Extricating Accrual Quality

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Role of Accruals

- Earnings Matter to Investors (Ball and Brown, 1968)
  - Earnings = Cash Flows + Accruals
  - Accruals adjust for timing mismatch (Dechow, 1994)
  - Accrual component of earnings difficult to estimate
    - Assumptions - future cash flows (Dechow and Dichev, 2002)
    - Intangible capital investments (Sirivastava, 2014)
    - Growth option values (Skinner, 2008)

- Arguments for specific Accrual Quality Factors
  - Complexity of estimation
  - Desire to manipulate earnings

Accrual Quality Factors

- Deep Literature on Accrual Quality
  - Multiple Measures of AQ
  - Numerous determinants identified in this literature
  - Affects investor risk premiums (Nallareddy and Ogneva, 2017)

- 100s of Articles on Accrual Quality
  - Estimation complexity arguments
    - *Firm Traits:* Size, ROA, Z-Score, Cash sales, etc.
    - *Industry Traits:* Avg Growth, Competition
  - Manipulation/Incentive arguments
    - *Managerial Traits:* CEO pay, gender, ownership
    - *Intermediary Traits:* Analysists following, Auditor tenure
    - *Governance Traits:* Staggered boards, Audit Com Size

Growing Number of Determinants

- How to interpret this vast literature
  - Build coherent framework: First, second, third order affects?
  - Investors: What markers should I look at to assess the reliability of AQ?
  - To echo Sunday's talk: Disentangling the relevant factors important!

- Are the variables in prior research distinct from one another?
  - AQ studies typically don't condition on prior variables
  - Difficult to include all identified variables: But many are correlated
  - Capital Markets Research: Thought Experiment
    - We propose new factor that affects stock returns
    - Our empirical tests don't include FF 3 Factors or momentum?
  - AQ: No common set of control variables
    - 6 recent articles across *TAR/JAE/JAR*
    - 41 separate right hand side variables
    - Share only 2 common control variables: Firm Size & Mkt to Book

Recent RHS Variables (TAR, JAE, JAR)

Firm Size	6/6	Financial Expertise	2/6	Busy Board	1/6
Market-to-Book	6/6	CEO Gender	1/6	Delaware	1/6
Capital Structure	5/6	CEO Ownership	1/6	Staggered Board	1/6
Loss	5/6	Firm Age	1/6	Poison Pill	1/6
ROA	4/6	Asset Growth	1/6	AC Independence	1/6
Board Independence	4/6	Cash Sales	1/6	Analyst Experience	1/6
Cash flow Volatility	3/6	Change in ROA	1/6	Analyst Tenure	1/6
Change in Net Income	3/6	Net Income/Price	1/6	Analyst Top House	1/6
CEO Tenure	3/6	External Financing	1/6	Analyst Portfolio	1/6
Board Size	3/6	Foreign Sales	1/6		
Sales Volatility	2/6	Number of Segments	1/6		
Institutional Ownership	2/6	Extreme Growth	1/6		
CEO Duality	2/6	Merger	1/6		
CEO Delta	2/6	Restructuring	1/6		
CEO Vega	2/6	Dedicated Inst. Own	1/6		
Big 4	2/6	Non-Ded Ins Own	1/6		
AC Size	2/6				

Bruynseels & Cardinaels 2014; TAR	Zhao & Chen 2008; TAR	Bradley et al. 2017; JAE	Badolato et al. 2018; JAE	Ham et al. 2017; JAR	Faleye et al. 2011; JFE

Research Focus

- *Q1: Which characteristics in prior research provide material, independent information about accrual quality?*

  - In a "horse-race" among the determinants, which ones survive?

  - Natural experiments necessitate the identification of relevant control variables among many proposed determinants to test exclusion restriction

- *Q2: Do common measures of accrual quality share covariates?*

  - Do they exhibit heterogeneous covariates?

  - Explore a composite measure of accrual quality

  - Do using individual, noisy proxies of accrual quality contribute to the validation of inconsequential factors?

Numerous Documented Determinants

- Prior research: A host of factors cause better/worse AQ
  - We concentrate on 105 proposed determinants of innovation
  - No new economic or psychology based arguments
  - We assess the evidence behind previously proposed factors
  - Rather than gauging a local treatment impact (causality) we focus on the materiality of previously proposed AQ factors

- Measures of Accrual Quality
  - KLW (Kothari et al., 2005) performance-matched discretionary accruals
  - HN (Hribar and Nichols, 2007) unsigned abnormal accruals
  - DGLS (Dechow et al., 2011) industry-adjusted absolute value - DD residual

Traditional Horse Race Approaches

- Best Subset Selection Regressions
  - Fit all possible models for possible combinations of p predictors
  - $2^{105} = 40{,}564{,}819{,}207{,}303{,}300{,}000{,}000{,}000{,}000{,}000$ models (40.6 Noillion)
  - Penalize models for additional complexity (Akaike or Bayesian Information Criteria)
  - Attractive to evaluate proposed variables but computationally infeasible

- Step-wise Regressions
  - Only focus on a subset of the potential models
  - Computationally feasible: $p(1+p)/2$ or 5,565 models in our case
  - Feasible but unattractive: No Assurance you identify the correct variables

- Meta-Analysis
  - Combine several experimental results to overcome small sample sizes
  - Powerful tool for reducing noise in coefficient estimates
  - Observational data in Accounting/Finance
    - Omitted variables create biases in coefficient estimates
    - Difficult to aggregate biased coefficient estimates
    - No Assurance you get the true model if use meta-analysis with observational data

- Result: Uncommon in Accounting/Finance

Machine Learning Horse Race

- Machine Learning Based Methods
  - Complimentary tools to causal inference (Einav and Levin, 2014: *Science*)
  - Data driven detection of conditioning variables (Mullainathan and Spiess, 2017: *JEP*)

- Adaptive Lasso (least absolute shrinkage and selection operator)
  - Standard least squares fitting procedure estimates B_0, B_1,.....B_p by minimizing
    - RSS $= \sum_{i=1}^{n}(yi - B_0 - \sum_{j=1}^{p} B_j x_{ij})^2$
  - Adaptive Lasso coefficients minimize the quantity
    - $= $ RSS $+ \lambda \sum_{j=1}^{p} w_j |Bj|$
  - Adaptive weight *w* for each coefficient estimated via ridge regression
  - This penalty shrinks some of the coefficients to zero

- Instead of in-sample measures, use out-of-sample tests to estimate error
  - Cross-validation: Split data into training and validation subsets
  - Fit the models on training subsets, test on excluded subsets
  - Repeat with different training and validation subsets
  - *Oracle Property:* Performs as well as if know true underlying model (Zou, 2006)

Disentangling Accrual Quality

- Use Machine Learning techniques to assess 105 variables posited in prior research
  - Prior research provides arguments for these variables
  - Which ones provide material, independent explanatory power for AQ?
  - Which of these variables should future research uses as a common set of conditioning variables?

- Do common measures or signals of accrual quality share covariates?
  - How many and which covariates do they share?
  - How deal with multiple signals of left-hand side variable?

- Real World Application: Replicate Recent AQ Study
  - Examine how conditioning on prior determinants influences results
  - Examine how different measures of accrual quality could potentially contribute to the validation of insignificant factors

Data and Analysis

- Compustat, Execucomp, CRSP, BoardEx, IRRC/Risk Metrics, Department of Labor, Thomson Reuters, I/B/E/S, USPTO, US Census Bureau

- Main Sample 1992- 2013
  - 960 Industrial Firms; 9,852 Observations
  - CEO pay is major limiting factor

- Time Periods
  - 3 and 5 year Rolling Windows
  - Entire time period

- Adaptive Lasso: Cross Validation
  - Model formation and out of sample testing in each window
  - Aggregate across each of the windows
  - Aggregate across entire time period

Aggregate Base Results

- Managerial, Intermediary, and Governance *rarely* survive
  - Survival rates hover around 4%
  - Similar to what you might observe by chance
  - 82 of prior variables never survive during any of the rolling windows

- Example: Analyst following
  - 5-year windows (0 out of 18 windows)
  - 3-year windows (1 out 20)
  - Increases R^2 by 0.0006 in traditional AQ regressions

- 8 of 105 prior variables emerge in 2/3 of the rolling windows
  - Firm size, ROA, operating cash flows (and its absolute value), negative earnings, cash sales, FScore, and capital intensity
  - These 8 variables explain 88% of the variation in accrual quality

Main Results – Managerial

Table 3: Accrual Quality and Adaptive Lasso: A Rolling Window Approach

	KLW		HN		DGLS	
	Frequency	*Incremental*	*Frequency*	*Incremental*	*Frequency*	*Incremental*
Managerial Characteristics:						
CEO Tenure	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Age	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Delta	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Vega	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Cash Ratio	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Option Pay	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Opportunistic Trade	0/18	<0.001	0/18	<0.001	0/18	<0.001
CEO Gender	5/18	<0.001	7/18	0.0004	3/18	<0.001
CEO Confidence	0/18	<0.001	1/18	<0.001	0/18	<0.001
CFO Delta	0/18	<0.001	0/18	<0.001	0/18	<0.001
CFO Vega	0/18	<0.001	0/18	<0.001	0/18	<0.001
CFO Confidence	2/18	<0.001	0/18	<0.001	0/18	<0.001
CEO/CFO Bonus Ratio	1/18	<0.001	0/18	<0.001	0/18	<0.001
Insider Ownership	0/18	<0.001	0/18	<0.001	0/18	<0.001
Insider Total Shares	0/18	<0.001	0/18	<0.001	0/18	<0.001
TMT Pay	0/18	<0.001	0/18	<0.001	0/18	<0.001

Main Results – Firm

Firm Characteristics:						
Size	**12/18**	0.0485	1/18	<0.001	**18/18**	0.0532
Leverage	0/18	<0.001	0/18	<0.001	0/18	<0.001
ROA	4/18	<0.001	0/18	<0.001	**15/18**	0.0562
Tobin's q	2/18	<0.001	0/18	<0.001	0/18	<0.001
MB	0/18	<0.001	0/18	<0.001	0/18	<0.001
Operating Cash Flow	7/18	<0.001	3/18	<0.001	7/18	<0.001
Stock Liquidity	0/18	<0.001	0/18	<0.001	0/18	<0.001
Firm Age	0/18	<0.001	0/18	<0.001	0/18	<0.001
Distance to SEC	0/18	<0.001	0/18	<0.001	0/18	<0.001
Litigation Risk	0/18	<0.001	1/18	<0.001	0/18	<0.001
Financial Distress	0/18	<0.001	0/18	<0.001	0/18	<0.001
Loss	**13/18**	0.0292	**11/18**	0.0032	0/18	<0.001
Merger Dummy	1/18	<0.001	0/18	<0.001	0/18	<0.001
Merger	0/18	<0.001	0/18	<0.001	0/18	<0.001
Issue	4/18	<0.001	2/18	<0.001	**14/18**	0.0017
Size Growth	0/18	<0.001	2/18	<0.001	0/18	<0.001
Sales Growth	1/18	<0.001	1/18	<0.001	**12/18**	0.0094
Extreme Growth	**12/18**	0.0019	10/18	0.0024	5/18	<0.001
Benchmark	0/18	<0.001	0/18	<0.001	0/18	<0.001
Delaware	0/18	<0.001	0/18	<0.001	0/18	<0.001

Main Results – More Firm Characteristics

Net Income/Price	0/18	<0.001	0/18	<0.001	0/18	<0.001
Operating Cash Flow (Absolute)	**14/18**	0.0587	0/18	<0.001	**18/18**	0.0792
Quick Ratio	0/18	<0.001	0/18	<0.001	3/18	<0.001
Z-Score	0/18	<0.001	0/18	<0.001	0/18	<0.001
R&D^2	2/18	<0.001	1/18	<0.001	0/18	<0.001
Special Items	3/18	<0.001	0/18	<0.001	0/18	<0.001
Write-down	0/18	<0.001	0/18	<0.001	0/18	<0.001
Amihud	0/18	<0.001	0/18	<0.001	0/18	<0.001
ATO Score	0/18	<0.001	0/18	<0.001	6/18	<0.001
Top Size	0/18	<0.001	0/18	<0.001	0/18	<0.001
FScore	1/18	<0.001	0/18	<0.001	**16/18**	0.0239
Export	0/18	<0.001	0/18	<0.001	0/18	<0.001
Segment Number	0/18	<0.001	1/18	<0.001	0/18	<0.001
Capital Intensity	0/18	<0.001	**11/18**	0.0343	**14/18**	0.0076
Organization Capital	0/18	<0.001	0/18	<0.001	0/18	<0.001

Main Results – Governance

Governance Characteristics:						
Governance Index	0/18	<0.001	0/18	<0.001	0/18	<0.001
Staggered Board	0/18	<0.001	0/18	<0.001	0/18	<0.001
Mergers and Charter Amendments	2/18	<0.001	0/18	<0.001	0/18	<0.001
Poison Pill	0/18	<0.001	0/18	<0.001	1/18	<0.001
Golden Parachutes	1/18	<0.001	7/18	0.0007	0/18	<0.001
Bylaw Amendments Limit	1/18	<0.001	0/18	<0.001	1/18	<0.001
Audit Committee Size	0/18	<0.001	0/18	<0.001	0/18	<0.001
AC Independence	0/18	<0.001	1/18	<0.001	0/18	<0.001
AC Expertise	0/18	<0.001	0/18	<0.001	0/18	<0.001
Board Size	0/18	<0.001	0/18	<0.001	0/18	<0.001
Board Independence	0/18	<0.001	0/18	<0.001	0/18	<0.001
Busy Board	0/18	<0.001	0/18	<0.001	0/18	<0.001
CSR	0/18	<0.001	0/18	<0.001	0/18	<0.001

Main Results – Intermediary

Intermediary Characteristics:						
Analyst Following	0/18	<0.001	0/18	<0.001	0/18	<0.001
Analyst Tenure	0/18	<0.001	0/18	<0.001	0/18	<0.001
Analyst Portfolio	0/18	<0.001	0/18	<0.001	0/18	<0.001
Analyst Experience	0/18	<0.001	0/18	<0.001	0/18	<0.001
Analyst Top House	0/18	<0.001	0/18	<0.001	0/18	<0.001
Institutional Ownership	0/18	<0.001	0/18	<0.001	0/18	<0.001
Dedicated Institutional Ownership	0/18	<0.001	0/18	<0.001	0/18	<0.001
Non-Dedicated Institutional Ownership	0/18	<0.001	0/18	<0.001	0/18	<0.001
Blockholder	4/18	<0.001	0/18	<0.001	0/18	<0.001
New Auditor	6/18	<0.001	1/18	<0.001	2/18	<0.001
Auditor Tenure	0/18	<0.001	0/18	<0.001	0/18	<0.001
Big 5	0/18	<0.001	0/18	<0.001	0/18	<0.001

Results Seem Surprising

- Characteristics arise in two of the three proxies for accrual quality
  - Example: Firm size
    - 12 out 18 windows using KLW
    - 18 out of18 windows using DGLS
    - 1 out 18 times using HN
  - No Variable emerges across all 3 measures of accrual quality

- Each accrual quality measure
  - Idiosyncratic covariates
  - Shared covariates with one or the other measure
  - Explanatory power varies widely
    - KLW exhibiting 8.3% of R^2
    - HN 37.4% of R^2
    - DGLS 24.9% of R^2

- How deal with Multiple Signals
  - If RHS variables, then include each signal in test (Holmstrom, 1979)
  - Develop a composite measure based on their commonality

Composite Measure of AQ

- Factor analysis
  - These 3 measures of accrual quality not that highly correlated

	KLW	HN	DGLS
KLW	1.000		
HN	0.035	1.000	
DGLS	0.191	0.158	1.000

  - Share one significant common factor
  - DGLS most highly correlated with common factor

Variable	Factor1	Uniqueness
KLW	0.6221	0.6130
HN	0.5387	0.7099
DGLS	0.7671	0.4115

- Which prior variables explain the common factor?

Composite Measure Results

Table 6: Composite Measure and Variable Selection

	(1) 5-year Window	(2) 3-year Window
Managerial Characteristics:		
CEO Tenure	0/18	0/20
CEO Age	0/18	0/20
CEO Delta	0/18	0/20
CEO Vega	0/18	0/20
CEO Cash Ratio	0/18	0/20
CEO Option Pay	0/18	0/20
CEO Opportunistic Trade	0/18	0/20
CEO Gender	3/18	1/20
CEO Confidence	0/18	0/20
CFO Delta	0/18	0/20
CFO Vega	0/18	1/20
CFO Confidence	0/18	0/20
CEO/CFO Bonus Ratio	0/18	0/20
Insider Ownership	0/18	0/20
Insider Total Shares	0/18	0/20
TMT Pay	0/18	0/20
Intermediary Characteristics:		
Analyst Following	0/18	1/20
Analyst Tenure	0/18	0/20
Analyst Portfolio	0/18	0/20
Analyst Experience	0/18	0/20

Composite Measure Results

Analyst Top House	0/18	0/20
Institutional Ownership	1/18	0/20
Dedicated Institutional Ownership	0/18	0/20
Non-Dedicated Institutional Ownership	0/18	1/20
Blockholder	0/18	2/20
New Auditor	3/18	6/20
Auditor Tenure	0/18	0/20
Big 5	1/18	0/20
Firm Characteristics:		
Size	**18/18**	**20/20**
Leverage	0/18	0/20
ROA	**18/18**	**15/20**
Tobin's q	0/18	0/20
MB	0/18	0/20
Operating Cash Flow	**13/18**	**17/20**
Stock Liquidity	0/18	0/20
Firm Age	0/18	0/20
Distance to SEC	0/18	0/20
Litigation Risk	0/18	1/20
Financial Distress	0/18	2/20
Loss	**18/18**	**18/20**
Merger Dummy	0/18	0/20
Merger	0/18	0/20
Issue	8/18	11/20
Size Growth	0/18	0/20

Composite Measure Results

Sales Growth	5/18	1/20
Extreme Growth	2/18	10/20
Benchmark	0/18	1/20
Delaware	0/18	0/20
R&D	1/18	0/20
Change in Net Income	0/18	0/20
Stock Return	0/18	0/20
Cash Flow Variation	0/18	1/20
Net Income Variation	0/18	0/20
ROA Variation	0/18	0/20
Sales Growth Variation	0/18	0/20
Asset Turnover	0/18	0/20
Sales Variation	0/18	0/20
Operating Cycle	0/18	1/20
Advertise	0/18	0/20
CAPX	8/18	5/20
Change in ROA	0/18	0/20
Abnormal Employee	0/18	0/20
CAPX^2	2/18	0/20
Cash	0/18	1/20
Cash Sales	**15/18**	**14/20**
Cash Sale Change	0/18	0/20
Days Payable	0/18	0/20
Loss Percent	1/18	0/20
Non-Operating Assets	0/18	1/20

Composite Measure Results

Net Income/Price	0/18	0/20
Operating Cash Flow (Absolute)	**18/18**	**19/20**
Quick Ratio	0/18	0/20
Z-Score	0/18	0/20
R&D^2	0/18	0/20
Special Items	1/18	0/20
Write-down	0/18	0/20
Amihud	3/18	3/20
ATO Score	0/18	0/20
Top Size	0/18	0/20
FScore	**12/18**	**14/20**
Export	0/18	0/20
Segment Number	0/18	0/20
Capital Intensity	**18/18**	**15/20**
Organization Capital	0/18	0/20
Governance Characteristics:		
Governance Index	0/18	0/20
Staggered Board	0/18	0/20
Mergers and Charter Amendments	0/18	0/20
Poison Pill	0/18	0/20
Golden Parachutes	0/18	0/20
Bylaw Amendments Limit	0/18	1/20
Audit Committee Size	0/18	0/20
AC Independence	0/18	0/20
AC Expertise	0/18	0/20

Composite Measure Results

Board Size	0/18	0/20
Board Independence	0/18	0/20
Busy Board	0/18	0/20
CSR	0/18	0/20
State/Industry Characteristics:		
Industry Sales Growth	3/18	8/20
Industry MB	0/18	1/20
Industry Competition	1/18	1/20
State Population	0/18	0/20
Unemployment Rate	0/18	0/20
State GDP	0/18	0/20
GDP Growth	0/18	0/20
State Firm Return	0/18	0/20
State Return Variation	0/18	0/20

Does this matter in Practice?

- Evaluate recent study
  - Use each of the three AQ measures/signals
  - Include main conditioning variables
  - Use Composite measure of AQ

- Insider trading affects accrual quality (Ali and Hirshleifer, 2017)
  - Step 1: Repeat their tests using each AQ measure
    - KLW and DGLS measure related to insider trading (but not HN)
    - Incremental R^2 improvement from including insider trading in their specifications
      - 0.0003 with KLW
      - 0.0008 with DGLS
      - T-statistics are significant but the explanatory power is arguably weak.
  - Step 2: Include Material Conditioning Variables from prior research
    - Insider trading unrelated to accrual quality for each individual measures
  - Step 3: Using the Composite Measure of AQ
    - No relation between AQ and insider trading using their control variables

Insider Trading Results

Table 8: Evidence of Potential Bias

This table presents results showing the potential bias from two scenarios. First, we show that the inclusion of key identified variables could change the significance of the independent variable. Secondly, we show that using a different accrual quality measure also changes the inferences.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	KLW	HN	DGLS	Composite	KLW	HN	DGLS	Composite
	Without Key Variables				With Key Variables			
Constant	-0.250**	-0.871***	0.155	0.005	-0.223**	-0.709***	0.171	-0.020
	(-2.36)	(-5.74)	(0.68)	(0.02)	(-2.02)	(-5.65)	(0.76)	(-0.08)
Opp_Trade_CEO	**0.019***	**-0.009**	**0.030***	**0.017**	**0.016**	**-0.006**	**0.024***	**0.017**
	(1.66)	**(-0.93)**	**(2.70)**	**(1.48)**	**(1.41)**	**(-0.60)**	**(2.22)**	**(1.55)**
Their Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Key Control Variables	No	No	No	No	Yes	Yes	Yes	Yes
Industry and Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,852	9,852	9,852	9,852	9,852	9,852	9,852	9,852
Adjusted R^2	0.050	0.346	0.083	0.060	0.061	0.387	0.095	0.064

Conclusions and Implications 1

- Substantial literature on accrual quality
  - Relies on a disparate set of control variables
  - Limited use of previously documented determinants
  - Many of the findings about managerial or governance-related factors influencing accrual quality appear, at best, to be second-order concerns.

- Which factors really matter?
  - 8 variables explain at AQ in at least 2/3 of the windows
  - These variables offer >88% explanatory power of full specification
  - 82 Variables from prior research never emerge in a single window

- Variables related to the complexity of accrual estimation, rather than proxies of manipulation incentives or safeguards appear to be main drivers of AQ.

- These 8 variables provide a rich set of controls for future research on accrual quality.

Conclusions and Implications 2

- Individual measures of accrual quality potentially problematic without incorporating each signal simultaneously
  - We incorporate each signal of AQ into the analysis at the same time
  - Managerial, intermediary, and governance variables little explanatory power
  - Proliferation of inconsequential factors of AQ
    - Lack of including previously identified covariates
    - Noisy signals of AQ

- Future AQ Studies
  - Should condition their analysis on previously identified covariates
  - Studies focused on providing causal evidence
    - Use these variables to assess the exclusion restriction
    - Composite measure of AQ
  - If AQ measures provide noisy signals of the underlying accrual quality, then should incorporate multiple signals in the analysis