# Common Ownership and Market Entry

## Evidence from the Pharmaceutical Industry

Melissa Newham[1] Jo Seldeslachts[1] Albert Banal-Estanol[2]

[1]KU Leuven & DIW Berlin

[2]Universitat Pompeu Fabra

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# Common ownership between brand and generic - example

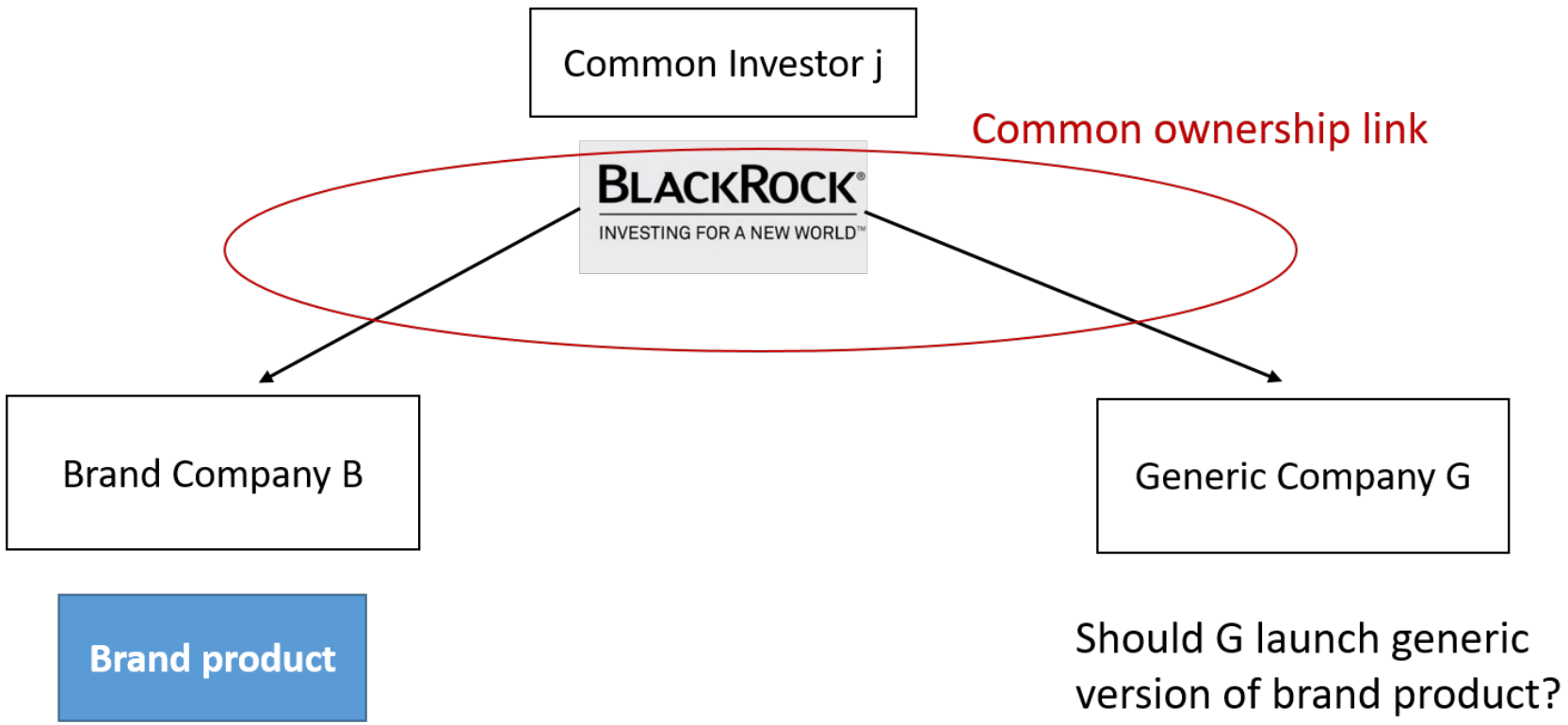
Table 1: Top 5 Largest Investors (2013)

| Brand | | Generic | |
|---|---|---|---|
| **Johnson & Johnson** | | **Mylan** | |
| State Street Global | 6% | Vanguard Group | 7% |
| BlackRock | 6% | BlackRock | 6% |
| Vanguard Group | 5% | State Street Global | 4% |
| Royal Bank of Canada | 2% | Wellington Mgmt. | 4% |
| Wellington Mgmt. | 2% | John Paulson | 4% |

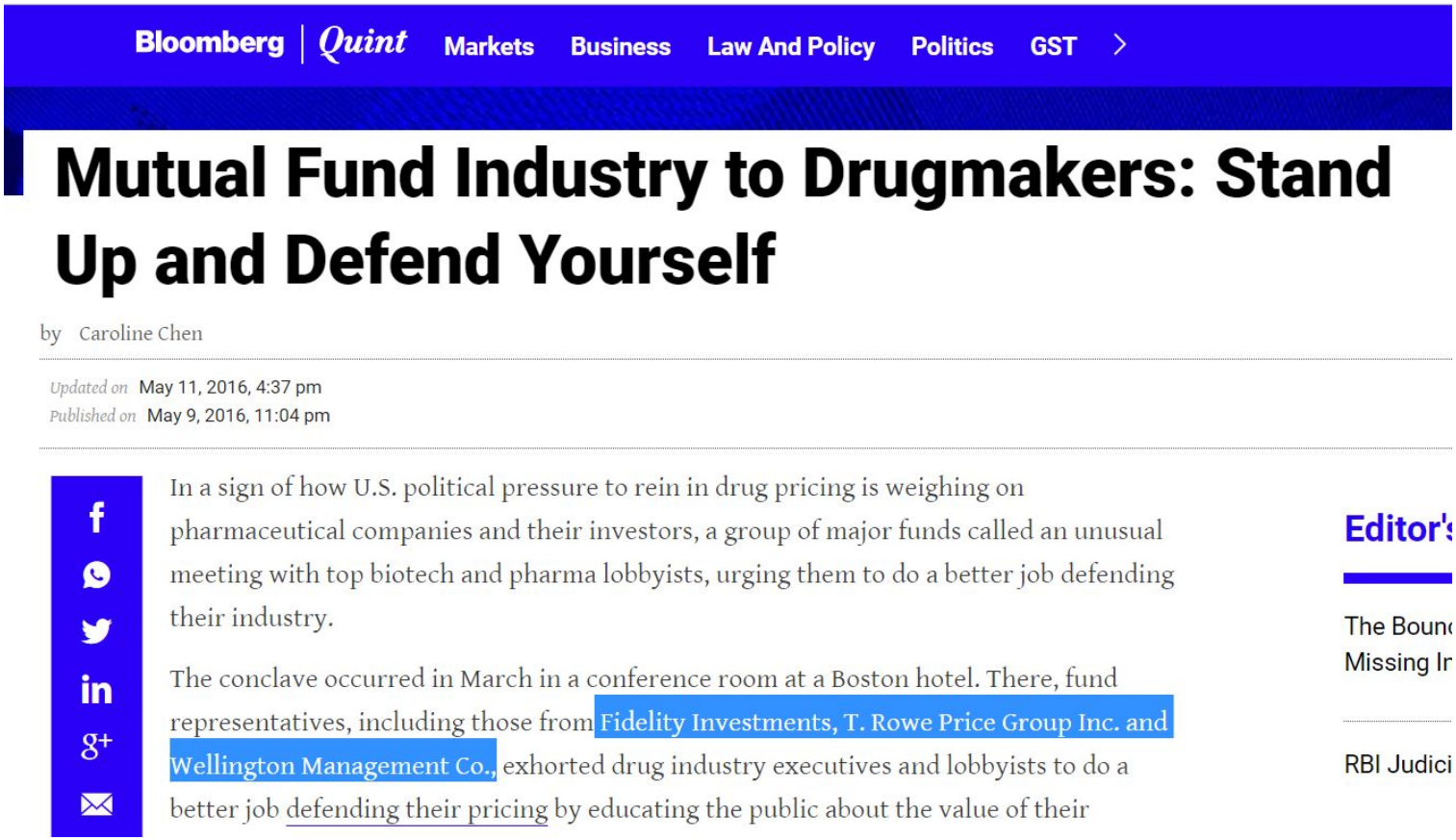
Source: Thomson Global Ownership Database

# Research question

How does **common ownership** between a potential generic entrant and the brand (incumbent) influence the **generic's market entry decision**?



# Investors discuss strategy with pharma companies



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## Mutual Fund Industry to Drugmakers: Stand Up and Defend Yourself

by Caroline Chen

*Updated on* May 11, 2016, 4:37 pm
*Published on* May 9, 2016, 11:04 pm

In a sign of how U.S. political pressure to rein in drug pricing is weighing on pharmaceutical companies and their investors, a group of major funds called an unusual meeting with top biotech and pharma lobbyists, urging them to do a better job defending their industry.

The conclave occurred in March in a conference room at a Boston hotel. There, fund representatives, including those from Fidelity Investments, T. Rowe Price Group Inc. and Wellington Management Co., exhorted drug industry executives and lobbyists to do a better job defending their pricing by educating the public about the value of their

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# Entry in pharmaceutical markets

- **Market entry** represents an important strategic decision
- Particularly in the pharma industry, entry by a generic firm after regulatory protection has dramatic effects
  - Brands face revenue **declines of up to 90%** (Bransetter et al., 2016)
- Gains from deterring entry much higher than losses of not entering for generic companies (Jacobo-Rubio et al., 2017):
  - Brand firms' value deterring entry, on average, at about **$4.6 billion**
  - Generic companies value the right to enter at about **$236.8 million**

# Theoretical framework

- Consider case of one potential generic entrant first. Assume entry
  - increases the market profits of generic $G$, from zero to $\pi_G > 0$, but
  - reduces profits of the brand $B$: $\Delta\pi_B \equiv \pi_B^D - \pi_B^M < 0$
  - joint profits decrease with entry as $\pi_G <\mid \Delta\pi_B \mid$
- Denote by $\delta$ weight decision-makers of $G$ place on joint profits:

$$\Pi_G(\delta) \equiv (1-\delta)\pi_G + \delta(\pi_G + \Delta\pi_B)$$

- Entry will only occur if these "net gains" are positive, i.e.

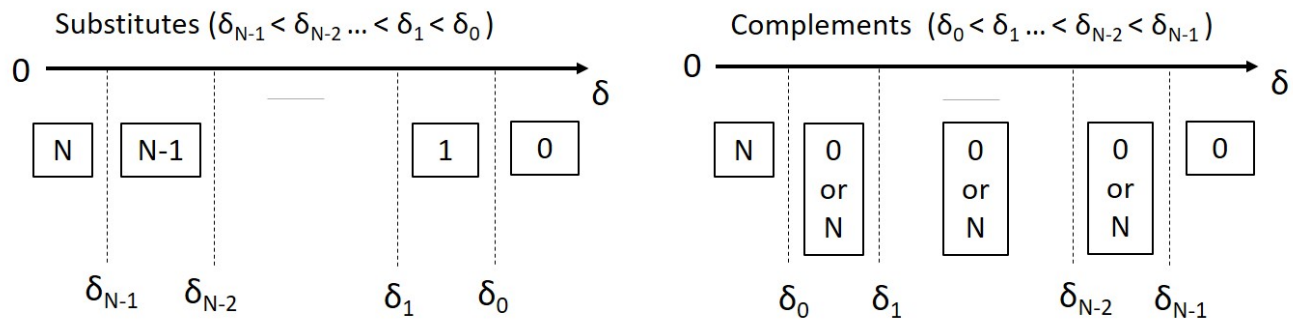
$$\Pi_G(\delta) = \pi_G + \delta\Delta\pi_B > 0.$$

- **Prediction 1: An increase in common ownership reduces entry incentives of the generic (as $\Delta\pi_B < 0$)**
- Holds if there are $N-1$ other potential entrants simultaneously deciding whether to enter the market of same brand drug

# Equilibrium number of entrants

- Assume $N$ potential symmetric entrants, both in terms of common ownership with the brand $(\delta)$ and profits $(\pi_G^k)$
- Define $\delta_i \equiv \pi_G^i / \Delta\pi_B^i$ where $\pi_G^i$ and $\Delta\pi_B^i$ are the generic entry profits and loss in brand profits when $i$ other generics have entered

Figure 1: Number of entrants in equilibrium as a function of $\delta$

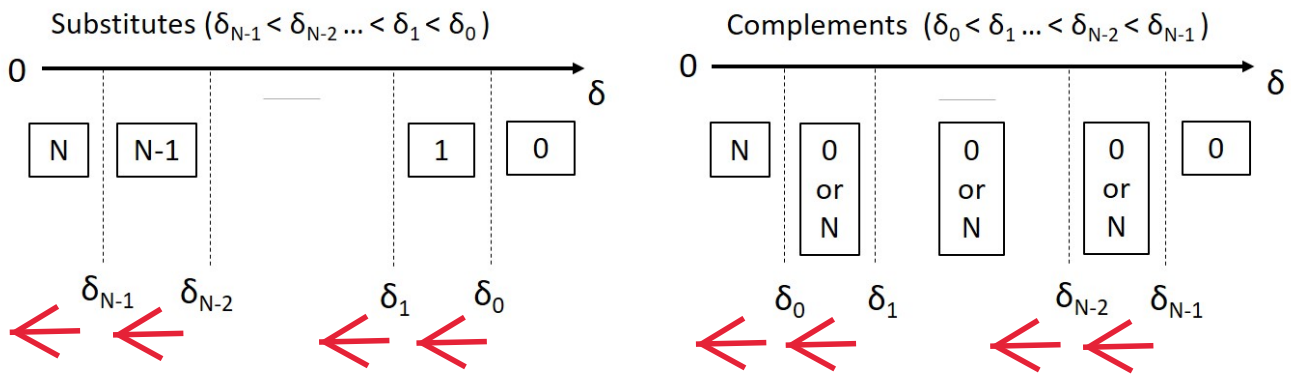



- **Prediction 2: The equilibrium number of entrants decreases as the level of common ownership increases**

# Comparative statics with respect to market size

- Assume that in larger markets the losses of the brand are relatively larger than the gains of the generic, i.e., $\delta_i \equiv \pi_G^i / \Delta\pi_B^i$ decreases in market size

Figure 2: Number of entrants in equilibrium as a function of $\delta$



# Measuring common ownership

1. Shareholdings can be "perfect substitutes": $\delta_S = \sum_{j=1}^{M} \frac{(\gamma_{jB}+\gamma_{jG})}{2}$

2. Shareholdings can be "perfect complements": $\delta_C = \sum_{j=1}^{M} \min(\gamma_{jB}, \gamma_{jG})$

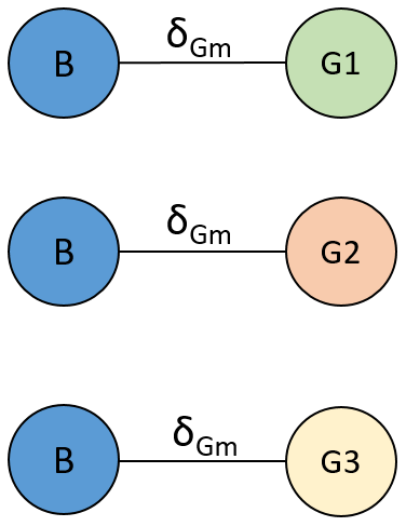
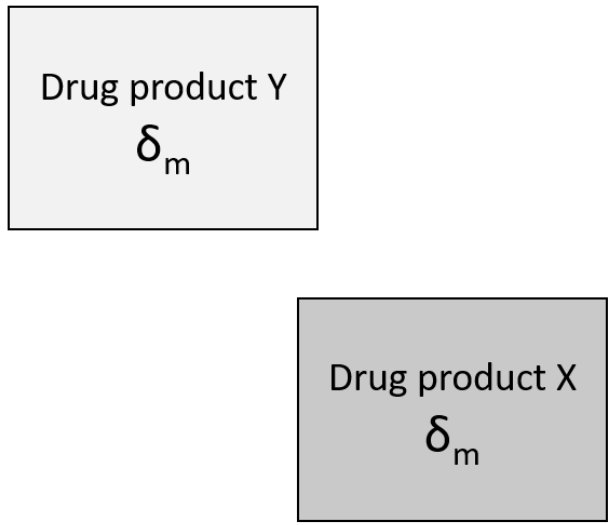
3. Weighted sum of financial interests: $\delta_L = \frac{\sum_i \gamma_{iB}\gamma_{iG}}{\sum_i \gamma_{iG}^2}$

where $j = 1, ...., M$ are the investors that $B$ and $G$ have in common and $i$ are *all* investors in either brand or generic or both. $\gamma_{iB}$ is the size of the shareholding of investor $i$ in brand (e.g. 5%) and $\gamma_{iG}$ is size of shareholding of investor $i$ in generic

# Data

- Dataset merging
  1. **FDA Orange Book** of all approved drugs for the US
  2. **Thomson Reuters Global Ownership Database**
- Additional data from *drugs.com*, Drugs@FDA database and FDA list of authorized generics
- 451 prescription drug products ("entry opportunities") that faced end of regulatory protection between 2004 and 2014
- Focus on early generic entrants (entry within 6 quarters after market becomes open for entry), who decide simultaneously
- Potential entrant set: firms that have launched a generic in at least one market in our sample with 6 quarters

# Empirical implementation: Overview

| | **Individual Entry** | **Market Outcomes** |
|---|---|---|
| |   |   |
| Unit of observation | Brand drug product-potential generic entrant pair | Drug product market |
| Dependent var. | Entry decision of generic G | Total number of generic entrants |
| Measures of CO | Three pairwise measures: $\delta_S$ , $\delta_C$ , $\delta_L$ | Market average measures |
| Model | OLS and IV | Negative Binomial |

# Pairwise analysis

$$Pr[Entry_{Gm} = 1] = \beta_0 + \beta\delta_{Gm} + \eta Z_m + \gamma X_{Gm} + A_m + \alpha_t + \epsilon_{Gm}$$

- Probability of entering specified as a function of generic and market characteristics (as in e.g. Scott Morton, 1999)
- $Entry_{Gm}$ takes 1 when generic $G$ enters drug market $m$ within six quarters after market becomes open for entry

# Pairwise analysis

$$Pr[Entry_{Gm} = 1] = \beta_0 + \beta\delta_{Gm} + \eta Z_m + \gamma X_{Gm} + A_m + \alpha_t + \epsilon_{Gm}$$

- Probability of entering specified as a function of generic and market characteristics (as in e.g. Scott Morton, 1999)
- $Entry_{Gm}$ takes 1 when generic $G$ enters drug market $m$ within six quarters after market becomes open for entry
- $\delta_{Gm}$: measure of common ownership
- $Z_m$: market characteristics (e.g. brand sales)
- $X_{Gm}$: generic-market characteristics (e.g. prior experience)
- $A_m$: market fixed effects (therapeutic field, form, submission type)
- $\alpha_t$: year of end of exclusivity

# Instrumental variables

**Endogeneity concern:** investors may react to entry opportunities and adjust their portfolios

IV strategy with two instruments:

1. **Index membership:** No. periods that both firms in pair are in the BlackRock iShares U.S. Pharmaceutical ETF
   - Investors tracking the index will adjust shareholdings to reflect U.S. pharma index
   - Inclusion in the index should not be related to entry decisions

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   - Investors tracking the index will adjust shareholdings to reflect U.S. pharma index
   - Inclusion in the index should not be related to entry decisions
2. **HQ location:** indicator variable taking value 1 if headquarters of both firms are in the same geographic region
   - If both brand and generic have their headquarters in the same region higher common ownership is expected ("home bias" of certain investors)
   - Generics should not be more/less likely to enter the markets of brand firms from the same region

# Results: pairwise analysis

| | OLS | | | IV | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $\delta_S$ | -0.0121*** | | | -0.0234** | | |
| $\delta_C$ | | -0.0422*** | | | -0.0601** | |
| $\delta_L$ | | | -0.0166*** | | | -0.0187** |
| Subsidiary (0/1) | -0.0411*** | -0.0406*** | -0.0411*** | -0.0427*** | -0.0412*** | -0.0413*** |
| Sales Rank (1-10) (0/1) | 0.0219*** | 0.0219*** | 0.0218*** | 0.0221*** | 0.0220*** | 0.0218*** |
| Sales Rank (11-50) (0/1) | 0.0223*** | 0.0223*** | 0.0224*** | 0.0225*** | 0.0224*** | 0.0224*** |
| Sales Rank (51-100) (0/1) | 0.0177*** | 0.0178*** | 0.0177*** | 0.0178*** | 0.0179*** | 0.0177*** |
| Authorized Generic (0/1) | 0.000922 | 0.000928 | 0.000930 | 0.000870 | 0.000907 | 0.000924 |
| Substitutes on Patent (ATC2) | -0.00445** | -0.00448** | -0.00444** | -0.00454** | -0.00453** | -0.00445** |
| Substitutes off Patent (ATC2) | -0.000814 | -0.000788 | -0.000827 | -0.000762 | -0.000753 | -0.000821 |
| Experience Route | 0.00835*** | 0.00834*** | 0.00836*** | 0.00835*** | 0.00834*** | 0.00836*** |
| Experience ATC2 | 0.0602*** | 0.0602*** | 0.0601*** | 0.0601*** | 0.0601*** | 0.0601*** |
| Experience New Drug | 0.00434* | 0.00431** | 0.00475** | 0.00549** | 0.00483** | 0.00496** |
| Breadth (ATC2) | 0.00325*** | 0.00333*** | 0.00329*** | 0.00343*** | 0.00345*** | 0.00332*** |
| Generic region of origin | Yes | Yes | Yes | Yes | Yes | Yes |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.0296*** | 0.0293*** | 0.0292*** | 0.0299*** | 0.0293*** | 0.0292*** |
| Observations | 58,737 | 58,737 | 58,737 | 58,737 | 58,737 | 58,737 |
| Drug Markets | 451 | 451 | 451 | 451 | 451 | 451 |
| R-squared | 0.079 | 0.079 | 0.079 | | | |

Notes: Standard errors are robust. $***p < 0.01, **p < 0.05, *p < 0.1$.

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| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
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Notes: Standard errors are robust. $***p < 0.01, **p < 0.05, *p < 0.1$.

- Economic magnitude: one standard deviation increase in $\delta_S$ implies a **9% reduction** in the unconditional entry probability

# Market-level analysis

- Count model for the total number of generic entrants in the market within 6-quarters after market opening
- Given dispersed numbers, apply a negative binomial estimator.
- Market-based average measure of $\delta_S$ including:
  - all potential generic entrants
  - top 50 most experienced at the drug form/route level
  - top 20 most experienced at the drug form/route level
- Market-level specification:

$$NumEntrants = \beta_0 + \beta Average\delta_{Sm} + \eta Z_m + \alpha_m + \epsilon_m \quad (1)$$

# Results: market-level analysis

| | All | | Top 50 | | Top 20 | |
|---|---|---|---|---|---|---|
| | (1) | (2) $\partial y/\partial x$ | (3) | (4) $\partial y/\partial x$ | (5) | (6) $\partial y/\partial x$ |
| Average $\delta_S$ | -2.479* | -6.479* | -1.968** | -5.149** | -1.515** | -3.962** |
| Sales top 100 (0/1) | 0.615*** | 1.608*** | 0.620*** | 1.621*** | 0.621*** | 1.623*** |
| Authorized Generic (0/1) | 0.167 | 0.438 | 0.163 | 0.427 | 0.167 | 0.437 |
| Substitutes on Patent (ATC2) | -0.221 | -0.577 | -0.219 | -0.573 | -0.222 | -0.581 |
| Substitutes off Patent (ATC2) | 0.0786 | 0.205 | 0.0745 | 0.195 | 0.0701 | 0.183 |
| Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.970* | | 0.994* | | 1.010* | |
| Observations | 451 | 451 | 451 | 451 | 451 | 451 |
| $R^2_{corr}$ | 0.404 | | 0.403 | | 0.406 | |
| $R^2_{pseudo}$ | 0.122 | | 0.123 | | 0.123 | |

Notes: Negative Binomial Regression. Standard errors in parentheses are robust. The dependent variable is total number of entrants within 6 quarters. $***p < 0.01, **p < 0.05, *p < 0.1$.

# Results: market-size

| | OLS | | IV | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| VARIABLES | Largest 50% | Smallest 50% | Largest 50% | Smallest 50% |
| $\delta_S$ | -0.0376*** | 0.00232 | -0.0731*** | -0.00412 |
| | (0.0104) | (0.00575) | (0.0282) | (0.0166) |
| Observations | 25853 | 25751 | 25853 | 25751 |
| R-squared | 0.108 | 0.0445 | 0.0906 | 0.0381 |
| Therapeutic field | Yes | Yes | Yes | Yes |
| Drug form | Yes | Yes | Yes | Yes |
| Submission type | Yes | Yes | Yes | Yes |
| Generic region of origin | Yes | Yes | Yes | Yes |
| Year end of exclusivity | Yes | Yes | Yes | Yes |

Notes: Standard errors in parentheses. The dependent variable is total number of entrants within 6 quarters. $***p < 0.01, **p < 0.05, *p < 0.1$.

# Summary of results

- This paper contributes to evidence that **common shareholders influence strategic decisions** of companies

1. Higher common ownership robustly linked to lower entry probabilities
2. Negative impact of common ownership is **strongest when common ownership levels are high**
3. The impact of complete common ownership is **smaller than the effect of being a subsidiary**
   - 1% decline vs. 4% decline *ceteris paribus*
4. Higher common ownership linked to **lower market entry**
5. Effects of common ownership on entry **only present in large markets**

Thank you for your attention.

# Measuring common ownership

- Unclear exactly how to translate common shareholdings into $\delta$ (weight that the generic firm places on joint profits)
- We posit that
  - shareholdings in brand provide investors with *incentives* to steer decisions towards joint profits whereas
  - shareholdings in the generic provide *ability* to influence such decisions
- We use several measures of common ownership, which differ in the way incentives and ability to influence decisions are taken into account

# Production function approach

- Transforms each common investor $j$'s shareholdings in the two firms $(\gamma_{jG}, \gamma_{jB})$ (inputs) into a "joint-profit-steering" index (output)
- Assuming perfect coordination among common investors,

$$\delta = \sum_j f(\gamma_{jG}, \gamma_{jB}), \tag{2}$$

- Increasing in $\gamma_{jB}$ (incentives) and $\gamma_{jG}$ (ability) with some degree of complementarity between the two
- Two extreme production function examples:
  - "perfect substitutes," i.e., $f(\gamma_{jG}, \gamma_{jB}) = (\gamma_{jG} + \gamma_{jB})/2$
  - "perfect complements," i.e., $f(\gamma_{jG}, \gamma_{jB}) = \min\{\gamma_{jG}, \gamma_{jB}\}$

# Weighted sum of interests approach

- Generic firm maximizes a weighted sum of the interests of all investors in the generic firm (Salop and O'Brien, 2000), where
  - (i) interests of an investor are given by her holdings in two firms and
  - (ii) weights are given by investor's degree of control of generic firm,

$$\sum_i \gamma_{iG} \left[ \gamma_{iG} \pi_G + \gamma_{iB} \pi_B \right]$$

- This is equivalent to maximizing

$$\pi_G + \frac{\sum_i \gamma_{iG} \gamma_{iB}}{\sum_i \gamma_{iG}^2} \pi_B$$

and thus, the measure (often called "lambda")

$$\delta_L \equiv \frac{\sum_i \gamma_{iG} \gamma_{iB}}{\sum_i \gamma_{iG}^2}$$

# Appendix

# Data

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Entry (0/1) | 58737 | 0.02 | 0.14 | 0 | 1 |
| $\delta_S$ | 58737 | 0.074 | 0.15 | 0 | 0.868 |
| $\delta_C$ | 58737 | 0.021 | 0.051 | 0 | 0.366 |
| $\delta_L$ | 58737 | 0.062 | 0.16 | 0 | 1.365 |
| Cross Ownership (0/1) | 58737 | 0.002 | 0.046 | 0 | 1 |
| Sales Top 100 (0/1) | 58737 | 0.158 | 0.365 | 0 | 1 |
| Authorized Generic (0/1) | 58737 | 0.26 | 0.439 | 0 | 1 |
| Substitutes on Patent (ATC2) ÷10 | 58737 | 2.325 | 1.669 | 0 | 7.3 |
| Substitutes off Patent (ATC2) ÷10 | 58737 | 1.6 | 1.31 | 0 | 6.1 |
| Experience Route ÷10 | 58737 | 1.305 | 3.086 | 0 | 29.9 |
| Experience ATC2 ÷10 | 58737 | 0.07 | 0.223 | 0 | 3.2 |
| Experience New Drug ÷10 | 58737 | 0.179 | 0.424 | 0 | 2.8 |
| Breadth (ATC2) ÷10 | 58737 | 1.135 | 1.204 | 0 | 6.1 |

Table 2: Pairwise Analysis: Summary Statistics

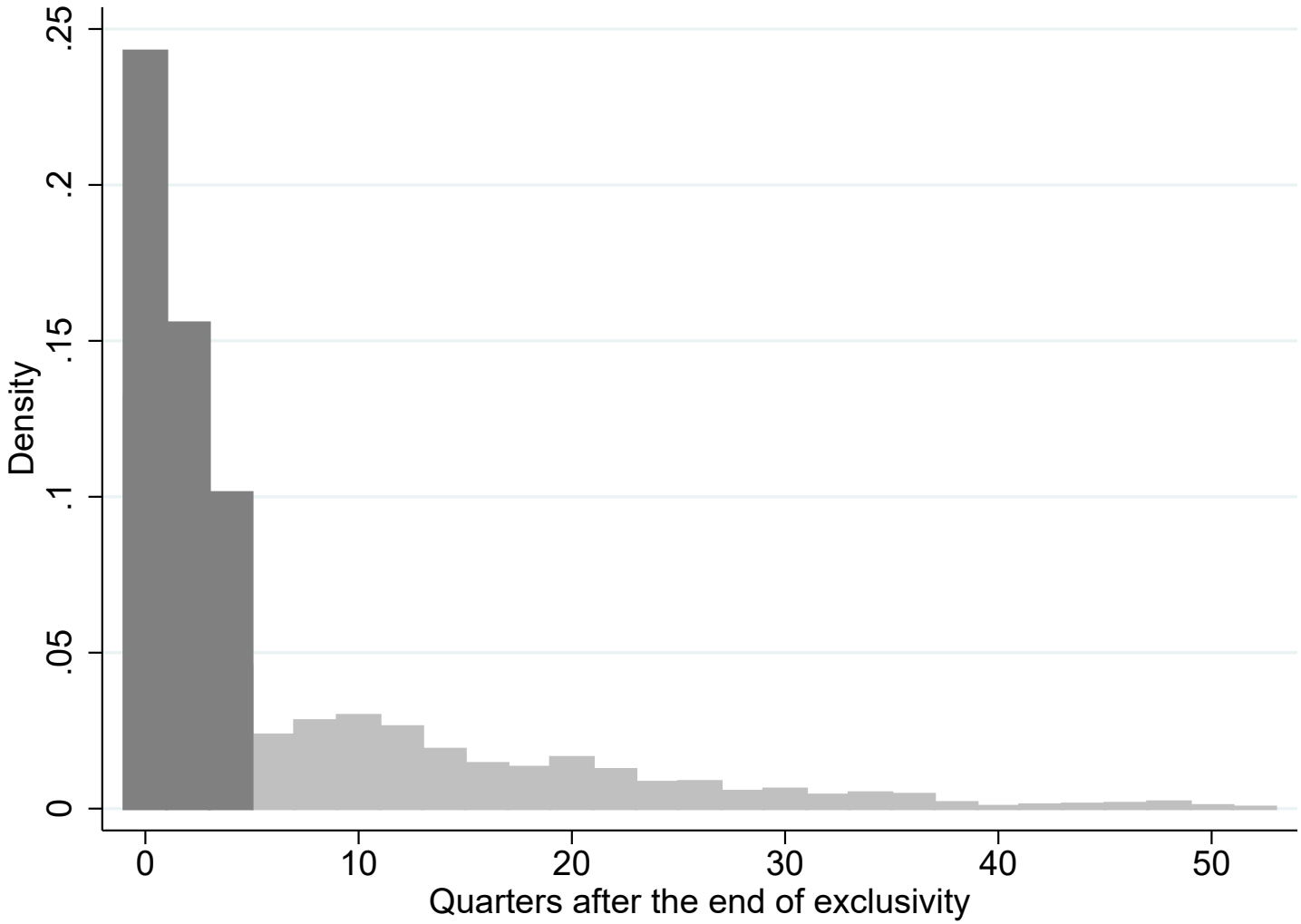
# Data

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Number of entrants | 451 | 2.608 | 3.249 | 0 | 18 |
| $\delta_S$ - all | 451 | 0.074 | 0.044 | 0 | 0.176 |
| $\delta_S$ - top 50 | 451 | 0.112 | 0.069 | 0 | 0.307 |
| $\delta_S$ - top 20 | 451 | 0.138 | 0.085 | 0 | 0.325 |

Table 3: Market-level Analysis: Summary Statistics

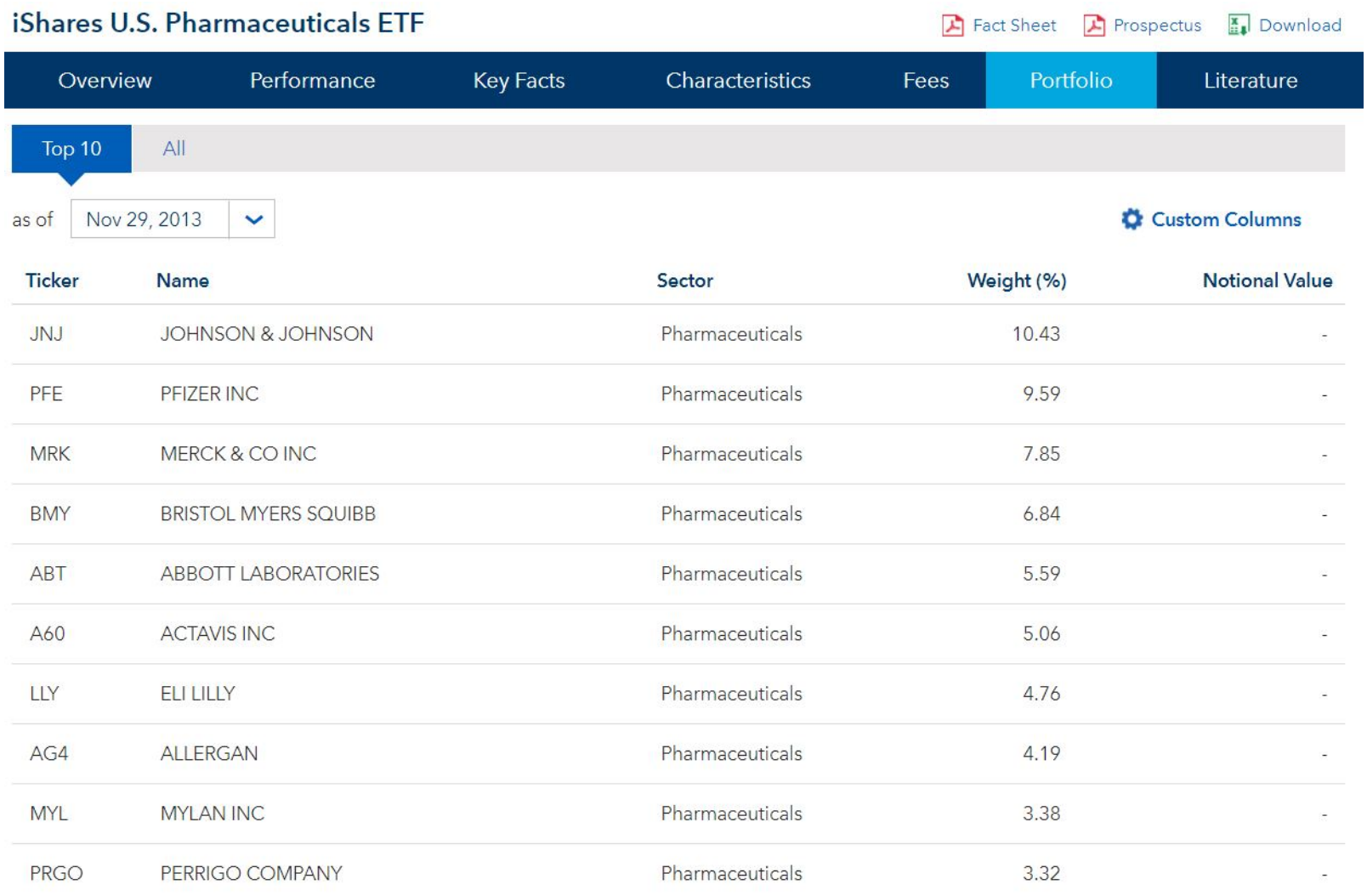
# Data

Figure 3: Entry patterns



# Instrumental variables

Figure 4: iShares U.S. Pharmaceutical (IHE) ETF



iShares U.S. Pharmaceuticals ETF

Fact Sheet | Prospectus | Download

Overview | Performance | Key Facts | Characteristics | Fees | Portfolio | Literature

Top 10 | All

as of Nov 29, 2013

Custom Columns

| Ticker | Name | Sector | Weight (%) | Notional Value |
|---|---|---|---|---|
| JNJ | JOHNSON & JOHNSON | Pharmaceuticals | 10.43 | - |
| PFE | PFIZER INC | Pharmaceuticals | 9.59 | - |
| MRK | MERCK & CO INC | Pharmaceuticals | 7.85 | - |
| BMY | BRISTOL MYERS SQUIBB | Pharmaceuticals | 6.84 | - |
| ABT | ABBOTT LABORATORIES | Pharmaceuticals | 5.59 | - |
| A60 | ACTAVIS INC | Pharmaceuticals | 5.06 | - |
| LLY | ELI LILLY | Pharmaceuticals | 4.76 | - |
| AG4 | ALLERGAN | Pharmaceuticals | 4.19 | - |
| MYL | MYLAN INC | Pharmaceuticals | 3.38 | - |
| PRGO | PERRIGO COMPANY | Pharmaceuticals | 3.32 | - |

# Identification

| Southern Asia | | Eastern Asia | | Northern Europe | |
|---|---|---|---|---|---|
| Life Insurance of India | 12 | Bank of Tokyo-Mitsubishi | 7 | BlackRock | 6 |
| Citigroup | 7 | Nomura Holdings | 6 | Invesco | 5 |
| La Caixa | 7 | Nippon Life Insurance | 6 | Aviva | 5 |
| fil investment management | 7 | Sumitomo Life Insurance | 4 | NBIM | 5 |
| HDFC Asset Mgmt | 6 | Nikko Asset Mgmt | 4 | HarbourVest Partners | 5 |

| Western Europe | | Northern America | |
|---|---|---|---|
| BlackRock | 10 | BlackRock | 65 |
| Fidelity Investments | 9 | Vanguard Group | 59 |
| NBIM | 8 | State Street Global | 57 |
| HarbourVest Partners | 6 | Northern Trust Global | 45 |
| Franklin Templeton | 6 | Fidelity Investments | 42 |

Table 4: Top common owners in each region for pharmaceutical firms and their number of blockholdings >1% (2009)

# Results

| | (1) $\delta_S$ | (2) $\delta_C$ | (3) $\delta_L$ |
|---|---|---|---|
| Index Periods | 0.0527*** | 0.0207*** | 0.0652*** |
| Same Region | 0.0103*** | 0.00635*** | 0.00614*** |
| Constant | 0.0776*** | 0.0197*** | 0.0547*** |
| Observations | 58,737 | 58,737 | 58,737 |
| Drug markets | 451 | 451 | 451 |
| R-squared | 0.285 | 0.298 | 0.293 |
| Fixed Effects | Yes | Yes | Yes |
| F-Test | 156.7 | 110.7 | 115 |
| F-Test (p-val) | 0 | 0 | 0 |
| Weak Instrument | 2289 | 2253 | 2215 |
| Endogeneity test (p-val) | 0.276 | 0.445 | 0.757 |

Notes: Standard errors in parentheses are robust. For simplicity only the coefficients associated with the excluded instruments are reported. $***p < 0.01, **p < 0.05, *p < 0.1$.

Table 5: First Stage

# Other robustness checks

- Different potential entrant sets
  - Potential entrants with experience in drug form/route
  - Potential entrants with experience in therapeutic field
- Measuring common ownership at different points in time
  - 2 years before market is open for entry
  - 0 years before market is open for entry
- Different entry windows
  - Entry within 1 year after market becomes open
  - Entry within 2 years after market becomes open
- Additional measures of common ownership
  - $\delta_M$ (Gilje et al.,2018); $\delta_G$ (Gilje et al.,2018); $\delta_H$ (Harford et al., 2011)
- Different econometric specifications
  - Logit model
  - Probit model