - ➤ However, firms follow deliberately designed dividend policies (Black 1976).
  - ➤ Dividend is especially puzzling for U.S. firms because shareholders pay higher taxes on dividends than on capital gains (Allen and Michaely 1997).

- **"Outcome model" (La Porta et al. 2000)**
  - ➤ Because of agency problem, firm managers have incentives to misuse their firms' profits. As a result, outside investors will push managers to pay dividends which reduces the amount of free cash flows.
  - ➤ This phenomenon concentrates in firms with poor investment opportunities where resources are likely to misused.
  - ➤ Predicts an **increase** in dividends for event firms: Satellite data provides a new source of timely and value-relevant information that helps outsider investors better monitor firm managers.

- **"Substitute model" (e.g., Myers 2000).**
  - ➢ Also based on the premise of agency problem.
  - ➢ Managers want to establish a reputation for not expropriating outside investors so that they can raise financing at a low cost. Dividend serves as a costly commitment of managers to not misuse corporate earnings.
  - ➢ Predicts a **decrease** in dividend for event firms: Satellite data reduces information asymmetry in turn the need for managers' costly commitment.


- **"Signaling model" (e.g., Grullon et al. 2002).**
  - ➢ Because of information asymmetry, managers of high-quality firms use dividends as a costly signal of private information about future cash flows or risk.
  - ➢ Predicts a **decrease** in dividend for event firms: Satellite data reduces information asymmetry and in turn firms' incentives of costly signaling.

## Table 2: Difference-in-Differences Regression of Dividend Payout on Satellite Data Release

| | Dividend Yield (%) | | Div/E (%) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *PostRelease* | **0.630*** ** | **0.663*** ** | **10.315** ** | **11.009** ** |
| | (3.39) | (3.26) | (2.43) | (2.53) |
| *Size* | | 0.019 | | -0.452 |
| | | (0.19) | | (-0.16) |
| *Leverage* | | -0.866** | | -12.304 |
| | | (-2.22) | | (-1.13) |
| *Tobin Q* | | -0.058 | | -0.618 |
| | | (-1.35) | | (-0.59) |
| *Profitability* | | 0.565 | | -3.337 |
| | | (1.16) | | (-0.41) |
| *Tangibility* | | -0.872 | | -3.058 |
| | | (-1.40) | | (-0.26) |
| *Cash* | | 0.286 | | 13.825 |
| | | (0.54) | | (1.19) |
| *InstOwn* | | 0.099 | | 2.813 |
| | | (0.73) | | (0.74) |
| *AnalystCoverage* | | 0.065 | | 3.418*** |
| | | (0.97) | | (2.72) |
| *RetainedEarn* | | -0.004 | | -0.123 |
| | | (-0.79) | | (-0.96) |
| *RetVol* | | -1.749*** | | -21.728 |
| | | (-3.25) | | (-1.52) |
| *Firm FE* | Yes | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes | Yes |
| *Observations* | 6,229 | 6,089 | 6,010 | 5,880 |
| *Adj. R²* | 0.488 | 0.506 | 0.383 | 0.390 |

## Table 3A: Dynamic Effects of Satellite Data Release: Pre-Trend Analysis

| | Dividend Yield (%) | | Div/E (%) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| $PostRelease_{\{i, -2<=t<=-1\}}$ | 0.184 | 0.169 | 2.109 | 2.039 |
| | (1.18) | (1.07) | (0.57) | (0.58) |
| $PostRelease_{\{i, 0<=t<=1\}}$ | **0.372\*\*** | **0.387\*\*** | 4.997 | 5.801 |
| | (2.19) | (2.11) | (0.98) | (1.14) |
| $PostRelease_{\{i, t>=2\}}$ | **0.825\*\*\*** | **0.882\*\*\*** | **13.441\*\*** | **14.489\*\*** |
| | (3.68) | (3.93) | (2.14) | (2.46) |
| Controls | No | Yes | No | Yes |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| Observations | 6,229 | 6,089 | 6,010 | 5,880 |
| Adj. $R^2$ | 0.487 | 0.505 | 0.383 | 0.390 |

**Figure 3: Parallel Trend Analysis: Dynamic Treatment Effect on Dividend Payout**



Dynamic Treatment Effects
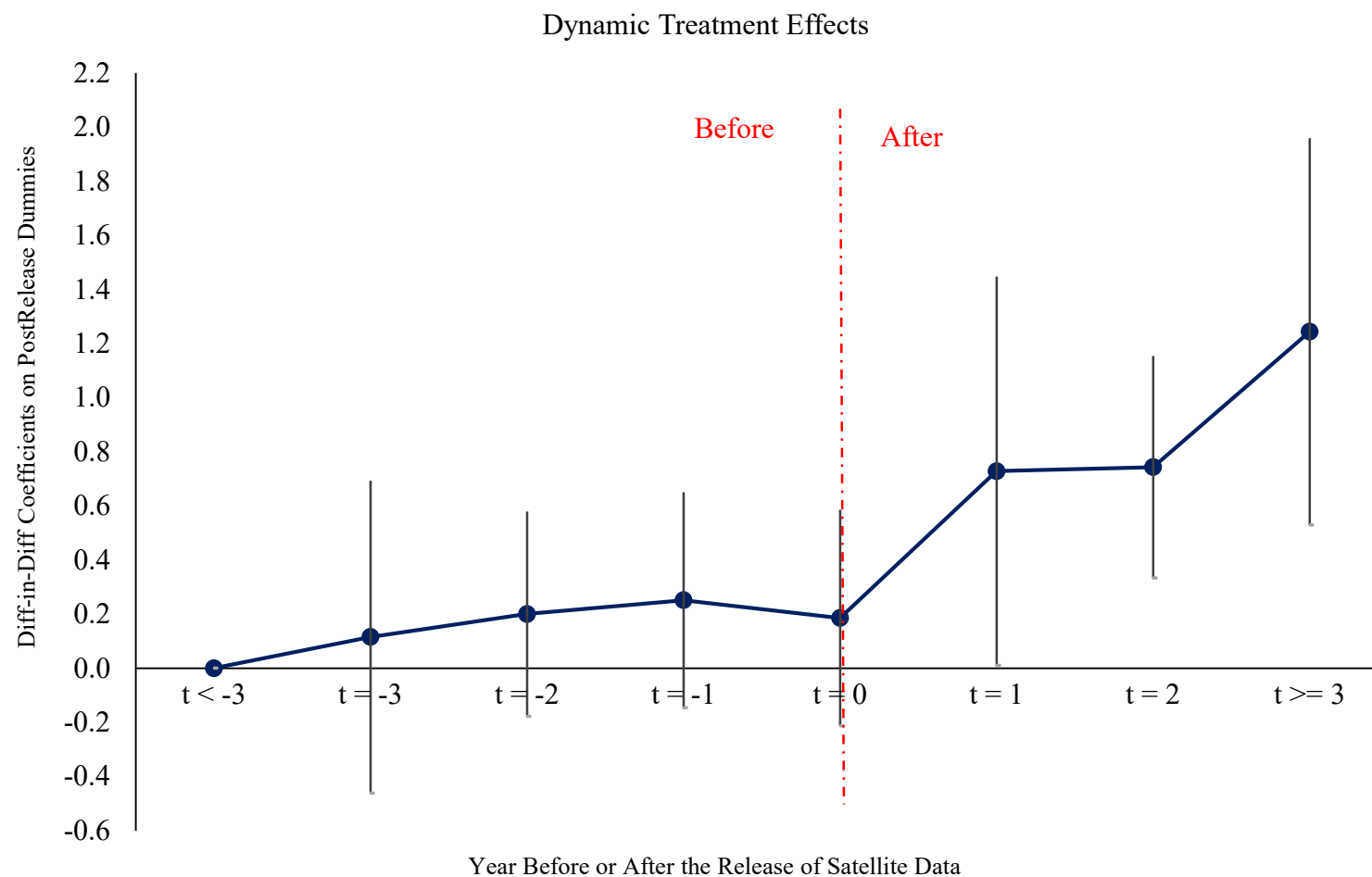
# Robustness Tests

- **Pseudo firm or pseudo event analyses.**
  - ➤ Pseudo treated firms: Randomly chosen control firms whose satellite data have never been released by the end of 2018.
  - ➤ Pseudo treatment events: Assume that the onset of satellite data release occurs 10 years before it actually started.

- **Alternative sample constructions.**
  - ➤ Treated firms only.
  - ➤ Matched firms using the PSM approach.
  - ➤ Matched firms using 2-digit SICs
  - ➤ Exclude firms with negative earnings.

- **Alternative dividend measures.**
  - ➤ Dummy of paying dividends.
  - ➤ Dividend/Asset ratio.

- **As emphasized by La Porta et. al. (2000), investment opportunity is critical in the outcome model.**
  - ➤ Outside investors will push firms with poor investment opportunities to pay dividends so that the cash will not otherwise be wasted.
  - ➤ For firms with good investment opportunities, outside investors are willing to accept low dividends to support high reinvestment rates.

- **The outcome model predicts that the increase in dividends will be much larger among firms with poor investment opportunities than among firms with good investment opportunities.**
  - ➤ Measures of growth opportunities: Sales growth and Q.

## Table 5: Satellite Data Release and Dividend Payout: The Role of Investment Opportunities

| | Dividend Yield (%) | | | | | | Div/E (%) | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| PostRelease x LowSG | 0.462** | 0.461** | | | 11.518*** | 11.141*** | | |
| | (2.52) | (2.53) | | | (2.67) | (2.60) | | |
| LowSG | 0.152*** | 0.182*** | | | 2.889** | 3.542*** | | |
| | (3.00) | (3.36) | | | (2.18) | (2.61) | | |
| PostRelease x LowQ | | | 0.536** | 0.548** | | | 15.213*** | 15.106** |
| | | | (2.24) | (2.30) | | | (2.58) | (2.48) |
| LowQ | | | 0.155* | 0.199** | | | 0.804 | 1.127 |
| | | | (1.85) | (2.47) | | | (0.53) | (0.65) |
| PostRelease | 0.366* | 0.400* | 0.391*** | 0.411*** | 3.923 | 4.866 | 4.148 | 4.845 |
| | (1.79) | (1.76) | (3.00) | (2.80) | (1.07) | (1.24) | (0.97) | (1.05) |
| Controls | No | Yes | No | Yes | No | Yes | No | Yes |
| Firm FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 6,229 | 6,089 | 6,229 | 6,089 | 6,010 | 5,880 | 6,010 | 5,880 |
| Adj. $R^2$ | 0.490 | 0.509 | 0.490 | 0.508 | 0.385 | 0.392 | 0.385 | 0.392 |

**Consistent with the outcome model, the increase in dividends is much stronger among firms with poor investment opportunities (measured by sales growth or Q).**

- **The outcome model predicts that the increase in dividends among firms with poor investment opportunities to be stronger for:**

  ➢ Firms with *higher levels of managerial entrenchment*: The improved monitoring will have a larger marginal effect.

  ➢ Firms with *less severe financial constraints*: Managers have more flexibility to waste resources.

  ➢ Firms with *more sophisticated institutional ownership*: Sophisticated institutional investors are able to access and utilize the satellite data in their monitoring.

# Table 6: Dividend Payout of Low-Growth firms after Satellite Release: The Effect of Managerial Entrenchment

| | Entrenchment Measured by E-Index | | | | Entrenchment Measured by ATI | | | |
|---|---|---|---|---|---|---|---|---|
| | *Div. Yield (%)* | | *Div/E (%)* | | *Div. Yield (%)* | | *Div/E (%)* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *PostRelease×LowSG ×HighEntrench* | **0.690\*\*\*** | **0.598\*\*\*** | **18.261\*\*\*** | **16.336\*\*\*** | **0.788\*\*\*** | **0.694\*\*\*** | **17.161\*\*** | **15.268\*\*** |
| | **(3.88)** | **(4.39)** | **(4.02)** | **(4.13)** | **(3.13)** | **(3.13)** | **(2.45)** | **(2.31)** |
| *PostRelease×LowSG ×LowEntrench* | 0.249 | 0.099 | 2.173 | -0.888 | -0.284 | -0.414 | 6.923 | 3.443 |
| | (0.33) | (0.13) | (0.09) | (-0.04) | (-0.55) | (-0.74) | (0.47) | (0.23) |
| *PostRelease×HighEntrench* | 0.318* | 0.383** | 0.393 | 1.931 | 0.282* | 0.354** | 2.241 | 3.662 |
| | (1.81) | (2.09) | (0.10) | (0.47) | (1.68) | (2.02) | (0.58) | (0.85) |
| *PostRelease×LowEntrench* | 0.631 | 0.777 | 17.048 | 19.426 | 0.822 | 0.940 | 6.864 | 9.672 |
| | (1.18) | (1.44) | (1.49) | (1.59) | (1.19) | (1.37) | (0.55) | (0.79) |
| *LowSG×HighEntrench* | 0.067 | 0.081 | 3.226 | 3.784* | 0.071 | 0.090 | 4.066* | 4.641** |
| | (1.35) | (1.49) | (1.38) | (1.68) | (0.95) | (1.22) | (1.69) | (2.05) |
| *LowSG×LowEntrench* | 0.035 | 0.051 | -0.831 | -0.472 | 0.020 | 0.013 | -4.649 | -4.348 |
| | (0.20) | (0.29) | (-0.17) | (-0.09) | (0.17) | (0.11) | (-0.85) | (-0.79) |
| *HighEntrench* | 0.002 | 0.016 | -0.996 | -0.830 | -0.363** | -0.362** | -7.383* | -8.595* |
| | (0.02) | (0.14) | (-0.44) | (-0.34) | (-2.09) | (-2.04) | (-1.67) | (-1.85) |
| *Controls* | No | Yes | No | Yes | No | Yes | No | Yes |

# Table 7: Dividend Payout of Low-Growth firms after Satellite Release: The Effect of Financial Constraints

| | KZ Index | | HP Index | | WW Index | |
|---|---|---|---|---|---|---|
| | *Div. Yield* | *Div/E* | *Div. Yield* | *Div/E* | *Div. Yield* | *Div/E* |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *PostRelease×LowSG×LowConstraints* | **1.102*** | **26.098**** | **0.734*** | **13.095**** | **0.505**** | **14.685*** |
| | (3.39) | (2.45) | (3.10) | (2.32) | (2.23) | (2.72) |
| *PostRelease×LowSG×HighConstraints* | -0.024 | 2.103 | -0.117 | 7.079 | 0.432 | 5.174 |
| | (-0.18) | (1.04) | (-0.43) | (0.58) | (1.00) | (0.71) |
| *PostRelease×LowConstraints* | 0.513 | 12.564** | 0.303 | 4.544 | 0.407* | 5.331 |
| | (1.45) | (1.98) | (1.25) | (0.94) | (1.92) | (1.36) |
| *PostRelease×HighConstraints* | 0.295** | -3.253 | 0.514** | 5.181 | 0.348 | 3.005 |
| | (2.11) | (-0.88) | (2.07) | (1.09) | (0.94) | (0.52) |
| *LowSG×LowConstraints* | 0.327*** | 6.984*** | 0.142*** | 3.421*** | 0.192*** | 3.351** |
| | (4.08) | (2.66) | (2.61) | (2.64) | (3.88) | (2.14) |
| *LowSG×HighConstraints* | 0.065 | 1.068 | 0.230*** | 3.690 | 0.173** | 3.815** |
| | (1.51) | (0.67) | (2.61) | (1.56) | (2.23) | (2.08) |
| *LowConstraints* | 0.813*** | 14.281*** | 0.145 | 2.986 | 0.554*** | 10.804*** |
| | (3.98) | (3.44) | (1.10) | (0.95) | (3.89) | (3.00) |
| *Controls* | Yes | Yes | Yes | Yes | Yes | Yes |
| *Firm FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes | Yes | Yes | Yes |
| *Observations* | 5,809 | 5,612 | 6,089 | 5,880 | 6,084 | 5,875 |
| *Adj. R²* | 0.548 | 0.417 | 0.509 | 0.392 | 0.516 | 0.396 |

# Table 8: Dividend Payout of Low-Growth firms after Satellite Release: The Effect of Sophisticated Investor Ownership

| | Hedge Fund Ownership | | | | Monitoring Institutional Ownership | | | |
|---|---|---|---|---|---|---|---|---|
| | *Div. Yield (%)* | | *Div/Earn (%)* | | *Div. Yield (%)* | | *Div/Earn (%)* | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *PostRelease×LowSG ×HighOwn* | **0.571\*** | **0.584\*** | **16.141\*\*** | **16.114\*\*\*** | **0.647\*\*\*** | **0.639\*\*\*** | **13.018\*\*** | **12.178\*\*** |
| | **(1.83)** | **(1.92)** | **(2.55)** | **(2.64)** | **(2.72)** | **(2.77)** | **(2.49)** | **(2.38)** |
| *PostRelease×LowSG ×LowOwn* | 0.301 | 0.295 | 5.307 | 4.737 | -0.010 | -0.004 | 11.533 | 11.712 |
| | (0.97) | (0.93) | (0.80) | (0.67) | (-0.03) | (-0.01) | (1.26) | (1.28) |
| *PostRelease× HighOwn* | 0.419\*\* | 0.437\*\* | 4.308 | 4.876 | 0.292\* | 0.337\*\* | 4.643 | 5.627 |
| | (2.30) | (2.15) | (1.35) | (1.43) | (1.94) | (1.99) | (1.33) | (1.53) |
| *PostRelease×LowOwn* | 0.289 | 0.340 | 3.114 | 4.490 | 0.555 | 0.566 | -2.318 | -1.778 |
| | (1.15) | (1.22) | (0.59) | (0.80) | (1.10) | (1.06) | (-0.30) | (-0.23) |
| *LowSG× HighOwn* | 0.151\*\*\* | 0.163\*\* | 3.767\*\* | 4.163\*\* | 0.158\*\*\* | 0.175\*\*\* | 3.183\* | 3.582\*\* |
| | (2.69) | (2.56) | (2.37) | (2.42) | (2.86) | (3.03) | (2.15) | (2.28) |
| *LowSG×LowOwn* | 0.149\*\* | 0.195\*\* | 1.878 | 2.708 | 0.133 | 0.202\* | 1.442 | 2.907 |
| | (1.97) | (2.54) | (0.85) | (1.22) | (1.21) | (1.92) | (0.45) | (0.95) |
| *HighOwn* | -0.102 | -0.132 | -4.129\* | -5.226\* | 0.082 | 0.109 | 3.405 | 5.123\* |
| | (-1.39) | (-1.64) | (-1.74) | (-1.91) | (0.74) | (0.92) | (1.32) | (1.82) |
| *Controls* | No | Yes | No | Yes | No | Yes | No | Yes |

# External Financing and Corporate Investment

- **Under the outcome model, the increased dividend payments is financed by the reduction in value-destroying investment projects rather than the increase in external financing.**

- **We attempt to distinguish between general investment and "good" investment.**
  - ➢ General investment as measured by asset growth: Existing literature shows that general investment is associated with lower future stock returns.
  - ➢ Good investment (R&D): R&D is widely documented as "good" investment associated with positive future performance.

# Table 10A: Difference-in-Difference Regressions of Financing Decisions on Satellite Data Release

|  | STDebt | LTDebt | Equity |
|---|---|---|---|
|  | (1) | (2) | (3) |
| *PostRelease* | **-0.025** | **0.134** | **-0.227** |
|  | **(-0.23)** | **(0.25)** | **(-1.32)** |
| *Size* | -0.008 | -1.740*** | -2.760*** |
|  | (-0.05) | (-3.24) | (-5.28) |
| *Leverage* | -1.885*** | -21.157*** | 4.150*** |
|  | (-8.09) | (-8.35) | (4.79) |
| *Tobin Q* | 0.025 | 1.203*** | 0.752*** |
|  | (0.59) | (3.76) | (3.52) |
| *Profitability* | 0.688 | 2.680 | -10.155*** |
|  | (1.12) | (0.97) | (-3.06) |
| *Tangibility* | 0.904** | 10.330*** | -2.026 |
|  | (2.15) | (4.00) | (-1.20) |
| *Cash* | -0.258 | -3.771 | -3.470*** |
|  | (-0.49) | (-1.53) | (-2.68) |
| *InstOwn* | 0.046 | -0.248 | 1.158** |
|  | (0.29) | (-0.25) | (2.59) |
| *AnalystCoverage* | 0.049 | 0.139 | 0.172 |
|  | (0.93) | (0.38) | (1.03) |
| *RetainedEarn* | 0.001 | -0.030 | -0.031 |
|  | (0.04) | (-0.61) | (-0.91) |
| *RetVol* | -1.753*** | -5.975* | 3.277 |
|  | (-3.36) | (-1.94) | (1.40) |

# Table 10B: Difference-in-Difference Regressions of Investment Decisions on Satellite Data Release

|  | Asset Growth | Investment | Inventory | R&D |
|---|---|---|---|---|
|  | (1) | (2) | (3) | (4) |
| *PostRelease* | **-5.051**\*\* | **-1.537**\*\* | **-0.919**\*\*\* | **0.017** |
|  | **(-2.55)** | **(-2.47)** | **(-3.46)** | **(0.20)** |
| *Size* | -22.255\*\*\* | -2.199 | -1.324\*\*\* | -0.749\*\* |
|  | (-5.98) | (-1.54) | (-4.67) | (-2.16) |
| *Leverage* | -21.785\*\*\* | -8.348\*\*\* | -1.171\* | 0.589 |
|  | (-3.66) | (-3.89) | (-1.89) | (1.08) |
| *Tobin Q* | 5.882\*\*\* | 1.214\*\*\* | 0.269\*\* | 0.219\* |
|  | (6.03) | (3.74) | (2.43) | (1.87) |
| *Profitability* | 22.834\*\*\* | 17.218\*\*\* | 8.248\*\*\* | -0.847 |
|  | (3.91) | (3.40) | (6.50) | (-0.96) |
| *Tangibility* | 5.385 | -27.293\*\*\* | 1.886\*\* | -0.962 |
|  | (0.52) | (-4.08) | (1.96) | (-1.02) |
| *Cash* | -3.663 | 4.281\*\* | 4.557\*\*\* | -1.707 |
|  | (-0.41) | (2.21) | (3.21) | (-1.13) |
| *InstOwn* | 3.182 | 2.717\*\*\* | 0.442 | 0.310 |
|  | (1.08) | (3.39) | (1.56) | (1.42) |
| *AnalystCoverage* | 0.414 | 0.792\*\* | 0.058 | 0.022 |
|  | (0.33) | (2.34) | (0.30) | (0.53) |
| *RetainedEarn* | 0.173 | 0.104 | 0.026 | -0.012 |
|  | (1.52) | (1.25) | (1.28) | (-0.63) |
| *RetVol* | 4.065 | -0.305 | 1.147 | 0.820 |
|  | (0.45) | (-0.06) | (0.53) | (1.00) |

# Conclusions

- **We examine how the emergence of alternative data affects firms' corporate policies.**
  - ➢ Firms significantly increase their dividend payouts after the release of their satellite data, especially for firms with poor investment opportunities.
  - ➢ Larger increase in dividends for firms with higher levels of managerial entrenchment, less severe financial constraints, or higher ownerships by sophisticated investors.
  - ➢ Event firms finance the increased dividends by cutting overall corporate investment but not R&D which is considered "good" corporate investment.

- **Taken together, these results support the outcome model of dividends.**

- **Our findings provide new evidence that the emergence of alternative data can close the information gaps between outside investors and firm managers and have significant impact on corporate policies.**