Strategic Complexity in Disclosure

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Motivation

Broad agenda: Develop theoretical underpinnings for understanding the consequences of disclosure processing costs and constraints.

- Blankespoor, deHaan, and Marinovic (2021) review concludes that *"the analytical literature on disclosure processing costs is at an early stage of development."* In particular:
  - *"the* ***mechanisms for how and why processing costs affect market outcomes are not well understood****, in part because the underlying theory (analytical or otherwise) is still relatively early"*
  - *"the literature has spent little time modeling the* ***effects of disclosure processing costs on managers' disclosure decisions.****"*

Our specific focus: Managers' strategic choice of disclosure complexity, defined as a disclosure's accessibility to investors.

Research Questions

1. **What determines a manager's choice of disclosure complexity *in equilibrium*?**
   - We incorporate a key insight from voluntary disclosure theory: managers' disclosure choices send a signal to investors regarding their info.
   - For instance, investors may be skeptical of seemingly obfuscated disclosures.

2. **What are the implications for empirical research on disclosure complexity?**
   - Specifically, how does disclosure complexity relate to:

Firm performance	Economic complexity
Firm's investor base	Stock price reactions

Model: Overview

Key takeaway from the empirical literature: There are multiple reasons why firms may issue complex disclosures.

1. **Obfuscation.** Complexity in disclosure can be strategically used to *reduce investor understanding*.

   Li (2008), Ertugrul et al. (2017), Lo et al. (2017), Kim et al. (2018), deHaan et al. (2020)

2. **Information provision.** Complexity in disclosure may be *necessary* to fully convey certain types of information.

   Li (2008), Merkley (2014), Bushee et al. (2018), Cohen et al. (2020), Cookson et al. (2022)

3. **Compliance.** Regulation and litigation concerns may impose that some firms issue complex disclosures.

   Dyer et al. (2015), Lang & Stice-Lawrence (2015), Guay et al. (2016), Chychyla et al. (2019)

We develop a model that captures each of these drivers of complexity.

Model: Manager's Problem

Price-maximizing manager observes a signal regarding firm value.

- We let $\tilde{y}$ denote expected firm value given this signal and refer to it as the manager's private info.
- We allow $\tilde{y}$ to have an arbitrary distribution with connected support.

Manager must disclose verifiable information regarding y. But, she can choose both the complexity and informativeness of the disclosure.

- Litigation/regulatory concerns require some disclosure, but there is leeway in the nature of this disclosure.
- Reflects a qualitative discussion in, e.g., a 10-K/Q, press release, or conference call.

Model: Investor Base

Market is composed of heterogeneous investors.

- A fraction χ are "sophisticated" – can process complex info.
- $1 - \chi$ are "unsophisticated" – can process simple, but not complex info.
- All investors can observe the disclosure's complexity. Reflects their ability to observe length/diction of disclosure, even if they cannot understand it.

This assumption is consistent with empirical evidence showing that certain investor groups better utilize accounting information than others.

e.g., Miller (2010), Drake et al. (2011), Lawrence (2013), Akbas et al. (2015)

Can think of unsophisticated investors as attention constrained (i.e., as facing temporary "integration costs"). However, rational attention *choice* is outside the scope of our analysis.

Model: Pricing

Classic assumption in voluntary disclosure models, in which investors are identical: $P = \mathbb{E}(\tilde{y})$.

Natural extension to our setting – prices reflect a weighted average of investor beliefs:

$$P = \chi \underbrace{\mathbb{E}_I(\tilde{y})}_{\text{sophisticated beliefs}} + (1-\chi) \overbrace{\mathbb{E}_N(\tilde{y})}^{\text{unsophisticated beliefs}}.$$

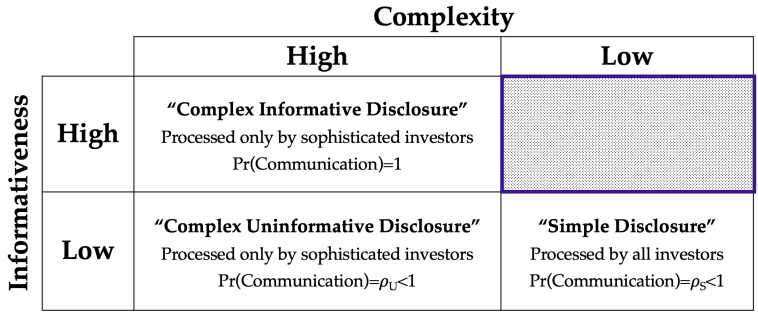
In an extension, we endogenize price in a model where the investors are risk averse $\Rightarrow$ main insights are robust.

Model is consistent with, but does not require, price drift following disclosure.

You and Zhang (2009), Cohen et al. (2020), Cookson et al. (2022): info in 10-K text leads to such drift

- Always drift in the direction of manager's unobservable private info.
- Return autocorrelation arises only if the unsophisticated ignore price info.

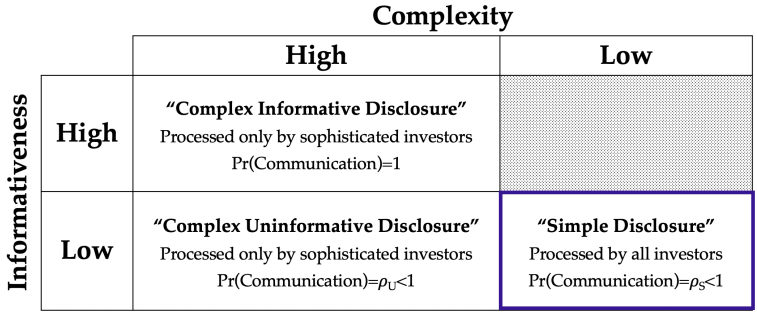
Model: Disclosure Choice



Key constraint: the manager cannot present her info in both a *simple* and *highly informative* manner.

- Captures info that is inherently complex, detailed, or requires supporting evidence to be credible, consistent with the **information provision** role of complexity (Bushee et al. (2018)).
- Leaves three disclosure choices: $x \in \{S, C, U\}$

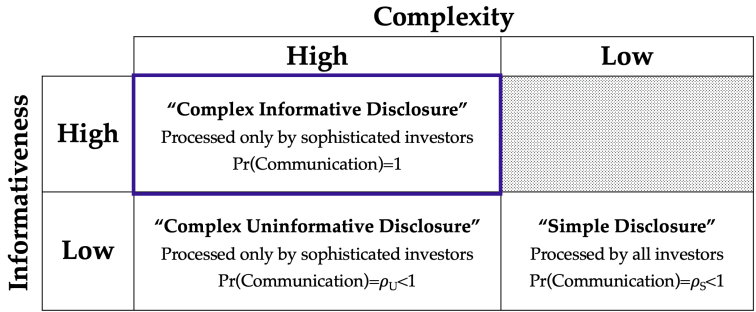
Model: Disclosure Choice



Simple disclosure: processed by all investors, but low informativeness.

- We capture this using an "information loss" specification.
  Similar to Dewatripont and Tirole (2005), Guttman and Marinovic (2018) and others.
- Firm's information is successfully conveyed with probability $\rho_S < 1$.

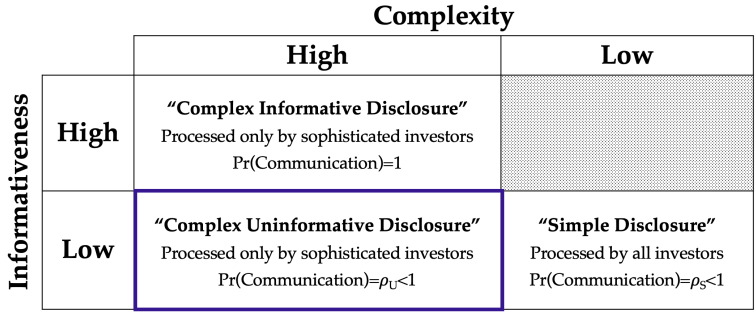
Model: Disclosure Choice



Complex informative disclosure:

- Always fully conveys the firm's information, but only understood by sophisticated investors.
- Main analysis: complex informative disclosure more informative than simple disclosure to the **average** investor: $\rho_S < \chi$.

Model: Disclosure Choice



Obfuscated disclosure:

- Conveys no more information than simple disclosure, but impedes understanding. Captures the unnecessary use of complex language or the inclusion of irrelevant details /pseudo-signals.
  Formal assumption: $\chi\rho_U < \rho_S$
- Only the sophisticated can distinguish an obfuscated from a complex informative disclosure.

Model: Non-Discretionary Complexity

With probability $\beta > 0$, the manager lacks discretion in her disclosure choice and must issue one of the three disclosure types with probabilities $\omega_U > 0, \omega_S > 0, \omega_C \geq 0$.

- Avoids an unrealistic "unraveling" equilibrium in which all firms are compelled to choose complex informative disclosure.
- Non-discretionary complexity can capture **compliance-driven complexity** and/or ineffective communication. Bloomfield (2008), Dyer et al. (2017), Chychyla et al. (2019)
- Non-discretionary simple disclosure: forthcoming/non-strategic firm that lacks informative detail.

Related Theoretical Literature

1. **Disclosure "clarity."** Past work models some disclosures as exogenously "clearer" or "more objective" than others, in that agents' posterior means given such disclosures are more highly correlated. Myatt and Wallace (2012), Chen et al. (2017), Avdis and Banerjee (2019), and Liang and Zhang (2019).

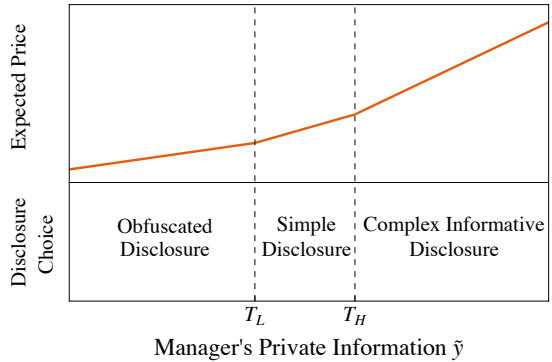
2. **Audience choice.** Michaeli (2017) considers optimal audience choice in a Bayesian persuasion framework; our focus is on ex-post complexity, which influences both audience size and precision.

3. **Signalling and multiple disclosure precision choices.** Titman and Trueman (1986) consider a model of IPOs where going-public firms can choose the quality of their auditor from a continuum.

4. **Obfuscation of prices.** Prior work considers complexity/obfuscation in *product* prices. Carlin (2009), Carlin and Manso (2011), Ellison and Wolitzky (2012), and Gu and Wenzel (2014).

Main Results: Strategic Complexity Equilibria

- **First main result:** Any equilibrium is a "strategic complexity equilibrium."
  - $y < T_L$: obfuscated disclosure
  - $T_L \leq y \leq T_H$: simple disclosure
  - $y > T_H$: complex informative disclosure
- **Intuition:**
  - Managers with very high/low signals want the most/least informative disclosure.
  - The incentives of firms with moderate news to select simple disclosure are more subtle.



Main Results: Strategic Complexity Equilibria

Formal argument:

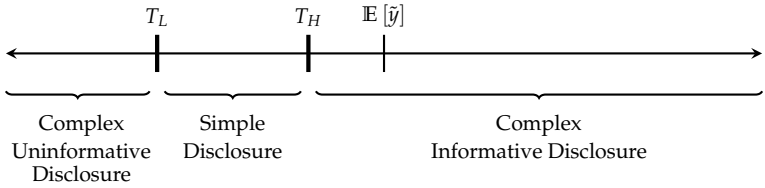
1. Taking limits: for sufficiently positive (negative) news, the manager prefers C (U).
   But, there could still be an equilibrium in which just C and U are selected.
2. Conjecture an equilibrium in which the manager never issues a simple disclosure. By Jung and Kwon (1988), the equilibrium threshold τ must be less than the prior mean μ.
3. Suppose the type τ manager deviates to simple disclosure. The difference in her payoffs is:

$$\rho_S \tau + (1 - \rho_S)\mu - \{\chi\tau + (1 - \chi)\mu\} = (\rho_S - \chi)(\tau - \mu) > 0.$$

   So, she strictly prefers to deviate.

Main Results: Equilibrium Existence and Multiplicity

There **always exists** an equilibrium in which the manager issues a simple disclosure when she has moderately **negative** news. Thus, on average, simple (complex) disclosure leads to a negative (positive) price reaction:

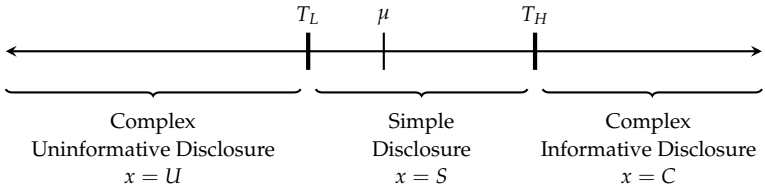


Intuition: When the manager observes mildly negative news:

- She wants to reduce the reaction to this news, and so prefers simple over complex informative disclosure.
- She does not obfuscate, because this would send a highly negative signal to sophisticated investors.

Main Results: Equilibrium Existence and Multiplicity

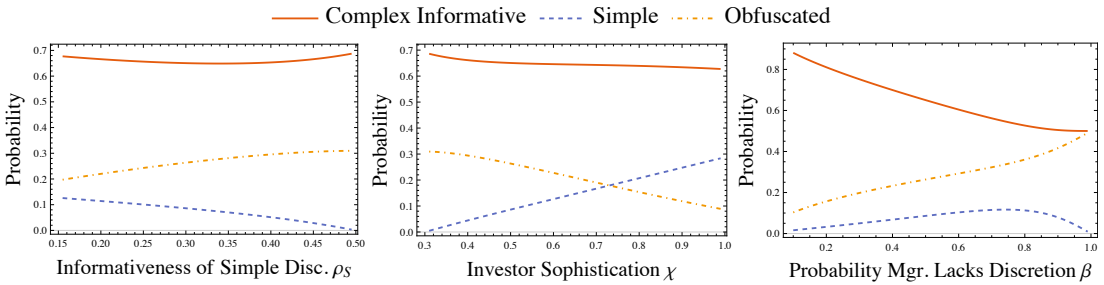
There **also exists** an equilibrium in which the average reaction to simple news is **positive** to complex news is **negative** if and only if simple and complex informative disclosure provide a similar amount of info to the avg. investor ($\rho_S \approx \chi$).



Intuition: When $\rho_S \approx \chi$, simple and complex informative news lead to almost the same average investor reaction.

- Simple disclosure sends a more positive signal in such an equilibrium.
- So, while the manager observing $T_H > \mu$ prefers C based on the reaction in investors' beliefs, she prefers S based on the signal it sends. These precisely offset.

Main Results: Prevalence of Complex vs. Simple Disclosure

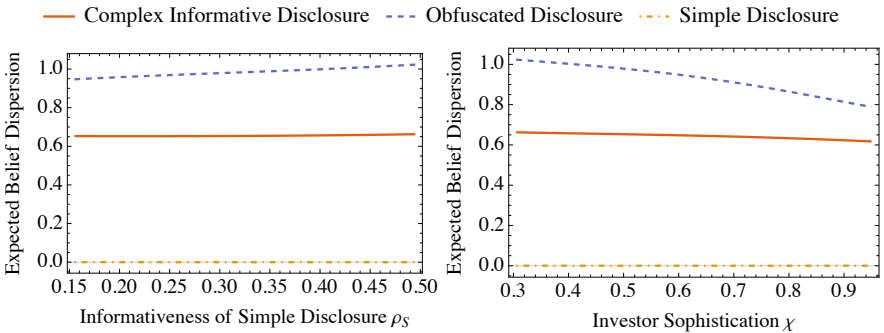


Discretionary complexity in disclosure:

- decreases in the proportion of sophisticated investors χ;
- increases in the simplicity of the firm's information ρ_S.

Moreover, obfuscation $\uparrow$ and informative complexity $\downarrow$ as "boilerplate" regulatory complexity β rises.

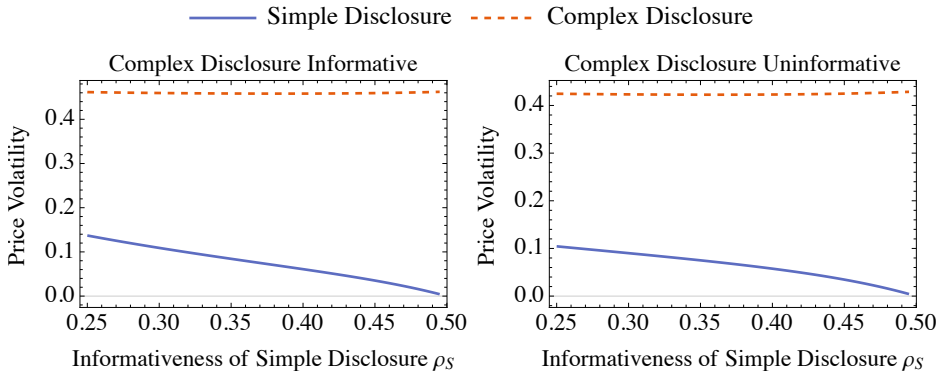
Main Results: Belief Dispersion



In the robust equilibrium, obfuscated disclosure tends to create the most dispersion in investor beliefs, despite being relatively uninformative.

- The ability to distinguish between complex informative and obfuscated disclosures provides a considerable information advantage, even when obfuscation is not informative.

Main Results: Disclosure-Induced Return Volatility



Regardless of the on avg. informativeness of complex disclosure, it generates higher volatility than simple information.

- Arises from a "selection" effect: firms with extreme news choose complex disclosure.

Extension: Unsophisticated Investor Base

Suppose now that $\rho_S > \chi$, i.e., the firm's information can be communicated in a way that is widely understood without significant information loss.

- Then, we obtain an equilibrium with a *monotonic* relation between complexity and the manager's private info. The manager chooses S given high y and U given low y.
- Consistent with classic work on fog and performance. This case may better correspond to a "simple" industry.
- When the likelihood the firm lacks discretion and issues a complex uninformative disclosure is small, the manager issues given intermediate news an informative complex disclosure in equilibrium. Otherwise, she never issues such a disclosure.

Extension: Informational Effects of Obfuscation

Corollary

Suppose now that the manager is unable to obfuscate. There is a unique equilibrium such that the manager chooses $x = C$ when $y > T$ and $x = S$ when $y < T$. The expected amount of information available to investors in this equilibrium is strictly greater than that in a strategic complexity equilibrium.

Intuition: Obfuscation has both direct and indirect negative effects on information quality.

1. **Direct effect.** Directly reduces unsophisticated investors' ability to understand disclosure.
2. **Indirect effect.** It disincentivizes the manager from issuing a complex informative disclosure when she has good news, because unsophisticated investors perceive this disclosure as potential obfuscation.

Empirical Applications

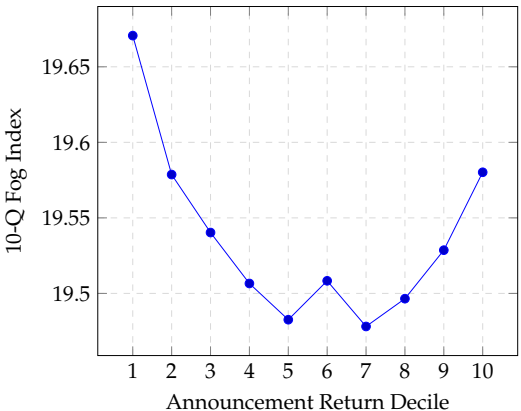
Testing the model requires:

- Controlling for non-discretionary complexity (as in e.g., Bushee et al. (2018)).
- Using a metric for the manager's private information.
  - The model suggests idiosyncratic contemporaneous and future returns are both effective.
  - Contrasts with prior studies that examine earnings/ROA, which capture public info rather than the manager's private info (e.g., Li (2008)).
  - Length or textual complexity metrics both apply.

Main predictions:

1. Main prediction: U-shaped relation between manager's private information and disclosure complexity. Strengthens with measures of investor sophistication.
2. Mass of firms issuing simple disclosure $\downarrow$ as simple disclosures become more informative / investor sophistication $\uparrow$.
3. Belief dispersion and price volatility are greater for firms that issue complex disclosures than firms that issue simple disclosures.

Descriptive Findings



Additional analyses:

1. Holds in quadratic regression specifications with standard controls and fixed effects.
2. Holds for other metrics of complexity/processing costs including document length.
3. Events that lead to extreme performance may require more complex explanations. Holds given the control for the complexity of analysts' questions, as developed in Bushee et al. (2018).
4. Consistent with model predictions, U shape strengthens with institutional ownership as a proxy for investor sophistication.

Conclusion

- We model a manager's choice of disclosure complexity.
  - Incorporates three drivers of complexity documented in the empirical literature: obfuscation, information provision, and compliance.
- The model offers novel predictions on how disclosure complexity relates to stock prices, price volatility, investor sophistication, and regulatory and economic complexity.
- We present empirical evidence on the relation between complexity and returns that is difficult to reconcile with existing models, but is consistent with our model.
  - Results suggest empirical work in this setting may benefit from considering non-monotonic specifications.
- Our model and findings may apply to complexity not only in financial disclosures, but also in other forms of communication.

Thank you!

Appendix Slides

Table 1: Baseline Specification

Dependent variable:	(1) $Complex\ Word_{i,t}$	(2) $Fog\ Index_{i,t}$	(3) $Smog\ Index_{i,t}$	(4) $Rix_{i,t}$	(5) $Avg\ Word_{i,t}$
$CAR\ Announce_{i,t}$	-0.109^{***}	-0.099^{***}	-0.070^{***}	-0.068^{***}	-0.028^{***}
	(0.013)	(0.033)	(0.023)	(0.026)	(0.006)
$CAR\ Announce^2_{i,t}$	1.652^{***}	2.624^{***}	1.911^{***}	1.941^{***}	0.398^{***}
	(0.098)	(0.230)	(0.161)	(0.179)	(0.040)
Controls	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Quarter-Year FE	Y	Y	Y	Y	Y
Observations	203,749	203,749	203,749	203,749	203,749
Adjusted R^2	0.63	0.28	0.28	0.28	0.22

Table 2: Institutional Ownership

Dependent variable:	(1) $Complex\ Word_{i,t}$	(2) $Fog\ Index_{i,t}$	(3) $Smog\ Index_{i,t}$	(4) $Rix_{i,t}$	(5) $Avg\ Word_{i,t}$
$CAR\ Announce_{i,t}$	-0.206***	-0.318***	-0.227***	-0.184**	-0.0530***
	(-6.59)	(-3.16)	(-3.92)	(-2.40)	(-2.97)
$Inst\ Own_{i,t}$	0.120***	0.312***	0.219***	0.234***	0.0399***
	(5.44)	(5.83)	(6.10)	(5.65)	(3.78)
$CAR\ Announce_{i,t} \times Inst\ Own_{i,t}$	0.199***	0.436***	0.317***	0.248**	0.0744**
	(3.83)	(2.76)	(3.27)	(2.03)	(2.32)
$CAR\ Announce_{i,t}^2$	1.320***	1.711***	1.107***	0.846*	0.174
	(5.74)	(2.79)	(2.84)	(1.80)	(1.28)
$CAR\ Announce_{i,t}^2 \times Inst\ Own_{i,t}$	0.987**	2.152*	2.040***	2.447***	0.540**
	(2.24)	(1.88)	(2.71)	(2.74)	(2.13)
Controls	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Quarter-Year FE	Y	Y	Y	Y	Y
Observations	148738	148738	148738	148738	148738
Adjusted R^2	0.630	0.174	0.257	0.171	0.141

Table 5: Controlling for N-D Complexity

Dependent variable:	(1) $Complex\ Word_{i,t}$	(2) $Fog\ Index_{i,t}$	(3) $Smog\ Index_{i,t}$	(4) $Rix_{i,t}$	(5) $Log\ Avg\ Word_{i,t}$
$CAR\ Announce_{i,t}$	-0.063^{***}	-0.040	-0.025	-0.022	-0.002
	(0.022)	(0.055)	(0.038)	(0.044)	(0.010)
$CAR\ Announce^2_{i,t}$	1.493^{***}	2.335^{***}	1.721^{***}	1.653^{***}	0.277^{***}
	(0.167)	(0.400)	(0.278)	(0.317)	(0.072)
$Analyst\ Fog_{i,t}$	0.015^{***}	0.039^{***}	0.028^{***}	0.030^{***}	0.001
	(0.002)	(0.006)	(0.004)	(0.004)	(0.001)
Observations	62,435	62,435	62,435	62,435	62,435
Adjusted R^2	0.38	0.32	0.30	0.34	0.10
Controls	Y	Y	Y	Y	Y
Industry FE	Y	Y	Y	Y	Y
Quarter-Year FE	Y	Y	Y	Y	Y

Does our model generate price drift/inefficient prices?

Model is consistent with, but does not require, price drift following disclosure.

You and Zhang (2009), Cohen et al. (2020), Cookson et al. (2022): info in 10-K text leads to such drift

- In the model, the manager's private information is unobservable, except to the informed following disclosure.
- The baseline model generates price drift (i.e., return autocorrelation / "momentum" following the disclosure), because there is no learning form price.
- However, a noisy rational expectations variation of the model would eliminate such drift. Moreover, our results appear to extend to a more involved setting.
  - Only necessary feature of our results: prices do not *fully* reflect sophisticated investors' beliefs (e.g., presence of liquidity traders or noisy supply).
  - Tractability issues when extending to Grossman and Stiglitz (1980) framework.
  - Advantage of the current setting: allows for reduced-form representation of lack of full revelation from prices while permitting tractability of the analysis.