

## Analytical research in accounting: Theories and empirical predictions

Alfred Wagenhofer

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## Typical analytical research ...

Equating all decision variables with their rational conjectures ( $\bar{m} = m$ ,  $\bar{q} = q$ ,  $\bar{\rho} = \rho$ ), we establish the following unique equilibrium.

**Theorem 1.** *There exists a unique rational expectations equilibrium with the following strategies.*

(i) *The manager exerts manipulative effort*

$$m^* = \frac{\tau(\rho^*) - \omega(\rho^*)}{2\alpha} \quad (7)$$

(ii) *The enforcer exerts investigative effort*

$$q^* = \frac{2\alpha[1 - F(\rho^*)K] + [\tau(\rho^*) - \omega(\rho^*)]}{2\alpha\lambda[1 - F(\rho^*)K]} \quad (8)$$

(iii) *If the enforcer uncovers misreporting, the investor always sues. Otherwise the investor sues if  $y \leq \rho^*$ , where  $\rho^* \in (-\infty, \infty)$  is implicitly defined by*

$$\frac{1}{1 + \psi(\rho^*)} \left( \frac{\rho^* - 1}{f(\rho^*)} \right) D - c = 0. \quad (9)$$

Schantl and Wagenhofer (2020)

## Typical (archival) empirical research

Panel B: Portfolio of disclosure tests

	(1) VD_Indicator2	(2) VD_Indicator3	(3) Sum_VD
Intercept	0.153 [0.88]	0.082 [1.33]	1.001*** [3.25]
Limit_Discr	0.204*** [6.90]	0.152*** [4.81]	0.429*** [10.98]
Size	0.293*** [6.40]	0.157*** [3.66]	0.496*** [8.32]
Return on Assets	0.000 [0.00]	-0.026 [-1.30]	-0.015 [-0.36]
Leverage	0.042** [2.01]	0.013 [0.69]	0.066** [2.26]
MTB	-0.066** [-2.57]	-0.026 [-1.12]	-0.146*** [-4.42]
Special Items	-0.101*** [-8.28]	-0.025** [-2.09]	-0.214*** [-13.04]
Loss	-0.009 [-0.78]	0.002 [0.18]	-0.019 [-1.25]
Standard Deviation of Returns	-0.008 [-0.35]	0.010 [0.46]	-0.031 [-0.93]
Returns	-0.003 [-0.22]	-0.021* [-1.68]	-0.017 [-0.99]
Firm FE	Yes	Yes	Yes
Industry by Year FE	Yes	Yes	Yes
Cluster	Firm	Firm	Firm
Adjusted-R <sup>2</sup>	0.708	0.883	0.550
Observations	18,253	9,812	33,688

Hribar, Mergenthaler, Roeschley, Young, and Zhao (2022)

3

## Using economic theory

- **Economic theory considers effects of information on multiple decision makers**
- **Key assumptions**
  - Asymmetric information
  - Potential conflicts of interest of players
  - Fully rational players
- **Main modeling sources**
  - Economic theory (microeconomics, regulation)
  - Finance (capital markets, governance)
  - and, of course, accounting (information structures)
- **Theories**
  - Agency theory, contract theory
  - Game theory
  - Descriptive models, e.g., linking earnings, book value and prices (Feltham and Ohlson 1995)

4

## Structures of analytical models

- **Accounting provides information**
- **Explicit focus on asymmetric information**
  - Economic setting that generates demand for information
  - Identifies optimal information system in specific use
- **Games with incomplete information**
  - Solution concept: (Bayesian) Nash equilibrium
- **Precommitment ability**
  - Sequential or simultaneous moves
  - Heavy use of precommitment: Agency models, contracting
    - Focus on stewardship use of accounting information
  - Lack of precommitment: Signaling, disclosure, cheap talk, bargaining, renegotiation
    - Decision-usefulness of accounting information

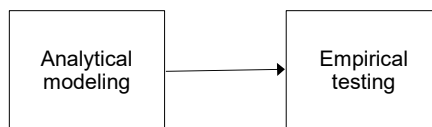
5

## Results of analytical models

- **Rigorous structure for analysis**
  - Uncovers driving forces
  - Is careful about the effects of accounting information
- **Major strength is to aid in strategic reasoning**
  - Interactions among self-interested players
  - Information transfer and use are at the heart
- **Most interesting are *a priori* counter-intuitive results**
  - Show that an intuitively reasonable result does not hold in general or only under certain conditions
  - → Leads to Bayesian updating of priors by players
  - Possibility results or impossibility results
  - Identify key parameters with first-order effect on results

6

## Theory and empirics

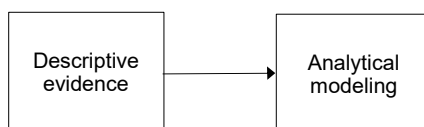


### ■ Theory informs empirical research

- Provides possible explanations for observed phenomena (the “story”)
- Basis for the “Hypotheses development” section
- Can generate new predictions
- Generates predictions to distinguish between alternative hypotheses
- States conditions under which relation should hold → guides selection of controls
- Identifies unintended consequences
- Deals rigorously with endogeneity and causality
- Guides the selection of variables and controls

7

## Theory and empirics



### ■ Empirical research informs model building

- New phenomenon → triggers development of theory
- Input to explain patterns of fact as basis for developing an explanation
- Economically significant event
- Generates possible explanations for mixed empirical evidence

8

## Challenges in empirical testing of theory

- **Unobservability of many variables**
  - Examples: Utility functions, set of actions, beliefs, conjectures, information endowments, contractual agreements
  - Human decision-making biases
- **Difficulties with empirical tests** (*Demski and Sappington 1999*)
  - Multiple equilibria
  - Equilibria in mixed strategies
  - Out-of-equilibrium strategies
    - Agency models: Agent is induced to work hard – do not observe effect of alternative actions that are not taken under optimal contract
    - Threat points – other incentive mechanisms that are never played out (eg high sanctions deter particular behavior)
  - Unobservability of effects
    - Multi-period consequences
    - Multiple outputs, not all are unobservable
- **Generalization, robustness**

## Why do few papers include theoretical *and* empirical research in accounting?

- **Note: Less so in other disciplines**
- **Hard to build expertise in multiple methodologies**
  - Lack of education, high investment cost
  - But one can team up with coauthors accordingly
- **Evaluation process in top journals**
  - Review process requires reviewers that are experts in more methodologies
  - Alternatively: two reviewers with different methodologies  
→ Risk of disagreement increases
  - Papers become too long
- **New battle fronts**
  - Attention of some reviewers shift to link of theory and data
- **Recent developments in structural estimation is promising**
  - Uses model to create simulation data to establish functional form of associations
  - Benefit: provides counterfactuals

## What can theory contribute?

- **“Generate new insights and challenge our existing way of thinking”** (*Chen and Schipper* 2016)
  
- **Contributions for peer theorists**
  - Provides novel (= “counter-intuitive”) results or interactions
  - Focus on strategic interaction of players
  - Endogeneity is key
  - Schools of thought and changing taste functions over time
  
- **Contributions for empirical researchers**
  - Rationalizes observed behavior and the underlying mechanism
  - Identifies key ingredients of what drives results and causal chain
  - Provides economic null hypothesis
  - Provides ideas for more specific predictions and tests
  - Helps select controls
  - Provides alternative explanations that can be tested

## Examples

## Characterizing theory papers

- **Players, information endowment, sequence of events and interactions**
  - Time line is key
  - Players' objective functions and conflicts of interest
  - Information endowment and information flows matter (and are focus of accounting)
- **Consistent derivation and explanation of results**
  - Provides conditions for the result to arise
  - Puts discipline on thinking
- **Reduces complexity: Stylized depiction of real phenomena with particular assumptions about situation and behavior**
  - A priori assumption on what is an "important" economic tradeoff
  - Deliberately excluding possible other interactions
  - But: the real world *is* complex!
- **Mathematical "language" provides rigor and precision of reasoning**
  - Assumptions are explicit → intersubjective verifiability
  - Technical part often difficult to understand  
May deter some audience

13

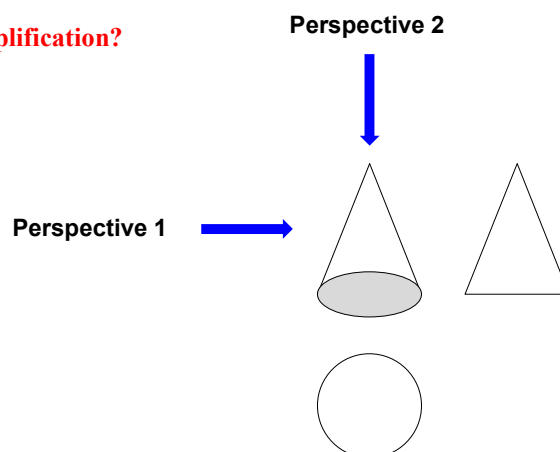
## Quiz

- **Does more information reduce uncertainty?**
  - Answer depends on the functional form of uncertain factor
    - **Yes:** Normal distribution → more information reduces conditional variance
    - **No:** Binary event → more information can "reverse" prior information and increase conditional variance
    - Bayesian updating depends on functional form (*Johnstone* 2018)
- **Does more information reduce the cost of capital?**
  - Need to distinguish between ex ante and ex post CoC (*Christensen, de la Rosa, and Feltham* 2010)
  - Yes – for ex post CoC as (and if) uncertainty reduces
  - But reduction is offset by equal increase of the "preposterior" CoC
  - Overall, no impact on ex ante CoC over the full time span of firm

14

## Quiz

- What is the “right” simplification?



15

## Earnings management (1)

- **Why do we observe earnings management?**
- **Revelation principle**
  - If there is a contract that induces the manager to lie about private information, there is an *outcome-equivalent contract* that induces the manager to tell the true information
  - **Sketch of proof:** Reported earnings  $m(y)$  of information  $y$ . If compensation scheme  $S(y)$  motivates manager to manage earnings, ie  $m(y) \neq y$ , then there is another compensation scheme  $S^*(y) \equiv S(m(y))$ , which motivates truthful reporting and achieves same allocation
  - Why is it useful? Introduces another constraint to solve the model (without losing optimal outcome), but there may be many non-truth-telling equilibria
- **But revelation principle requires strong assumptions**
  - Unconstrained contracts
  - Unlimited communication
  - Full commitment
  - Otherwise, earnings management can arise (*Arya, Glover, and Sunder 1998*)

16



## Earnings management (2)

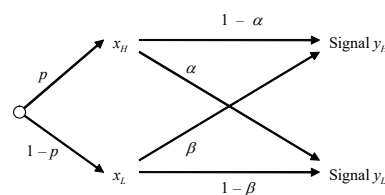
- **Common observation: Real earnings management and accruals earnings management are substitutes – but WHY?**
- **Explanation 1 (usual intuition): Management wants to achieve particular result and chooses “production function”**
  - Optimal “production mix” suggests substitution of AEM by more REM, which depends on the marginal costs of AEM and REM
  - Possible test: Look at benchmark beaters
- **Explanation 2: Costs of earnings management are substitutes**
  - Accounting standards produce substitution effect (*Demski 2004*) → More rules-based standards may restrict AEM but invites structuring of transactions (REM)
  - Possible test: Does change in standards affect REM?
- **Explanation 3: Reducing AEM increases value relevance, which increases incremental benefit of real earnings management → more REM (*Ewert and Wagenhofer 2005*)**
  - Possible test: Value relevance should increase – despite more REM

17

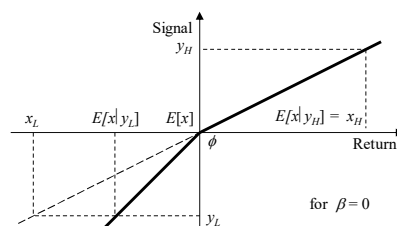
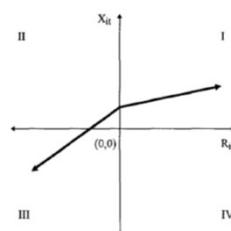
## Modeling and measuring conservatism

### ■ Modeling conservatism

- Probability of signals
  - $\text{prob}(y_H) = p(1 - \alpha) + (1 - p)\beta$
  - $\text{prob}(y_L) = (1 - p)(1 - \beta) + p\alpha$
- Conservative accounting has  $\beta < \alpha$



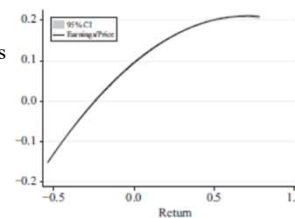
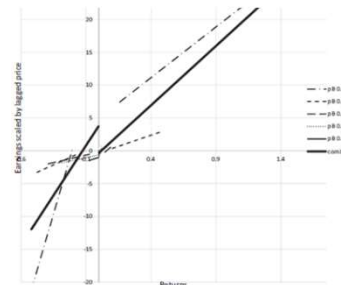
### ■ Empirical relation (*Basu 1997*)



18

## Is this kink evidence of conservatism?

- **Are there other explanations?**
- **Hemmer and Labro (2019)**
  - Benevolent manager chooses investment and decides based on report whether to divest it and invest in another project
  - Kink in earnings-return function (on average) even though accounting is unbiased
  - And: it also produces a discontinuity in the earnings frequency distribution
- **Breuer and Windisch (2019)**
  - Benevolent manager chooses investment in an infinite-horizon dynamic investment problem with symmetric shocks and capital adjustment costs
  - Concave earnings-return function
- **Consequence: Derive meaningful null hypothesis to test for conservatism**



19

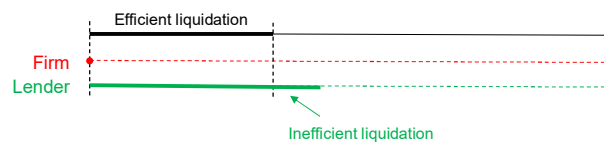
## Conservatism

- **Is conservatism desirable or undesirable?**
- **Is conservatism desirable from a debt contracting perspective?**
- **Typical intuition**
  - Counters management incentives to report favorable performance, e.g., requires recognition of bad news early, imposes greater cost of upward bias of earnings
  - Reduces litigation and reputation risks, e.g., due to asymmetric loss functions of directors and auditors
  - Preferable to debtholders because they are only interested in the downside risk
  - Motivates manager to abandon poorly performing projects early; induces early violation of debt covenants
  - But: Why then require disclosure *only* of unfavorable information?
- **Potential frictions in debt contracting**
  - Incentives for productive effort, information acquisition
  - Asset substitution
  - Private benefit from investing

20

## Optimal bias in debt covenant (1)

- **Gigler, Kanodia, Sapra, and Venugopalan (2009)**
  - Firm with positive NPV project raises debt capital to finance it
  - Project return is risky
  - Liquidation value  $L$  is less than expected cash flow
- **Efficient decision would be liquidation if  $E[\text{return}]$  (conditional on interim signal)  $<$  liquidation value  $L$**
- **Incentives**
  - Firm always continues project (equity = call option)
  - Lender liquidates project if conditional  $E[\text{debt repayment}] < L$



21

## Optimal bias in debt covenant (2)

- **Covenant transfers control to lender if interim signal is below threshold**
  - Threshold trades off two inefficiencies
    - Type I error: project liquidated although conditional  $E[\text{return}] > L$
    - Type II error: project continued although conditional  $E[\text{return}] < L$
- **Conservative accounting has two effects**
  - Increases probability of unfavorable signals and precision of favorable signals
  - Marginal type I error  $>$  marginal type II error because (unconditional) expected return  $> L$  for a viable project
- **Result: Optimal bias is aggressive accounting**
  - Intuition: ex ante NPV  $> 0 \rightarrow$  without information continuation optimal  
To overturn this base decision strong evidence to the contrary is required
- **Extensions show potential benefits of conservatism**

22

## Information prior to financing

- **Göx and Wagenhofer (2009)**

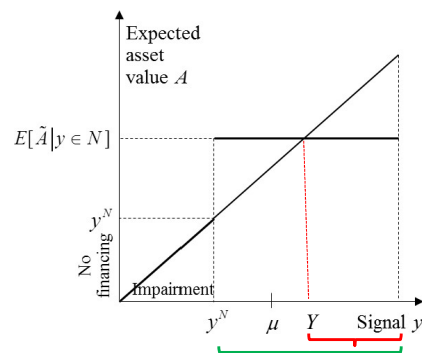
- Firm has a positive NPV project and, to raise debt capital, it must pledge assets of sufficient worth (to induce sufficient incentives to work hard)
- Lender's decision rule: Provide loan if asset value  $A >$  threshold  $Y$
- Full information  $\rightarrow$  probability of funding equals  $\text{prob}(A > Y)$
- Partial information: funding if  $A > y$  if disclosure or  $E[A \mid \text{no disclosure}] > Y$

- **Results**

- Less information is beneficial
- Impairment maximizes welfare (funding probability)

- **"Bayesian persuasion"**

- Requires credible commitment



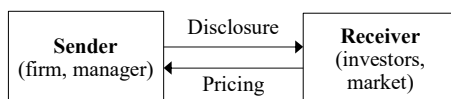
23

## Voluntary disclosure

- **Why do many firms voluntarily disclose additional information, whereas others do not?**
- **Helpful to learn about non-disclosing firms**
- **Helpful to assess economic effects of disclosure requirements**
  - What issues would one expect if one empirically studies firms in a voluntary disclosure regime?
- **Different types of models based on characteristics of disclosures**
  - Rational expectations equilibrium (assuming truthful disclosure)
  - Cheap talk
  - Signaling (signal jamming)
  - Contracting

24

## Truthful disclosure: Disclosure principle



### ■ Base setting

- Future value of a firm is  $x$  with expected value  $E[x]$
- Firm receives information  $y$  on  $x$ ,  $y \in [0, 1]$  uniformly distributed and conditional expectation is  $E[x | y] = y$
- Firm maximizes current market value
- Investors are fully rational and know that firm has information and can disclose

### ■ Unraveling in equilibrium: Full disclosure

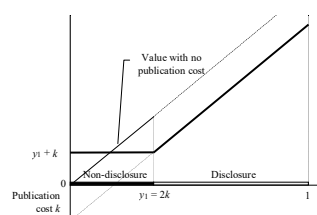
- Reason: Skeptical beliefs of receiver when observing nondisclosure
- But equilibrium includes always disclosure, so skeptical beliefs are a zero probability event

## What can then explain non-disclosure?

### ■ Direct cost of disclosure

(Verrecchia 1983)

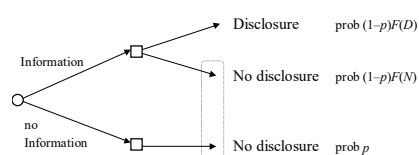
- Cost  $k > 0$  arises only if information is disclosed
- Equilibrium:  $N = [0, y_1]$



### ■ Market is uncertain whether firm has received information

(Dye 1985, Jung and Kwon 1988)

- Ex ante probability that firm has no information =  $p$
- Equilibrium:  $N = [0, y_1]$



## Distinguishing between explanations

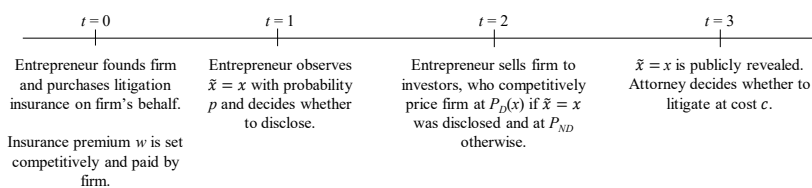
- These two explanations lead to structurally similar disclosures
- Predictions

	Disclosure cost	Information endowment
Range of disclosures	$[y_1, 1]$ with $y_1 \in (0, 1]$ , no disclosure for high $k$	$[y_1, 1]$ with $y_1 < 0.5$ and decreasing in $p$
Probability of disclosure	Decreases in $k$	$(1 - p)F(D)$

27

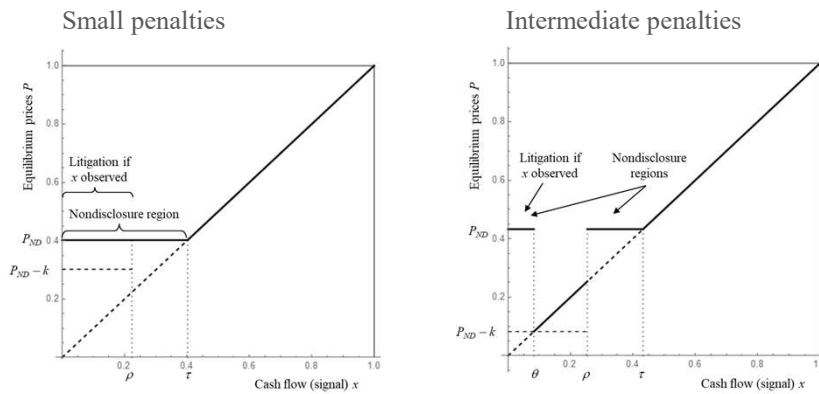
## Disclosure and litigation

- **Motivation: Mixed empirical evidence**
  - Negative association of litigation and disclosure  
(Johnson et al. 2001, Baginski et al. 2002, Bourveau et al. 2018)
  - Positive association of litigation and disclosure  
(Houston et al. 2019, Naughton et al. 2019, Huang et al. 2020)
- **Model with uncertainty about information**  
(Schantl and Wagenhofer 2023)
- **Time line**



28

## Depends on size of manager's penalty



- **Deterrence effect:** More disclosure to avoid penalties
- **Insurance effect:** Less disclosure due to investors pricing expected compensation from litigation

29

## Enforcement

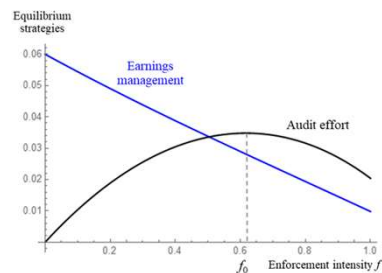
- **Several institutions that should ensure accounting quality**
  - Corporate governance: Internal controls over financial reporting, internal audit, audit committee
  - Auditing and audit oversight
  - Enforcement
  - Litigation
- **Does enforcement improve financial reporting quality?**  
**Some empirical evidence**
  - *Christensen, Liu, and Maffett (2020)*: More enforcement increases audit costs and reduces firm value
  - *Florou, Morricone, and Pope (2020)*: Stronger enforcement increases audit fees and induces more conservative accruals

30

## Enforcement and auditing

- **Ewert and Wagenhofer (2019)**
  - Model with accounting system errors and earnings management incentives
  - Auditor audits and corrects errors and earnings management
  - Enforcing is limited in scope and identifies (ex post) earnings management
  - Enforcement action costly to shareholders, manager, and auditor

- **Stronger enforcement ...**
  - Reduces earnings management**
  - Increases OR decreases audit effort and audit fees**
    - Crowding out auditing is harmful as audit adds value
  - Increases financial reporting quality (except for inefficient ICFR)**



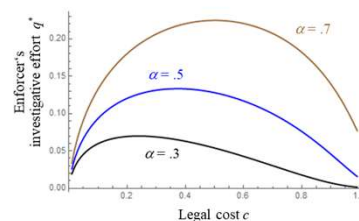
31

## Enforcement and litigation

- **Schantl and Wagenhofer (2020)**
  - Two strategic enforcement institutions: Public enforcement (enforcer) and private enforcement (costly litigation)
  - Three strategic players: manager, investor, enforcer

- **Strengthening private enforcement (lower legal cost)**

- can improve public enforcers' incentives or decrease them (thus increasing manipulation)
- yet always improves deterrence of misreporting



- **Strengthening public enforcement**
  - always crowds out private enforcement
  - can lead to less overall deterrence, i.e. to *more* misreporting
- **When private litigation is strong, public and private enforcement are strategic substitutes**

32



## What makes a theory paper interesting?

### ■ Characteristics

- Rationalizes observed behavior
- Provides rigorous structure for results and precision of reasoning
- Clearly shows economic effects and economic tradeoffs
- Provides (ex ante) counter-intuitive results
- Assumptions laid out explicitly → intersubjective verifiability
- Isolates what drives results (within model confines)
- Strategic interaction and endogeneity are important!

### ■ Constraints

- A priori assumption on what is the economic tradeoff
- Ignores complexity in real world: Highly stylized depictions of real phenomena with strong assumptions on the situation and on behavior
- "It depends" results, often idiosyncratic or ambiguous
- Math complex and difficult to understand

## Issues with theoretical research

- **"Deals" with complexity by reducing it:  
Stylized depiction of real phenomena with particular assumptions about situation and behaviors**
  - A priori *assumptions* on "important" economic tradeoff  
Question: Is the effect of first-order importance in reality?
  - Deliberately foregoing possible other interactions
- **Results can (structurally) depend on assumptions**
  - Acceptance of assumptions logically leads to the results
  - How "close" are the results to the underlying assumptions?
- **Trade-off between more realistic assumptions and tractability**
  - Constrained by mathematical tractability
- **Robustness of results**
  - Slight variations of assumptions may have substantial effect on results
  - But of course: Complex interactions are in fact complex

## What makes a paper exciting? (at least for me)

- **The obvious answer: Contribution!!**
  - Do I learn something new from it? (Bayesian updating of prior beliefs)
- **Novelty – identify an economic effect undiscovered as yet**
  - New, refined, or modified theory
- **Important constraint: Persuasive writing**
  - Following “standard” organization of papers
  - Clarity of thought

**My ultimate test:**  
**Would I tell others (including non-accounting persons) about it?**

## Research opportunities (very subjective)

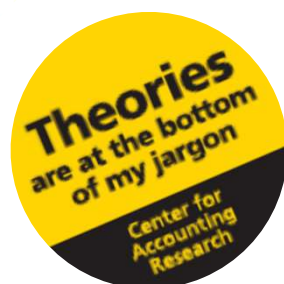
- **Topics arising from changes in regulation and standards**
  - Sustainability reporting, information over a firm’s value chain
  - Management compensation
  - Auditing and governance
- **Topics arising from changes in economic environment**
  - New business models, products and services, new markets
  - Digitalization
- **Model variants**
  - Real effects of accounting
  - Multiperiod models, providing time-stationary results
  - Introducing behavioral assumptions
- **Structural estimation**
  - Simulation to gain insights if no closed-form solution is available
  - Elicit model parameter values from data
  - Show economic magnitudes of effects

Novel data as  
motivation for  
new papers

## Conclusions

- **Main advantages of analytical research**
  - Mathematical “language” provides rigor and precision of reasoning
  - Provides logic behind its results
  - Transparency of assumptions
  - Inter-subjective confirmation
  - Replicable findings
- **Cautions us not to be too quick in using simple “theorizing” to develop hypotheses**
  - Often hypotheses are developed from simple intuition
  - Appeal to agency theory or other theories often insufficient because of wealth of different economic forces
- **Analytical research should better speak to empiricists**
  - Much research does not translate easily into testable predictions
  - Work on more robust results
  - Address first-order effects rather than rare events or knife-edge cases

37



38

## Literature



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39

## Literature ...



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40