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Has accounting gone bad?

Ruiting Dai
Yale School of Management
ruiting.dai@yale.edu

Panos N. Patatoukas
Berkeley Haas School of Business
panos@haas.berkeley.edu

Jacob K. Thomas
Yale School of Management
jake.thomas@yale.edu

Frank Zhang
Yale School of Management
frank.zhang@yale.edu

First Draft :June , 2020

ABSTRACT

We investigate two aspects of earnings smoothing via accruals that are consistent with the view that accounting rule changes have caused a decline in accounting quality. First, smoothing coefficients—slopes from annual cross-sectional regressions of accruals (ACC) on cash flow from operations (CFO)—have unexpectedly turned positive since 2000. Rather than smooth earnings, accruals now cause earnings to be more volatile than cash flows. We find that this surprising result is an anomaly, due to the disproportionate influence of a subset of unusual firms with negative CFO and low total assets. It is observed only for the popular specification—cross-sectional levels regressions based on asset deflation. Changing the deflator to number of shares, which remedies this distortion, offers a simple way to reexamine prior results based on asset deflation Second, smoothing coefficients have become less negative over time. We find this trend is due mainly to a decline in the levels of three working capital accounts: inventories, accounts receivable, and accounts payable. Trends in the relation between accruals and cash flows over the past three decades appear to be due to changes in operating characteristics, not accounting rules.

Keywords: Earnings quality; deflation by total assets; smoothing; persistence

Data Availability: Data are available from the public sources indicated in the text.

We thank Sudipta Basu for suggestions and Ed Kaplan for the relation derived in Appendix 3. We acknowledge financial support from the Yale School of Management and the Center for Financial Reporting and Management at Berkeley Haas.

1. Introduction

Accrual accounting converts cash inflows and outflows to revenues and expenses to generate earnings, a performance measure designed to be more informative than net cash flows. Prior research (e.g., Dechow 1994) has associated accruals with improving various desirable earnings attributes such as value relevance, persistence, predictability, and matching. We refer to these attributes as "accounting quality" (AQ), However, an emerging stream of research (e.g., Dichev and Tang, 2008) suggests that AQ is in decline. Reasons proposed for this decline include changes in accounting rules that result in more one-time items, more conditional conservatism, poorer matching between revenues and expenses, and increased emphasis on the balance sheet and mark-to-market accounting (e.g., Bushman et al. 2016). We focus on one AQ attribute: the extent to which accruals offset volatility in cash flows to smooth earnings volatility. The "smoothing coefficient" that describes the negative relation between contemporaneous accruals (ACC) and cash flow from operations (CFO) is the slope from regressions of ACC on CFO.[1]

We seek to understand two empirical findings related to smoothing coefficients. First, smoothing coefficients have turned *positive* since 2000, and have become increasingly positive thereafter. It is puzzling that ACC is now so positively related to CFO, given that accruals offset (same magnitude but opposite sign) all operating cash flows that have no contemporaneous earnings impact. Observing a zero or positive smoothing coefficient implies another puzzle: the variance of earnings (EARN) is much higher than the variance of CFO. We confirm empirically that the variance of EARN exceeds that of CFO, and this variance gap is increasing over time.

[1] We limit our analysis to this measure of AQ because the other measures are based on parameters, such as explained variance (R^2) and unexplained variance (of residuals), that are not comparable across samples.

Over the past two decades, why are accruals increasing the variance of EARN, relative to CFO variance, rather than decreasing it as they are expected to? As explained below, we find that the positive slope is an anomaly caused by the disproportionate influence of a subset of firms with negative CFO and low total assets. It is unrepresentative of the underlying relation, which is negative, and is only observed for the popular specification based on cross-sectional regressions using asset-deflated levels of ACC and CFO. The smoothing coefficient is clearly negative when we switch to other specifications based on per share data or firm-by-firm time-series regressions.

The second empirical finding we investigate is the steady upward trend in smoothing coefficients documented in Bushman et al. (2016), hereafter BLZ, which is observed even when we switch away from the popular specification. For example, the smoothing coefficient from cross-sectional regressions of ACC on CFO, based on per share data, trends upward from about –0.7 in 1990 to about –0.4 in 2018. Is this decline in the smoothing role of accruals due to changes in accounting rules and practices? Or is it due to "economic" changes, which include changes in the types of firms represented in the sample (e.g., manufacturing versus service) as well as changes in firms' operations (e.g., level of investments in working capital and PP&E)?

To motivate the first investigation, we replicate the main results of BLZ, based on annual cross-sectional regressions of ACC on CFO, both deflated by total assets. We focus on a subset of their sample period, since 1989, to obtain consistent estimates for CFO, based on statement of cash flow data. The smoothing coefficient increases from about –0.1 in 1990 to about 1 by 2018.[2] From the mid-1990s on the smoothing coefficient is consistently positive and becomes more so over

[2] We find that the smoothing coefficients close to zero reported in BLZ for this period are because they apply an additional filter (exclude firm-years with total assets < $10 million).

time.[3] When the negative relation between ACC and CFO turns positive, the variance of EARN, which equals the sum of the variances of ACC and CFO plus twice the covariance (which is now positive), is considerably higher than the variance of CFO. Empirically, the variance of EARN is as much as seven times the variance of CFO over this period.

We suspect that these puzzling results arise because accounting numbers are commonly deflated by total assets (AT). This is because the evidence in a second strand of the literature (e.g., Cheong and Thomas 2017) suggests that earnings volatility is considerably *lower* than CFO volatility. The deflator employed in this second strand is the number of shares (NS). That is, the analyses are estimated on per share data. We confirm that using per share data removes both puzzling aspects of the results observed for asset-deflated data. The smoothing coefficient is always substantially negative. and the variance of EARN is always much lower than that of CFO. The two variances exhibit parallel, shallow U-shaped curves over time, with the variance of EARN being about half that of CFO.

While different deflators might explain differences in the relative variances of EARN and CFO, it is hard to see why deflating by total assets flips the sign of the smoothing coefficient, given that both deflators—AT and NS—are always positive. We turn to a result in BLZ that suggests a potential clue. They find in their Table 5 that most firms are associated with negative smoothing coefficients when they switch from annual cross-sectional regressions to firm-specific time-series regressions. We confirm that finding for our sample. We also find that the across-firm distribution of smoothing coefficients from time-series regressions is insensitive to the deflator employed: similar distributions are observed for deflation by AT and NS.

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[3] BLZ find the smoothing coefficient is close to zero during this period. We find that the difference in results arises because they delete firms with total assets less than $10 million (see also Christensen et al. 2019)

Isolating the puzzle to cross-sectional regressions offers a potential explanation for the flipped sign: perhaps the cross-section represents a mix of different populations with different smoothing coefficients, and the aggregate results assign too much weight to the subset with positive smoothing coefficients. To investigate distinct populations, we report mean levels of ACC for ventiles of CFO and see a clear separation of the sample based on the sign of CFO. Whereas firm-years with positive values of CFO (CFO+) exhibit a negative ACC/CFO relation, firm-years with negative values of CFO (CFO−) exhibit a positive ACC/CFO relation.[4]

The evidence in Denis and Mckeown (2018) potentially explains why partitioning on the sign of CFO produces different populations. They find that the subgroup of firms with negative CFO exhibits very different operating characteristics and financial policies. These firms tend to be early stage firms making large investments in intangibles. They issue equity at regular intervals (primarily through private placements), hold the funds raised as cash balances, and run down those balances to cover negative CFO and investments each year. The median "runway" for these firms—post-issue cash balances scaled by monthly cash burn rates—is between 6 and 18 months.[5]

Separating firm-years based on the sign of CFO reveals different trends for smoothing coefficients from asset-deflated data. The CFO− group exhibits positive smoothing coefficients, that increase from just above zero in the 1990s to just over 1 in the 2010s. In contrast, the CFO+ group is associated with a smoothing coefficient of around −0.5 over the sample period. We note

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4 Ball and Shivakumar (2006) and BLZ also document different slopes for CFO+ and CFO. They do not emphasize, however, that the two slopes are of opposite sign.

5 Srivastava (2014) also develops the notion of two populations to explain declining AQ, with cohorts of newly listed firms being fundamentally different because their investments tend to be in intangible assets, such as those created by expenditures on R&D and customer brands. While both papers appeal to intangibles, partitioning firms with negative CFO is not equivalent to cumulating newly listed firms. Some newly listed firms are mature firms with positive CFO, either because they are mature at listing (e.g., previously public firms taken private) or because their investments are successful and caused CFO to turn positive. The typical run of negative CFO for firms in Denis and Mckeown's sample is four years.

that the smoothing coefficients observed for the CFO− group resemble those observed for the overall sample. Even though the CFO+ group represents about 70 percent of the overall sample, it has almost no weight in the combined smoothing coefficient.

We show algebraically (see Appendix 3) that the combined slope is a weighted average of the CFO− and CFO+ slopes, and the weights are a function not only of the proportion of firms in the two groups but also the variances of CFO for the two groups. The combined slope is also affected by the differences between the two groups in their means for ACC and CFO.

We find that the CFO− group dominates because it is associated with variances of CFO and magnitudes of means of asset-deflated ACC and CFO that are many times higher than those for the CFO+ group. Further examination reveals that these large variances and means are due to a subset of firms in the CFO− group with very low values of AT. It's likely that the low AT values arise because the large investments these firms make in R&D and brand-building are expensed, not capitalized. The resulting asset-deflated values for CFO and ACC are very large. In sum, the positive and increasing smoothing coefficients observed for the overall sample should not be interpreted as a dramatic reversal of the smoothing role of accruals over time. It is a distortion caused by a subset of firms in the CFO− group with very low values of AT. The distortion caused by firm years with low AT values for asset-deflated data does not occur for per share data.

We next investigate whether distortion in the smoothing coefficient observed for asset-deflated data in the simple regression of ACC on CFO is observed for the multiple regression proposed by the Dechow and Dichev (2002), or DD, model, which adds lagged and lead values of

CFO to the simple regression.[6] To maintain consistency with the specification considered so far, we follow BLZ and estimate these models in annual cross sections. The variables added in the DD model alter slightly the trend for the slope on contemporaneous CFO: it increases from about −0.4 in the early 1990s to zero in the early 2000's, but then plateaus at that level thereafter. While the slope does not turn positive for the last two decades, the inference from the zero slope is again that accruals no longer play a smoothing role as the variance of EARN is larger than that of CFO. That inference is overturned when we re-estimate the DD model with per share data. The coefficient on contemporaneous CFO remains consistently negative, rising slightly from about −0.5 in the early 1990s to about −0.4 by the end of the sample period.

Our final analysis of the first question (have smoothing coefficients turned positive) considers replacing levels of per share ACC and CFO with their corresponding unexpected components or news. We do so because the smoothing role of accruals is better described as responses to CFO shocks, rather than levels. Focusing on news is even more relevant for cross-sectional regressions where firm-specific factors unrelated to smoothing might determine levels of CFO and ACC. To obtain unexpected components of CFO and ACC, we estimate annual cross-sectional regressions of current levels on lagged levels of CFO and ACC, respectively. We incorporate potential nonlinearity by allowing for a different slope for positive and negative values of the lagged variable, because plots indicate a clear difference based on the sign of lagged CFO and ACC. Our results suggest that the smoothing coefficient based on ACC and CFO news is even more aligned with the smoothing role for accruals, relative to results for ACC/CFO levels. In

[6] We employ the extension of the DD model proposed by Francis et al. (2006) and include changes in revenue and the level of PP&E as additional explanatory variables (see Christensen et al. 2019).

particular, it improves from values near zero observed for ACC/CFO levels for the CFO− group to become consistently negative in all years.

To investigate the second question—why smoothing coefficients have become less negative over time—we employ an alternative approach, different from those considered in BLZ and Srivastava (2014). We first separate ACC news into four components: short term accruals (STACC), relating to changes in noncash current assets and current liabilities; one-time items (CCACC) relating to write-offs and other applications of conditional conservatism; depreciation and amortization (D&A); and all other items (OTH). We find that the reduction in smoothing coefficient magnitudes is due mainly to STACC. We split STACC further into five components—changes in accounts receivable, inventory, accounts payable, taxes payable, and other working capital accruals—and find that the most relevant components are changes in accounts receivable, inventory, and accounts payable (to a lesser extent). A key finding is that the decline in smoothing from these items appears to be due to a decline in the magnitudes of the levels of accounts receivable, inventory, and accounts payable. That is, observed trends for the smoothing coefficient are due to changes in the underlying economics of sample firms, not accounting rule changes.

The first takeaway is that patterns observed for smoothing coefficients should be interpreted with caution. Trends vary depending on the specification used: cross-sectional versus time-series, levels versus unexpected components, and asset-deflated versus per share data. A positive smoothing coefficient that increases over time is observed only for the specification: commonly used: cross-sectional regressions of ACC on CFO, both asset-deflated levels. That result, which suggests the counterintuitive inference that accruals increase earnings volatility, is due to a subset of unusual firms with negative CFO that also have very low values of total assets.

As suggested by our analysis of the DD model, similar unreliable inferences might arise for other measures of accounting quality that are based on the same popular specification.

We encourage researchers to consider per share, rather than asset-deflated, data even though the number of shares is in concept an arbitrary number. We see at least four reasons to do so. First, managers select the number of shares—via a combination of stock splits and reverse splits—with a target share price in mind. The cross-sectional distribution of share prices has remained remarkably stable over time, except for an increase in the last five years of our sample. This improves comparability both over time and across peers Second, managers signal their estimates of future prospects by manipulating a currently observed performance measure. The evidence in the literature that examines per share data suggests considerable managerial efforts to further smooth earnings per share by increasing the negative correlation between ACC and CFO.[7] Third, partly because of a managerial focus on per share numbers, investors are more likely to view one share rather than a dollar of total assets as the relevant investment base. All discussions, including those with analysts and other intermediaries, are in terms of per share earnings rather than asset-deflated earnings, which is in effect a return on assets (ROA) measure. Finally, asset deflation creates a mismatch: the numerator reflects earnings to equity alone whereas the denominator reflects financing provided not just by equityholders but also debtholders and various other stakeholders (such as suppliers, employees, and tax authorities). In addition to impairing cross-sectional comparisons, this mismatch affects time-series comparisons because of changes in both capital structure and accounting rules on recording liabilities (e.g. booking operating leases).

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[7] Managerial efforts to smooth earnings volatility have been viewed in prior work as opportunistic (for example, designed to reduce perceived risk). But they have also been viewed as efforts to signal long-term prospects. Here we take the latter perspective.

Our second takeaway is that the smoothing role of accruals appears to be alive and well. We find consistently negative smoothing coefficients for all specifications other than the one commonly used, which we show is biased. The general decline observed in the magnitude of the smoothing coefficient is unlikely to be due to changes in accounting rules that affect accruals. The two items that explain much of the reduction in the smoothing coefficient—accounts receivable and inventory—are not associated with major rule changes. More likely, the reduction in smoothing coefficients is due to declining levels of those two current assets, which leads to lower across-firm variation in changes in those levels, relative to corresponding variation in CFO.

The remainder of the paper is organized as follows. Section 2 reviews the prior literature, Section 3 describes the sample selection process, Section 4 provides results, and Section 5 concludes.

2. Background

Accruals separate accounting from the mere counting of cash and occupy a central position in corporate financial reporting. As defined in Statement of Financial Accounting Concepts No. 6,

> *"…by accounting for noncash assets, liabilities, revenues, expenses, gains, losses, accrual accounting links an entity's operations and other transactions, events, and circumstances that affect it with its cash receipts and outlays."*

2.1 Accounting earnings decomposition

With this definition in mind, we next decompose accounting earnings into cash earnings and operating accruals. Accounting earnings can be described as

$$Accounting\ Earnings = \Delta(Stockholders'Equity) + Net\ Payout,$$

where the net payout to stockholders is equal to dividends plus stock repurchases minus stock issues. From the balance sheet identity, it follows that

$$Accounting\ Earnings = \Delta(Assets) - \Delta(Liabilities) + Net\ Payout.$$

Next, we follow prior research on financial statement analysis (e.g., Nissim and Penman, 2003) and separate operating from financial assets and liabilities. We classify cash as a financial asset and all noncash assets as operating assets. We classify debt as a financial liability and all non-debt liabilities as operating liabilities. We refer to the difference between operating assets and operating liabilities as net operating assets. Expanding and rearranging, we obtain the following expression for accounting earnings

$$Accounting\ Earnings = \Delta(Net\ Operating\ Assets) + \Delta(Cash) + Net\ Payout - \Delta(Debt).$$

Next, we define cash earnings as the change in cash plus the net payout to stockholders minus the change in debt, or

$$Cash\ Earnings = \Delta(Cash) + Net\ Payout - \Delta(Debt).$$

The right-hand-side of the expression above says that positive cash earnings can be retained within the firm as additional cash balance or be distributed to stockholders and debtholders. For negative cash earnings, the expression says that the deficiency must be covered by reducing the cash balance or by obtaining financing from stockholders and debtholders.

From the articulation of the balance sheet and the statement of cash flows, the change in cash is equal to cash flow from operating activities (CFO) plus cash flow from investing activities (CFI) plus cash flow from financing activities (CFF), or

$$\Delta(Cash) = CFO + CFI + CFF.$$

Cash flow from operating activities reflects cash inflows and outflows for operations, while it excludes cash flows related to investing activities and financing activities. Cash flow from investing activities reflects net capital expenditure, i.e., cash outflows for capital expenditure and acquisitions and cash inflows from sale of PP&E. Cash flow from financing activities reflects the net payout to stockholders plus the change in debt. Based on these definitions, we rewrite cash earnings as follows

$$\begin{aligned} Cash\ Earnings &= \Delta(Cash) + Net\ Payout - \Delta(Debt) \\ &= CFO + CFI + CFF + Net\ Payout - \Delta(Debt) = CFO + CFI. \end{aligned}$$

The definition of cash earnings as the sum of operating cash flow plus investing cash flow is roughly enterprise free cash flow—a construct discussed in corporate finance valuations: the present value of projected enterprise cash flows equals enterprise value.[8]

Next, we define operating accruals as accounting earnings minus cash earnings or equivalently as accounting earnings minus free cash flow.

$$Operating\ Accruals = Accounting\ Earnings - CFO - CFI.$$

This definition of operating accruals hews closely to the conceptual definition of accruals in Statement of Financial Accounting Concepts No. 6. It is also consistent with textbook definitions of operating accruals as the change in net operating assets under clean surplus accounting (see, e.g., Penman 2009). We note that our derivation of operating accruals excludes accruals that do not articulate across the balance sheet and the statement of cash flows. Such non-articulating accruals play no role in smoothing.

8 To be precise, enterprise free cash flow equals the sum of CFO, CFI, and after-tax interest.

2.2 On the measurement of accruals as accounting earnings minus operating cash flow

Starting with Hribar and Collins (2002), several papers on the properties of corporate financial reporting measure accruals (ACC) as accounting earnings minus operating cash flows using statement of cash flow data. (Statement of cash flow data is available post-1988, i.e., after the promulgation of Statement of Financial Accounting Standards No. 95.) Starting with Hribar and Collins (2002), variants of this measure have been extensively used in subsequent research.

Using the accounting identities from the previous section, it follows that ACC is equivalent to the sum of operating accruals plus investing cash flow

$$\begin{aligned} ACC &= Accounting\ Earnings - CFO = Operating\ Accruals + Cash\ Earnings - CFO \\ &= Operating\ Accruals + CFI. \end{aligned}$$

Even though ACC is a widely-used measure of accruals, it is not consistent in its treatment of long-term operating accruals. As Larson et al. (2018) point out, ACC includes the reversal (e.g., depreciation and write-downs of PP&E) but not the origination (e.g., the initial capitalization of PP&E) of long-term operating accruals related to investing activities. Indeed, it can be verified that the ACC measure of accruals does not fully reverse over the life of the firm and that $\sum_{t=1}^{\infty} ACC_t = \sum_{t=1}^{\infty} CFI_t$. In contrast, the definition of operating accruals as the difference between earnings and free cash flow offers a consistent treatment of long-term operating accruals and satisfies the accrual reversal property; that is, $\sum_{t=1}^{\infty} OPACC_t = 0$.

2.3 On the smoothing role of accruals

Prior research in corporate financial reporting postulates that a key role of accruals—typically defined as earnings minus operating cash flows or equivalently as short-term operating accruals minus depreciation—is to smooth fluctuations in operating cash flows.

To illustrate the smoothing role of accruals, suppose a customer expected to pay in the current period defers payment to the next period. While current earnings remains unaffected by this negative cash flow shock, the firm would record a higher level of accruals (i.e., accounts receivables) in the current period. On the other hand, if there was a positive shock to cash flows because the firm unexpectedly deferred payment of wages to the next period, the firm would record negative accruals in the form of accrued wages. More generally, partition CFO and ACC into two components each: CFO1 and CFO2, and ACC1 and ACC2, respectively. CFO1 (CFO2) is the CFO component that flows into (does not affect) contemporaneous EARN. ACC1 is the ACC component that flows into EARN, and ACC2 is the ACC component that offsets CFO2. The smoothing role of accrual accounting, which predicts a negative smoothing coefficient, arises because ACC2 offsets CFO2 (equal magnitude but opposite sign), the operating cash flow shocks that do not affect earnings.

Prior research on the degree of smoothing in accrual accounting typically estimates a regression of the level of ACC on the level of CFO and predicts a negative slope coefficient;

$$ACC = \alpha + \beta CFO + \varepsilon_t,$$

$$\beta = \frac{Cov(ACC, CFO)}{Var(CFO)} < 0.$$

While the smoothing role of accruals implies that the covariance of accruals with operating cash flows is negative; that is, $Cov(ACC, CFO) < 0$, smoothing does not necessarily imply that the variance of earnings is lower than the variance of operating cash flows. The necessary condition for earnings volatility to be lower is that the covariance term be *sufficiently* negative, greater in magnitude than half the variance of accruals. To see this, consider the following variance decomposition of accounting earnings

$$Var(EARN) = Var(ACC) + Var(CFO) + 2Cov(ACC, CFO).$$

For $Var(EARN) < Var(CFO)$, we require $Var(ACC) < -2Cov(ACC, CFO)$, which implies, $Cov(ACC, CFO) < -0.5 * Var(ACC)$.

BLZ initiated a new line of research investigating the changing landscape of the smoothing role of accruals and documented a steady decline in the smoothing coefficient to levels close to zero. Given that the variance of accruals is nonnegative, a covariance close to zero (reflected in smoothing coefficients close to zero) implies that EARN volatility exceeds CFO volatility. Nallareddy et al. (2020) in untabulated results confirm that the smoothing role of accruals is also declining overseas. Their study shows that the decline in smoothing is accompanied by increased cash flow persistence both in the U.S. and in the international sample. Other studies examining temporal changes in the properties of accounting data include Givoly and Hayn's (2000) study of the changing degree of accounting conservatism; Dichev and Tang's (2008) study of the changing degree of matching between revenues and expenses,; Srivastava's (2014) analysis of the effect of newly listed firms on the time-series changes in earnings quality attributes; and Christensen's et al. (2019) study of time-series variation in accruals quality.

The most common specification used in prior research that predicts accruals, cash flows, and earnings is to estimate cross-sectional regressions based on levels of annual data, deflated by average total assets. As described in Appendix 2, there has been a change over time in the specifications used. In earlier research, some studies estimated firm-by-firm time-series regressions, focused on the unexpected components rather than levels, relied on quarterly data, and deflated by number of shares. As discussed in the Introduction, theory and conceptual reasons guide these choices. Regardless, there is evidence that the results are sensitive to the choices made.

For example, Nallareddy et al. (2020) find that the relative ability of CFO and EARN to predict next year's CFO flips when they switch from annual to quarterly data.

3. Sample and descriptive results

Table 1 provides details of the sample selection process. Our main sample includes 137,434 firm-years between 1990 and 2018. Our sample period begins in 1990 to allow consistent measures of CFO and ACC based on cash flow statements (see Appendix 1 for details of variables). Firms started reporting cash flow statements from 1988, and we move forward two years to allow collection of lagged values of asset-deflated variables, which requires one additional lag to compute average total assets. We exclude non-US firms and firms in the financial sector (SIC 6000-6999) and require non-missing values for average total assets, number of common shares used to compute basic EPS, CFO, and EARN. We trim firm-years that lie in the extreme 1 percent of the annual distributions for asset-deflated EARN, CFO, and ACC. We trim, rather than Winsorize, to maintain strict equality between EARN and the sum of CFO and ACC.

As described in the remaining panels of Table 1, we consider four other samples derived from our main sample. First, to replicate BLZ, we exclude approximately 27,000 firm-years with average total assets (AT) less than $10 million. Second to estimate firm-specific time-series regressions, we exclude approximately 19,000 firm-years from our main sample because they relate to firms with fewer than six years of non-missing data. Third, to estimate the contribution of different components of ACC, we lose about 4,000 firm-years because we require non-missing cash flow statement data for depreciation and amortization, and changes in accounts receivable and inventory. We also lose about 3,000 firm-years because we require at least 10 observations per 2-digit SIC code. Finally, to replicate the Francis et al. (2005) adaptation of the Dechow and

Dichev (2002) model, we require non-missing data for the relevant variables and also at least 20 observations per 2-digit SIC code.

Table 2, Panel A provides distributional statistics for key variables for the main sample. The first three rows describe asset-deflated EARN, CFO, and ACC, and the next three rows describe the corresponding per share amounts. The distributions in the first two rows are left-skewed and associated with extreme negative values: the means are negative even though medians are positive. This skewness is possibly due to firms with low levels of total assets being more likely to report negative EARN and CFO, The corresponding rows for per share data are associated with positive means and medians for both EARN and CFO. Accruals are expected to be negative (because of depreciation and amortization), and both means and medians for asset-deflated and per share ACC are negative.

Panel B in Table 2 reports Pearson and Spearman correlations for pairwise combinations of these six variables. In general, EARN is expected to be strongly positively related to CFO, less strongly positively related to ACC, and CFO is expected to be negatively related to ACC. Focusing on Pearson correlations, the expected positive relation between EARN and CFO is observed in the for both asset-deflated and per share data, but the weaker positive relation between EARN and ACC is observed only for per share data. It is strongly positive for asset-deflated data. And the expected negative relation between CFO and ACC is also only observed for per share data. It is strongly positive for asset-deflated data, which runs counter to the smoothing role for accruals. Also, the Pearson correlations between the two deflated versions of the same variable (e.g., EARN/AT and EAN/SHR) are only weakly positive. As suggested by the results in Panel A, the extreme negative values created by asset-deflation appear to create unexpected Pearson correlations.

Additional confirmation that asset deflation causes extreme values is obtained when we switch to Spearman correlations, which are less affected by extreme values. The unexpected positive relation between asset-deflated CFO and ACC is now negative. The unexpectedly strong positive relation between asset-deflated EARN and ACC is now less positive, and the correlations between the two deflated versions of the same variable are now considerably more positive.

4. Results

Figure 1, Panel A replicates the BLZ analysis on our main sample as well as the subset obtained by filtering firms with AT less than \$10 million. The trends for slopes and adjusted R^2 values for the filtered sample resemble those reported in BLZ for years that are common to both samples. The smoothing coefficient increases (adjusted R^2 decreases) from about -0.4 (0.15) in 1990 to zero by the late 1990s and hovers around zero thereafter. Removing BLZ's filter alters the results substantially. The smoothing coefficient increases steadily from about −0.1 in 1990 to about 1 by the 2010s. And the adjusted R^2 also increases steadily from about 0 in 1990 to about 0.3 in the 2010s. Observing a positive smoothing coefficient that increases to 1 is a counterintuitive finding. Rather than offset CFO variation, accruals reinforce that variation to generate earnings that are even more volatile than CFO, and that excess volatility has increased over time.

Untabulated results confirm that the positive smoothing coefficient observed for the unfiltered sample is a robust result. To be sure, imposing the BLZ filter (total assets < \$10 millions) drops the slope to values close to zero. But that filter excludes almost 27,000 firm years, representing nearly 20 percent of the available observations at that point. We considered three other less severe filters based on the annual distributions of asset-deflated EARN, CFO, and ACC: a) trim at the 5/95 percentiles; b) trim at the 1/99 percentiles and drop observations with total assets less than the 5th percentile of the total assets distribution; c) trim at the 1/99 percentiles and drop observations with total assets less than $1 million. The smoothing coefficients for all three cases are clearly positive, lying between 0.2 and 0.4, and increasing through time.

Panel B of Figure 1 confirms the implication of a positive smoothing coefficient: earnings volatility is greater than cash flow volatility. Given that EARN is the sum of CFO and ACC, the variance of EARN equals the sum of the variances of CFO and EARN plus two times the covariance. Panel B plots the time-series of the cross-sectional variances and covariance terms for our full sample (without the total asset filter applied in BLZ). Beginning in the late 1990's, the variance of EARN is much higher than that of CFO and that gap increases substantially over time. Consistent with the positive smoothing coefficient noted over this period in Panel A, the covariance term is also substantially positive and increasing over time.

The considerably higher variance of EARN, relative to CFO, and the large increase in the variance of EARN over time suggests that AQ has declined to low levels. Not only has the role of accruals switched from smoothing earnings to making it more volatile, other desirable attributes such as value relevance, predictability, and persistence of earnings are likely impaired.

4.1 Role of deflation by total assets.

Although the prior literature has offered different explanations for declining AQ, we focus on a new explanation. We believe it is due to the popular approach that deflates accounting data by total assets. We do so because the evidence in a different strand of research suggests that the volatility of per share EARN may be lower than that of per share CFO.[9] Cheong and Thomas (2018), for example, show that seasonally-differenced quarterly earnings per share (EPS) are less

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[9] We thank Sudipta Basu for pointing out this seeming contradiction between the two strands of research.

volatile than seasonally-differenced per share CFO. That study also documents managerial efforts to smooth earnings further by increasing the negative correlation between seasonally-differenced CFO and ACC. Also, the descriptive results in Table 2, Panel B suggest that asset-deflation creates extreme negative values that cause a positive Pearson correlation between CFO and ACC. The Spearman correlation for asset-deflated data as well as both Spearman and Pearson correlations for per share data are negative.

To investigate potential distortion due to asset deflation we repeat the Figure 1 analyses based on per share data. The results reported in Figure 2 confirm our conjecture. The smoothing coefficient in Panel A is now substantially negative, varying between −0.7 in the early 1990s and −0.4 by 2018. The adjusted R^2 is also substantially positive, varying between 0.6 in the early 1990s and 0.4 by 2018. The results in Panel B of Figure 2 also resolve the second puzzling implication of asset-deflated data: the variance of EARN is now much lower than the variance of CFO.

We repeat the regressions for asset-deflated data but estimate firm-specific time-series regressions over our sample period: 1990 to 2018. As described in Table 1, requiring 6 years of non-missing data shrinks sample size slightly. We confirm that untabulated results based on annual cross-sectional regressions on this sample resemble those reported for the full sample in Figure 1. The results in Panel A of Table 3 suggest that the firm-specific smoothing coefficients are negative for a substantial majority of the sample, and the means and medians are similar to those reported for the cross-sectional regressions estimated on per share data, reported in Figure 2. Panel B of Table 2 confirms that switching the deflator and using per share data has little impact on the firm-by-firm smoothing coefficients. This similarity contrasts sharply with the large differences observed for cross-sectional regressions based on asset-deflated versus per share data.

While we are reassured that accruals smooth earnings volatility for all specifications other than cross-sectional regressions based on asset-deflated data, we find the switch in sign of the smoothing coefficient between Figures 1 and 2 puzzling. Given that both deflators—total assets and number of shares—are positive, how can changing the deflator change the sign of the slope?

4.2 Partition sample by sign of CFO.

We turn to the possibility that the cross-sectional relation between ACC and CFO is nonlinear and is associated with both positive and negative signs for different partitions. Specifically, we consider the results in Ball and Shivakumar (2006), which show different slopes for positive and negative CFO. The emphasis in that study is on conditional conservatism and the difference between the slopes for good and bad news (represented by positive and negative CFO), rather than whether the signs of the two slopes are different. Regardless, the results in their Table 3, Panel A for the CF model reveal that the slope for positive CFO is quite negative and the slope for negative CFO is positive, albeit of smaller magnitude.

We examine nonlinearity in our sample by forming ventiles based on asset-deflated CFO, and report the mean levels of asset-deflated ACC for each ventile in Panel A of Figure 3. The inverted V-shape that emerges confirms that the slope for positive (negative) CFO is negative (positive). While the two slopes in our sample appear to be of similar magnitude, the distributions of asset-deflated ACC and CFO are skewed. Even though about 70 percent of the sample is in the positive CFO group, the mass is dispersed more for the negative CFO group. The corresponding results reported in Panel B for per share data also show nonlinearity, but the slopes and distribution are different than those in Panel A. The slope is near zero for negative CFO in Panel B, and that mass is relatively tightly distributed, but the positive CFO group exhibits a negative slope and is more dispersed.

The main finding from the results in Figure 3 is that separating the sample into CFO+ and CFO– provides a possible explanation for why changing the deflator changes the sign of the smoothing coefficients in Figures 1 and 2. The combined slope is a weighted average of the separate slopes for the CFO– and CFO+ groups, but the weights given to those two slopes differs across the two deflators: the slope for the CFO– group is weighted more (less) for asset-deflated (per share) data. Intuitively, the regression slopes reported in Figures 1 and 2 for the overall sample impose a linear fit on the inverted V-shaped relations in Panels A and B of Figure 3, respectively. Because the left (right) leg of the inverted V is considerably longer for asset-deflated (per share) data , the combined slope is positive (negative).

Appendix 3 derives the formal relation between the combined slope and the slopes for the two partitions. The weights assigned to the slopes for the CFO– and CFO+ partitions are a function not only of the fractions of the overall sample in the two partitions, but also the respective variances for CFO. In addition, the product of the differences between the CFO means and ACC means for the two partitions is added to the slope. (See the formula for the numerator in equation (1) of Appendix 3.) Because the CFO variance is considerably larger for the CFO– (CFO+) group for asset-deflated (per share) data in Figure 3, Panel A (Panel B), that group's slope is weighted more. Also, because the product of the difference between mean CFO and mean ACC for the two groups is positive for asset-deflated data in Panel A, the combined slope becomes even more positive. In Panel B, that product is negative and the combined slope becomes even more negative.

To understand better the reason why the distributions for ACC and CFO vary so much depending on the deflator used, we consider the role of deflators in our context. Ideally, the deflator captures scale accurately and deflated values of CFO and ACC are unrelated to scale. For each firm- year the observed value of CFO is lower or higher than expected, and our interest is in how

ACC responds to these shocks in CFO. It is this variation that is captured in regressions based on properly deflated data. To the extent that deflators do not represent scale accurately, however, deflated values will be related to scale. If so, a spurious positive relation is induced between magnitudes of deflated ACC and CFO, which generates a positive (negative) relation between ACC and CFO when they are of the same (opposite) sign.[10]

To investigate this possibility, we form deciles based on asset deflated and per share CFO separately for the CFO- and CFO+ groups. Table 4, Panel A (B) reports the mean values of asset-deflated (per share) CFO and ACC as well as the level of total assets (number of shares) for the two sets of deciles. The means for asset-deflated CFO and ACC describe the same patterns reported in Figure 3 for the CFO+ and CFO– groups. Decile 1 (10) refers to the most negative (most positive) decile for the CFO– (CFO+) group. Turning to the deflators, the mean level of total assets (AT) for the CFO+ group exhibits an inverted U shape: approximately $1.5 billion at the two ends and approximately $4 billion in the middle. This level of variation seems small compared to the variation in mean AT exhibited by the CFO– group: it increases more than a hundred-fold, from $6 million for decile 1 to about $700 million for decile 10. In effect, the lower AT values for low deciles inflate both CFO/AT and ACC/AT and make them both more negative. As discussed above, this strong correlation between deflated CFO/AT and AT induces a spurious positive relation between CFO/AT and ACC/AT for the CFO– group. It also increases the variance of CFO/AT for this group as well as the magnitudes of the means for CFO/AT and ACC/AT, both of which cause the positive smoothing coefficient for the CFO – group to carry a disproportionately larger weight in determining the overall smoothing coefficient.

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[10] See Lev and Sunder (1979) for an in depth discussion of deflation, and the potential for biases.

The results in Panel B for per share data suggest a positive relation between per share CFO and the deflator, number of shares. The number of shares increases from 42 million to 147 million shares for CFO+. That is, the more extreme deciles of CFO+ are associated with more shares, which *understates* mean values of per share CFO and ACC. As a result, the variances for CFO and means for both CFO and ACC are understated. For CFO– the number of shares stays relatively constant for most deciles, although it increases sharply for decile 10. Importantly, the more extreme deciles of CFO– are not associated with fewer shares. As a result, the smoothing coefficient for this group is not overstated, as it is for asset-deflated data. Also, the smoothing coefficient for the CFO− group does not carry a disproportionately larger weight in determining the overall smoothing coefficient because the variances of CFO and the means for CFO and ACC are not overstated.

Overall, the positive sign of the smoothing coefficient observed in Panel A of Figure 1 for asset-deflated date, is an anomaly created by firms with understated total assets in the extreme negative CFO– deciles. Deflation by total assets overstates CFO/AT and ACC/AT for those deciles, which overstates the variance of CFO and means of CFO and ACC. Together these two effects cause the positive smoothing coefficient for this group to be overstated and also carry a disproportionate weight in the overall smoothing coefficient .

To further describe the distortion created by asset deflation in Figure 3, we report the time-series of annual smoothing coefficients separately for the CFO+ and CFO– groups in Panel A of Figure 4. The results suggest that the pattern observed for the overall coefficient in Figure 1, Panel A reflects mainly the positive and increasing smoothing coefficient for the CFO– group. The CFO+ group, which is not reflected in the overall coefficient even though it represents about 70 percent of the sample, is associated with a strong negative smoothing coefficient, about -0.5, that remains relatively constant over time. The year by year results in Panel B for per share data are consistent with the average patterns reported in Panel B of Figure 3. While the smoothing coefficient for CFO– hovers around zero, the smoothing coefficient for CFO+ is strongly negative, varying between −0.75 and −0.4.

4.3. Replicate analysis on Dechow/Dichev (2002) model.

To explore the potential for the bias due to asset deflation to carry over to other measures of accounting quality, we repeat the analysis on the model from Dechow and Dichev (2002). Whereas the regression specification considered so far is a simple regression of ACC on contemporaneous CFO, the DD model includes lead and lagged CFO. We continue to focus on the slope on contemporaneous CFO and check to see whether the findings from the simple regression carry over to the DD model. That is, does the slope on CFO switch from positive to negative when we replace asset-deflated numbers with per share numbers? To make the DD model more comprehensive, we use the covariates proposed by Francis et al. (2005), which include the level of PP&E and changes in revenues as additional control variables that explain ACC. We follow BLZ and estimate the model annually across the entire sample, rather than within industries.

The results reported in Panels A and B of Figure 5 describe trends for the coefficient on contemporaneous CFO and the adjusted R^2 for regressions based on asset-deflated and per share data, respectively. The results reported for asset-deflated numbers in Panel A of Figure 5 differ slightly from those reported in Figure 1, Panel A. The slope on CFO in Figure 5 is close to zero, rather than the positive values observed in Figure 1. However, the inference is the same. There is no smoothing role for accruals, and the variance of EARN is higher than that for CFO. Switching to per share numbers in Panel B of Figure 5 yields the same effect observed when we switch the deflator from Figure 1 to Figure 2. The slope on CFO is clearly negative when the DD model is estimated on per share data, which leads to the opposite inference: accruals continue to play a smoothing role as they cause EARN to be smoother than CFO. Finding that asset-deflated data also substantially bias the smoothing coefficient in a different setting suggests that other AQ measures based on asset-deflated data might be affected by the group of firms with negative CFO and low AT.

4.4. Deflation by total assets versus number of shares.

Given the distortion associated with asset-deflated data, we take the opportunity to consider the pros and cons of using asset-deflated data versus per share data. Because accruals appear on the balance sheet as assets and liabilities, total assets is a natural choice for deflation. And the number of shares appears to be a poor choice because it is an arbitrary number, one that can be easily changed by stock splits or reverse splits. However, as described below we see reasons why the use of per share data might be preferred.

First, while the number of shares is arbitrary, it is a choice that managers make. Given the emphasis that managers and other stakeholders place on per share data, there could be an implied understanding that per share numbers can be compared across peers and over time, without additional deflation. That is, managers use stock splits/dividends and reverse splits to bring share prices within a target range. Figure 6 plots some key parameters of the distribution of share prices between the fourth quarter of 1971 and the fourth quarter of 2018. Except for the last 5 years of the sample period, the distribution is remarkably stationary. The first quartile is generally below $10, the median lies between $10 and $20, and the third quartile lies between $30 and $40. Setting aside the recent increase in share prices, these results suggest that the number of shares is chosen to ease comparisons over time and across peers.

Second, there is evidence that managers smooth earnings, especially "core" earnings that exclude non-recurring items. Smoothing increases earnings predictability, which improves the ability of current earnings to signal managers' estimates of future earnings. Cheong and Thomas (2018) provide considerable evidence of managers using accruals to smooth quarterly per share earnings. The negative correlation between unexpected per share CFO and ACC, proxied by seasonal differences, is very high, around –0.75. Also, the extent of smoothing increases with share price—indicated by that negative correlation increasing from –0.69 for the smallest price decile to –0.85 for the largest price decile. This differential smoothing is designed to make the volatility of per share earnings be similar in the cross-section.

Third, many relevant stakeholders, including investors and analysts, view per share numbers as the relevant investment base to analyze and communicate. This emphasis is likely related to managerial emphasis on per share numbers. We do not see references to a dollar of total assets as the relevant investment base, which in effect converts deflated earnings and its components to a return on assets measure.

Finally, asset deflation creates a mismatch that reduces cross-sectional and time-series comparability. The numerator reflects flows to equityholders, whereas the denominator includes financing provided by all stakeholders, including debtholders and suppliers. Cross-sectional variation in capital structure and liabilities owed to different stakeholders reduces comparability of asset-deflated numbers across firms. And time-series variation in the use of those liabilities as well as variation in the accounting for liabilities (tendency to book more off-balance sheet items, such as operating liabilities and deferred compensation) impairs comparisons over time.

Given the biases noted here with asset-deflated data, we limit the remaining discussion to per share items.

4.5 Levels versus news.

The discussion above suggests that the negative relation between ACC and CFO expected by the smoothing role of accruals should be more evident in the unexpected components of ACC and CFO, rather than the levels that have been considered so far. As in prior work, we predict current period ACC and CFO using their respective lagged values. Noting different ACC/CFO relationships for CFO+ and CFO- groups suggests that we allow for nonlinearity based on the sign of the lagged variable. The results in Panels A and B of Figure 7 confirm that the relation with lagged values for both CFO and ACC are nonlinear. The slope for CFO is positive, but less positive for the smaller subset with negative values of lagged CFO. The slope for ACC is also positive for negative values of lagged ACC, but turns clearly negative for the smaller subset with positive values of lagged ACC.

We estimate unexpected components (or news) of CFO and ACC for each firm-year based on a nonlinear prediction model using lagged values, which is estimated separately each year by 2-digit SIC industry code. The results for smoothing coefficients based on ACC and CFO news are reported in Figure 8, with Panel A (B) describing the CFO+ (CFO-) group. For reference, we also report the smoothing coefficients based on ACC/CFO levels reported in Figure 4, Panel B.

We find that the smoothing coefficients become more negative for both positive and negative CFO groups. The difference between the smoothing coefficient for the news and levels specifications is about 0.1, for the CFO+ group. That difference is much larger, about 0.4, for the CFO – group. More important, the smoothing coefficient for the CFO– group is always negative. Switching from levels to news suggests a stronger smoothing role for accruals, with no evidence of a positive smoothing coefficient for either partition in any year.

4.6 Upward trend in smoothing coefficients.

While the smoothing coefficients are always negative for both partitions in Figure 8, there is a clear drift upwards, suggesting that they become less negative over time. If so, there is the potential that while the smoothing role of accruals has remained over time, it has declined in importance. BLZ examine the following six explanations for the (more dramatic) decline they report for their sample. First, they examine "economic-based cash flow shocks" which correspond to increases in the variance of CFO due to increased variance in CFO1, the portion that flows through to earnings. Second, they consider "timing-related cash flow shocks" which correspond to increases in the variance of CFO2, the portion that does not flow through to current earnings and is offset by ACC2. Third, they consider "Non-timing related accruals", which corresponds to ACC1 (depreciation, write-offs, etc.) that flow through directly to EARN. More ACC1 should reduce the ACC/CFO negative correlation, which depends on ACC2 & CFO2. Fourth, they investigate "poor matching between revenues and expenses" based on Dichev/Tang regressions, Fifth, they consider intangible intensity from Srivastava. Finally, they examine asymmetric recognition of gains vs. losses or conditional conservatism (Ball and Shivakumar). They conclude that the explanations based on non-timing related accruals and poor matching are associated with significant coefficients when explaining the time trend in the DD measure of AQ. However, they note that multicollinearity is high, which inflates standard errors, making it harder to find significance for any specific explanation.

We take a different approach. We follow Dutta et al. (2017) and decompose ACCR into four components: short term accruals (STACC), one-time items that reflect conditional conservatism (CCACC), depreciation and amortization (D&A), and all other accruals (OTHER). Figure 9 describes our findings from this approach. We first confirm that the upward drift observed in the two partitions in Figure 8 for the ACCnews/CFOnews specification for the main sample is also clearly evident in the subset of the combined sample with non-missing accrual component data analyzed in Figure 9. The results in Panel A indicate a clear upward drift that resembles the trend observed for the full sample.

Next we decompose the smoothing coefficient, which equals the ratio of the standard deviations of ACC and CFO news multiplied by their correlation. Panel B of Figure 9 describes how the three vary over time. While the standard deviation of ACC news is more volatile, the standard deviations for both CFO and ACC news exhibit a shallow U-shape. The correlation coefficient increases from −0.6 to −0.3 over the sample period. Given that the correlation is itself a function of the two standard deviations, we focus our attention on the dispersion in ACC and CFO news.

We then turn to the decomposition of ACC news. The results in Panel C indicate that the upward drift in Panel A of Figure 9 is reflected mainly in the smoothing coefficient associated with news for one accrual component: STACC. Regressing smoothing coefficients on time for news in STACC, CCACC, D&A, and Other generates trend coefficients of 0.0054, 0.0008, 0.0014, and 0.0000, respectively. That is, the relation between CFO news and news in working capital changes (ΔWC)—changes in current assets (non-cash) and current liabilities—has become less negative over time, whereas the other relations have remained relatively unchanged, including the positive correlation between CFO news and news in CCACC (one-time items). STACC captures mostlyACC2, the offset to CFO2, which is the portion of CFO that does not flow through to current earnings. As a result, the decline in the smoothing coefficient is likely not due to the changes in accounting rules, such as increased conditional conservatism or the increasing emphasis on or the balance sheet over the income statement (See extensive discussion in BLZ.)

We continue the decomposition process further and report the smoothing coefficients for news in changes in the following five components of working capital: accounts receivable, inventory, accounts payable, taxes payable, and all other working capital items.[11] We find that that three components—accounts receivable, inventory, and accounts payable—exhibit the rising trend observed in Panel A; the remaining two exhibit flat trends. The slopes from regressions of smoothing coefficients (shown in Panel D) on time for news in accounts receivable (AR), inventory (INV), and accounts payable (AP) are 0.0026, 0.0030, and 0.0008, respectively. Inventory and accounts receivable appear to be more important than accounts payable.

As described above, smoothing coefficients are a function of the standard deviations of news in changes in the three working capital accounts as well as the standard deviation of CFO news. Panel E of Figure 9 provides the time-series of those four cross-sectional standard deviations As described earlier CFO news exhibits a shallow U-shape: it declines in the early 1990s, and then stays relatively constant until the early 2010s, before it starts to increase. The standard deviations for the three working capital accounts exhibit a downward trend that continues through to the early 2000's, before they level off. Because the working capital accounts do not rise toward the end of the sample, the increase exhibited by CFO explains why all three smoothing coefficients become less negative during the last decade. As noted for the smoothing coefficients in Panel D, the decline in standard deviations is more evident for accounts receivable and inventory.

At a general level, two possibilities exist for the relative decline in the standard deviation of news relating to the three working capital accounts: there has been a decline over time in

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[11] Changes in current assets show up as positive, and changes in current liabs are negative. A negative smoothing coefficient for accounts receivable (for example) means that unexpected increases in CFO are associated with unexpected decreases in accounts receivable. And unexpected increases in CFO are associated with unexpected increases in accounts payable. The smoothing coefficient will become less negative if levels of accounts receivable and accounts payable decline..

a) average levels of those three accounts, and b) cross-sectional heterogeneity in those levels. For example, the variance of news related to inventory changes should decline if inventory levels decline over time or if inventory levels become more homogenous in the cross-section. To investigate the first possibility, we report median levels for the three working capital accounts in Panel F of Figure 9. The results suggest that much of the decline in variance exhibited in Panel E is explained by a decline in the levels of the two accounts.[12]

Overall, our results suggest that the decline in the smoothing coefficient observed for our sample is likely due to operational factors that determine the levels of accounts receivable, inventory, and accounts payable that firms in each cross-section choose to hold. Any role played by changes in accounting rules, if it exists, is likely to be much smaller. This conclusion is consistent with those in BLZ and Srivastava. Our contribution is that we use a different approach that allows us to pinpoint the specific accruals components that are more relevant., and isolate the declining balance sheet levels for those three working capital accounts.

5. Conclusions

The seeming decline in accounting quality has attracted research interest over the past three decades. Although multiple measures of accounting quality have been proposed and investigated, similar declining trends are observed for all measures. One measure, the slope from cross-sectional regressions of accruals on cash flows from operations, exhibits an unexpected sign flip. This slope, which we refer to as the smoothing coefficient, is expected to be negative because cash flows that do not affect contemporaneous income are associated with equal and opposite accruals. And yet,

[12] Nallareddy et al. (2020) also document declines in median non-cash working capital over a similar sample period.

the smoothing coefficient has turned positive during the 1990's and become more positive over time. Perhaps even more puzzling, earnings volatility now exceeds cash flow volatility by many orders of magnitude.

Explanations proposed in prior research for the general decline in accounting quality run the gamut, from changes in accounting rules to changes in the type of firms represented in annual samples. Ever-increasing, positive smoothing coefficients are harder to explain. We find that the result is only observed for the specification that is commonly estimated: cross-sectional regressions based on asset-deflated levels of the two variables. We also find that the reason why the smoothing coefficient turns positive for this popular specification is a subset of start-up firms that have negative operating cash flows and low total assets. These firm-years are associated with very large negative values of asset-deflated accruals and cash flows, which cause the overall smoothing coefficient to turn positive.

We propose that the deflator be changed from total assets to number of shares. Per share data eliminate the distortion created by the subset of firms for asset-deflated regressions. The smoothing coefficient for this subset become negative and the trends resemble those for the smoothing coefficient for the remaining firms. Earnings volatility declines to levels well below that for cash flows. Per share data are more comparable across firms and over time. In addition, discussions among managers, investors, and intermediaries are all in terms of per share numbers.

As with the choice of deflator, we encourage researchers to investigate the sensitivity of their findings to other empirical choices. Do the results hold for quarterly and annual data, for the unexpected components and levels of relevant variables, and for time-series and cross-sectional or pooled regressions? To be sure, these choices should be guided by theory. But in the absence of theory, documenting the specific choices that substantially affect results is useful, as it suggests further avenues for inquiry.

While switching to per share data returns the smoothing coefficient to its expected negative value, there is a clear indication that the coefficient has become less negative over time. Again, we follow an approach that differs from those followed in prior research and decompose accruals into its components and find that the trend is due to just one component: working capital accruals. Further decomposition reveals that the overall trends are due to changes in inventory and accounts receivable, and accounts payable to a lesser extent, We find that the decline in the smoothing coefficient for these accrual components is mainly due to a decline in the levels of these accounts. We conclude that the declining trend observed for smoothing coefficients is unlikely to be due to changes in accounting rules. Rather, it is due to changes in the operations of sample firms.

APPENDIX 1
Variable definitions

Label	Definition
EARN	Earnings measured from the statement of cash flows as income before extraordinary items (IBC) scaled by average total assets (AT) or number of shares (SHR).
CORE	Core earnings scaled by average total assets measured as CORE = CFO + STACC +D&A.
CFO	Operating cash flow measured from the statement of cash flows as net cash flow from operating activities minus the cash portion of extraordinary items and discontinued operations scaled by average total assets (AT) or number of shares (SHR).
ACC	Total accruals scaled by average total assets (AT) or number of shares (SHR) measured as ACC= EARN - CFO.
STACC	Short-term accruals measured from the statement of cash flows as the change in accounts receivable, plus the change in inventory, minus the change in accounts payable and accrued liabilities, minus the change in accrued income taxes, plus the net change in other current assets scaled by average total assets (AT) or number of shares (SHR).
CCACC	Conditionally conservative accruals measured as special items minus extraordinary items and discontinued operations scaled by average total assets (AT) or number of shares (SHR).
D&A	Depreciation and amortization accruals from the statement of cash flows scaled by average total assets (AT) or number of shares (SHR).
OTH	Other accruals measured as OTH = ACC - STACC - CCACC - D&A.
AR	Account receivables (RECTR) measured from the balance sheet scaled by average total assets (AT) or number of shares (SHR)
AP	Account payable (AP) measured from the balance sheet scaled by average total assets (AT) or number of shares (SHR)
INV	Inventory (INVT) measured from the balance sheet scaled by average total assets (AT) or number of shares (SHR)

This appendix provides the variable definitions along with the corresponding Compustat data item mnemonics. The unexpected component, or news, is estimated for all variables as the residual from annual cross-sectional regressions of current values on lagged values of that variable, within 2-digit SIC industries, allowing for different slopes for positive and negative values of the lagged variable.

Appendix 2: Change over time in the specification used when predicting earnings, cash flows and accruals.

This Appendix describes relevant features of a selected subset of prior research. It is intended to show rough trends over time for four aspects of the specifications used when investigating earnings, cash flows, and accruals: whether unexpected components (news or surprise) are estimated or levels used; whether firm-specific time-series regressions or cross-sectional regressions are estimated; the deflator used (total assets or per share); and whether quarterly or annual data are examined.

Paper	Unexpected components?	Cross-sectional/time-series/pooled	Deflator	Quarterly or Annual data	Research question
Ball and Brown (1968)	Yes	Pooled	Undeflated and per share	Annual	Do earnings reflect information in stock returns
Watts (1975), Foster (1977), Griffin (1977), and Brown & Rozeff (1979)	Yes	Time-series	Per share	Quarterly	Forecasting EPS using Box Jenkins models.
Kormendi and Lipe 1987	Yes	Time-series	Per share	Annual	Linking earnings persistence to ERC
Bernard and Stober (1989)	Yes	Cross-sectional and time-series	Total assets	Annual and quarterly	Is ERC higher for CFO component of EARN than ACC component?
Jones (1991)	Yes	Tine-series	Total assets	Annual	Predicting discretionary accruals
Dechow (1994) (Table 2)	Yes	Time-series	Per share	Annual	Whether accrual makes earnings better performance measure
Sloan (1996)	No	Pooled and cross-sectional	Total assets	Annual	Accrual anomaly
Dechow, Kothari and Watts 1998	Yes	Tine-series	Per share	Annual	Build model of earnings, cash flows and accruals.
Pfeiffer et al. (1998)	Yes	Cross-sectional	Per share	Annual	Incremental information content of funds-based earnings component

Paper	**Unexpected components?**	**Cross-sectional/time-series/pooled**	**Deflator**	**Quarterly or Annual data**	**Research question**
Dechow and Dichev (2002)	No	Time-series/ Industry/ Pooled	Total Assets	Annual	Accounting quality measure based on model of accruals that includes lead and lagged cash flows
Hanlon (2005)	No	Pooled	Total Assets	Annual	Impact of large book-tax differences on pricing of earnings, accruals, and cash flows
Jayaraman (2008)	No	Time-series (for volatility measures)	Total Assets	Annual	Relation between informed trading and volatility of earnings and cash flows
Barth, Landsman and Lang (2008)	Yes	Pooled	Total Assets and per share	Annual	Does IAS adoption improve accounting quality
Frankel and Sun (2018)	Yes	Pooled	Total Assets	Annual	Improved prediction of accruals using cash flow properties

Appendix 3. **Slope of a pooled regression based on samples drawn from two populations.**

Consider two samples, 1 & 2, that are drawn from different populations. We derive below the regression slope of the pooled sample as a function of the slopes of the separate samples.

The slope for the first, second, and combined sample is $\beta 1$, $\beta 2$, and β, and they equal cov(x1,y1)/var(x1), cov(x2,y2)/var(x2), and cov (x,y)/var(x).

The proportion of observations from samples 1 and 2 are p and 1-p.

Let's do the numerator of β first: Cov(x,y)= E[xy] – E[x]E[y]

= p E[x1y1] + (1-p) E[x2y2]- E[p x1 + (1-p) x2].E[p y1 + (1-p) y2]

= p E[x1y1] + (1-p) E[x2y2]- p^2E[x1] E[y1]- $(1-p)^2$ E[x2] E[y2] – p(1-p){ E[x1] E[y2] + E[x2] E[y1]}

= p E[x1y1] - p^2E[x1] E[y1] + (1-p) E[x2y2] - $(1-p)^2$ E[x2] E[y2] – p(1-p){ E[x1] E[y2] + E[x2] E[y1]}

Adding and subtracting pE[x1]E[y1] and also (1-p) E[x2]E[y2], we get

= p E[x1y1] - pE[x1]E[y1] + pE[x1]E[y1] - p^2E[x1] E[y1] + (1-p) E[x2y2] -(1-p) E[x2]E[y2] +(1-p) E[x2]E[y2] - $(1-p)^2$ E[x2] E[y2] – p(1-p){ E[x1] E[y2] + E[x2] E[y1]}

= p cov(x1,y1) +p(1-p) E[x1]E[y1] + (1-p) cov(x2,y2) + p(1-p) E[x2]E[y2] - p(1-p){ E[x1] E[y2] + E[x2] E[y1]}

= p cov(x1,y1) + (1-p) cov(x2,y2) + p(1-p){ E[x1]E[y1] + E[x2]E[y2] - E[x1] E[y2] + E[x2] E[y1]}

Dividing and multiplying the covariance terms by the variances of x1 and x2, we get

Numerator = pβ1.var (x1) + (1-p)β2.var(x2) +p(1-p) {E[x1-x2].E[y1-y2]} (1)

Similarly, we can write the denominator: Var(x) = E[$(x-E[x])^2$] = E[x^2] –$\{E[x]\}^2$

= pE[$x1^2$] +(1-p) E[$x2^2$] – $\{pE[x1] +(1-p)E[x2]\}^2$

= pE[$x1^2$] +(1-p) E[$x2^2$] – $p^2\{E[x1]\}^2$ – $(1-p)^2\{E[x2]\}^2$ – 2p(1-p)E[x1]E[x2]

Adding and subtracting p$\{E[x1\}^2$ and also (1-p) $\{E[x2\}^2$, we get

= pE[$x1^2$] - p$\{E[x1\}^2$ + p$\{E[x1\}^2$ – $p^2\{E[x1]\}^2$ +(1-p) E[$x2^2$] - (1-p) $\{E[x2\}^2$ + (1-p) $\{E[x2\}^2$ – $(1-p)^2\{E[x2]\}^2$ – 2p(1-p)E[x1]E[x2]

= pvar(x1) + (1-p)var(x2) +p(1-p)($\{E[x1]\}^2$ + $\{E[x2]\}^2$ - 2E[x1]E[x2])

Denominator = pvar(x1) + (1-p)var(x2) + p(1-p) {E[x1-x2].E[x1-x2]} (2)

The pooled slope is the ratio of (1) to (2).

The numerator is a weighted average of β1 and β2, where the weights are p.var(x1) and (1-p).var(x2) plus a term that is a function of the product of E[x1-x2] and E[y1-y2].

The denominator is a weighted average of the two variances of X, where the weights are p and 1-p, plus a term that is a function of E[x1-x2].

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TABLE 1
Sample selection

This table presents the steps followed when collecting our main sample. We also provide the additional steps taken to generate four other samples. b) Sample used to replicate BLZ; c) Sample used for time-series analysis; d) sample for the ACC component analysis; and e) DD Sample based on Francis et al. (2005) regressions.

a) Main sample: 1990-2018	
Firm-years excluding financial industry (SIC 6000-6999) with available data for: average total assets, common shares used to calculate EPS basic, CFO, and EARN	195,816
Less:	
Firms not incorporated in the US	147,650
Trim all variables at 1% and 99%	137,434
b) BLZ sample : 1990-2018	
Firm-years excluding financial industry (SIC 6000-6999) with available data for: average total assets, common shares used to calculate EPS basic, CFO, and EARN	195,816
Less:	
Firms not incorporated in the US	147,650
Firms with average total assets < 10 million	120,834
Trim all variables at 1% and 99%	112,358
c) Time-series sample: 1990-2018	
Firm-years excluding financial industry (SIC 6000-6999) with available data for: average total assets, common shares used to calculate EPS basic, CFO, and EARN	195,816
Less:	
Firms not incorporated in the US	147,650
Firms with fewer than 6 years' observations	128,599
d) Component analysis sample: 1990-2018	
Firm-years excluding financial industry (SIC 6000-6999) with available data for: average total assets, common shares used to calculate EPS basic, current and lag CFO, EARN, Change in Receivables, Change in Inventory, and Depreciation	143,571
Less:	
Firms not incorporated in the US	116,526
Firms with fewer than 10 observations per 2-digit SIC-year	113,899
Trim all variables at 1% and 99%	103,353
e) DD sample based on FLOS regression: 1990-2018	
Firm-years excluding financial industry(SIC 6000-6999) with available data for: average total assets, common shares used to calculate EPS basic, CFO(t-1) CFO(t), CFO(t+1), EARN, Change in Revenue, PPE, Change in Receivables, Change in inventory	134,937
Less:	
Firms not incorporated in the US	108,457
Firms with fewer than 20 observations per 2-digit SIC-year	100,560

TABLE 2
Descriptive statistics

This table presents descriptive statistics. Panel A reports the empirical distributions of key variables. Panel B reports Pearson pairwise correlations. * indicates significant correlations at 5%. The sample includes 137,434 firm-year observations from 1990 to 2018. Details of all variables are provided in Appendix 1.

Panel A: Empirical distributions for key variables

Variable	N	Mean	Std.	Lower Quartile	Median	Upper Quartile	Min	Max
EARN/AT	137,434	-0.21	0.93	-0.15	0.01	0.07	-27.14	0.51
CFO/AT	137,434	-0.05	0.42	-0.06	0.06	0.12	-9.10	0.46
ACC/AT	137,434	-0.16	0.65	-0.13	-0.06	-0.01	-24.10	0.65
EARN/SHR	137,434	0.30	1.70	-0.33	0.09	1.01	-16.34	14.93
CFO/SHR	137,434	1.26	2.32	-0.06	0.44	2.04	-6.790	24.21
ACC/SHR	137,434	-0.96	1.81	-1.34	-0.37	-0.02	-23.95	5.17

Panel B: Pairwise correlations.
Pearson (Spearman) correlations are below (above) the main diagonal.

	EARN/AT	CFO/AT	ACC/AT	EARN/SHR	CFO/SHR	ACC/SHR
EARN/AT	1	0.743*	0.488*	0.821*	0.610*	0.012*
CFO/AT	0.800*	1	-0.058*	0.601*	0.798*	-0.443*
ACC/AT	0.919*	0.500*	1	0.398*	-0.024*	0.551*
EARN/SHR	0.194*	0.237*	0.125*	1	0.708*	-0.035*
CFO/SHR	0.194*	0.317*	0.072*	0.633*	1	-0.604*
ACC/SHR	-0.066*	-0.183*	0.024*	0.128*	-0.687*	1

Table 3: Distribution of smoothing coefficient estimated by firm.

The sample period is 1990-2018. We require each firm to have a minimum of 6 years of data. Firm-specific regressions of ACC on CFO are estimated, based on asset-deflated data (Panel A) and per share data (Panel B). The mean and representative percentiles of the distribution of the slope (smoothing coefficient) are reported below. We confirm that this sample is representative of the main sample (The levels and trends for slopes and adjusted R^2 for annual cross-sectional regressions resemble those reported for the "no filter" sample in Figure 1, Panel A)

Panel A: Distribution of smoothing coefficient for asset-deflated data

Time Period	Percentiles of dstribution									Mean
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
1990-2018	-2.19	-1.26	-1.05	-0.76	-0.36	0.05	0.53	1.07	2.35	-0.30

Panel B: Distribution of smoothing coefficient for per share data

Time Period	Percentiles of dstribution									Mean
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
1990-2018	-2.65	-1.42	-1.12	--0.82	-0.47	-0.03	0.47	1.03	3.73	-0.36

Table 4: Variation in the deflator across CFO deciles for CFO + and CFO - groups.

Firms are partitioned each year based on the sign of CFO, into CFO + and CFO – groups. Each group is then partitioned into deciles based on asset-deflated CFO and CFO per share. Mean values (across all years) are then reported for each decile for deflated CFO and ACC as well as the deflators—total assets (AT) and # of shares.

Panel A: Portfolio means for asset-deflated data (AT = total assets in $millions)

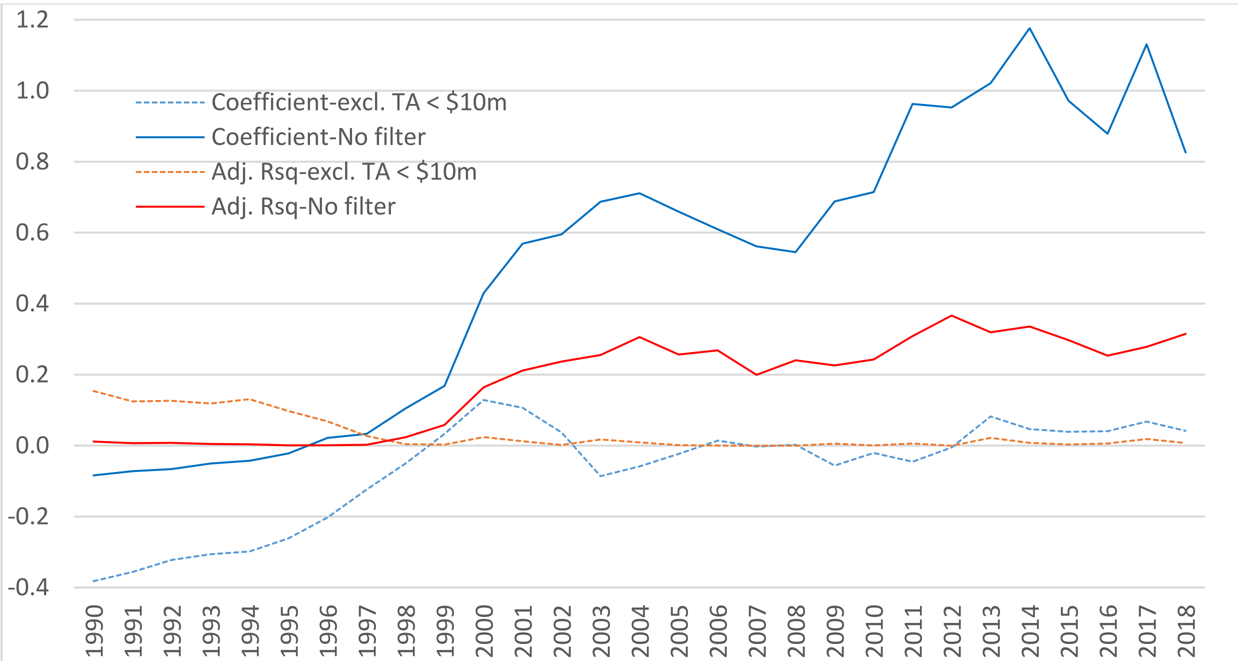
	CFO +			CFO -		
Decile	CFO/AT	ACC/AT	AT	CFO/AT	ACC/AT	AT
1	0.01	-0.06	1,379	-1.66	-1.35	6
2	0.04	-0.05	2,844	-0.72	-0.51	15
3	0.06	-0.05	4,312	-0.46	-0.29	29
4	0.07	-0.06	3,709	-0.31	-0.24	47
5	0.09	-0.07	3,224	-0.22	-0.18	68
6	0.10	-0.07	3,158	-0.15	-0.16	90
7	0.12	-0.08	3,499	-0.10	-0.13	154
8	0.15	-0.09	3,016	-0.06	-0.09	222
9	0.18	-0.11	2,179	-0.03	-0.08	361
10	0.27	-0.16	1,543	-0.01	-0.08	699

Panel B: Portfolio means for per share data (# of shares in millions)

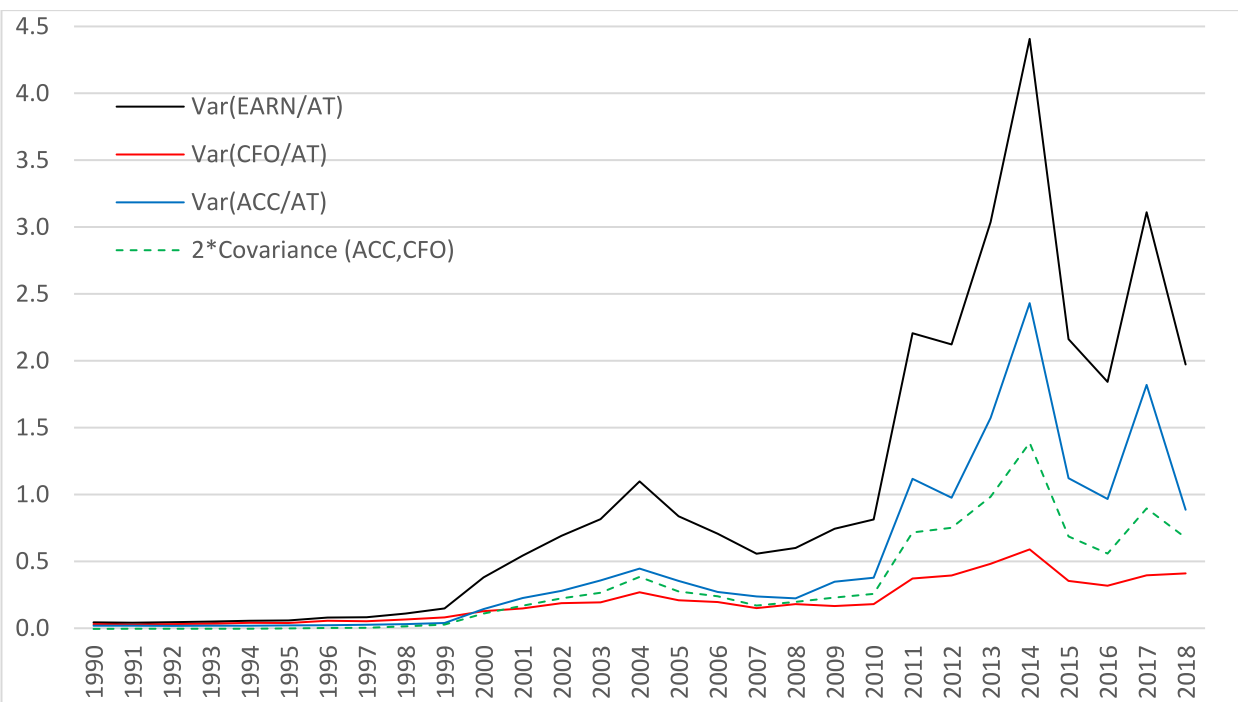
	CFO +			CFO -		
Decile	CFO/share	ACC/share	# of shares	CFO/share	ACC/share	# of shares
1	0.05	-0.17	42	-1.91	-0.13	24
2	0.22	-0.33	39	-1.01	-0.21	25
3	0.47	-0.46	42	-0.67	-0.24	26
4	0.80	-0.61	56	-0.46	-0.22	28
5	1.20	-0.80	76	-0.31	-0.20	30
6	1.67	-1.00	111	-0.21	-0.18	31
7	2.25	-1.31	115	-0.13	-0.19	34
8	3.05	-1.77	127	-0.07	-0.11	38
9	4.28	-2.49	139	-0.03	-0.10	56
10	7.42	-4.63	147	-0.01	-0.06	223

Figure 1: Time-series of key parameters from annual asset-deflated ACC/CFO regressions

Panel A: Slope (smoothing coefficient) and adj. R^2 for regressions of ACC on CFO for samples without and with a filter to exclude firm-years with total assets < $10 million)



Panel B: Variance of EARN, CFO, and ACC and 2*Covariance (ACC, CFO)



Panel C: Smoothing coefficient from regressions of ACC on CFO for different samples using filters based on total assets (AT) and trimming at various percentiles of annual cross-sectional distributions.

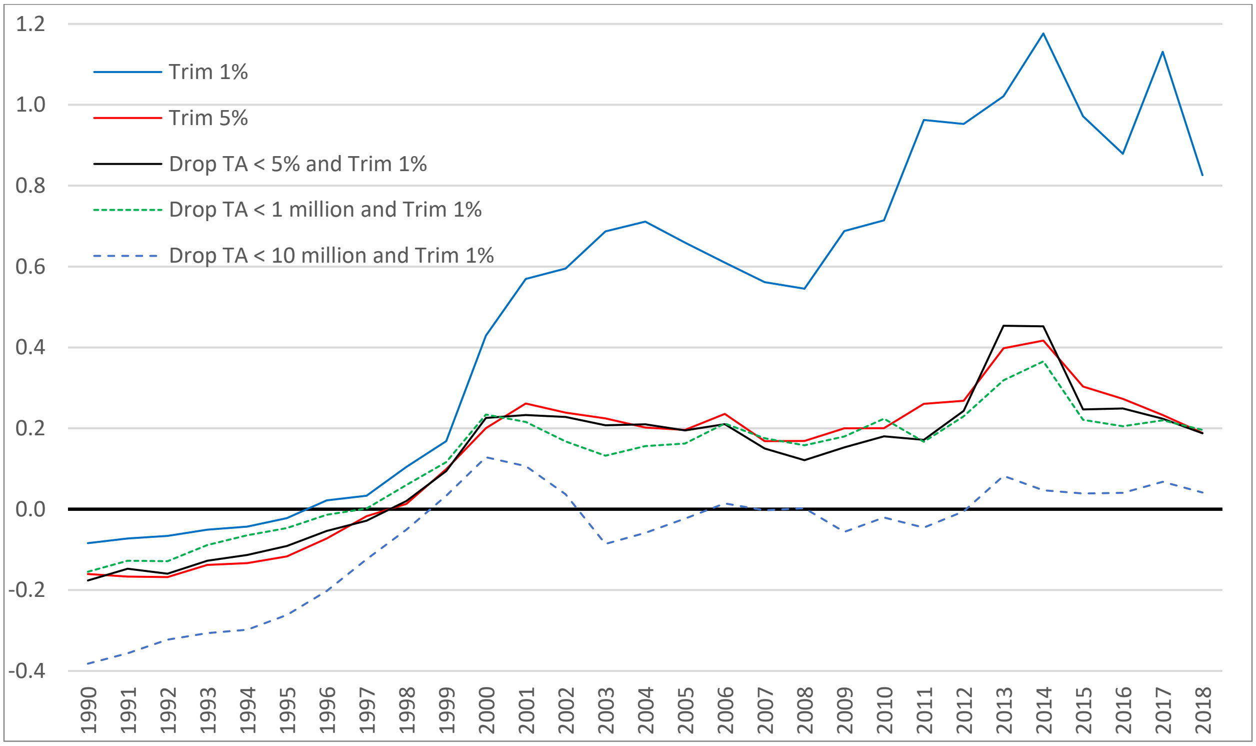
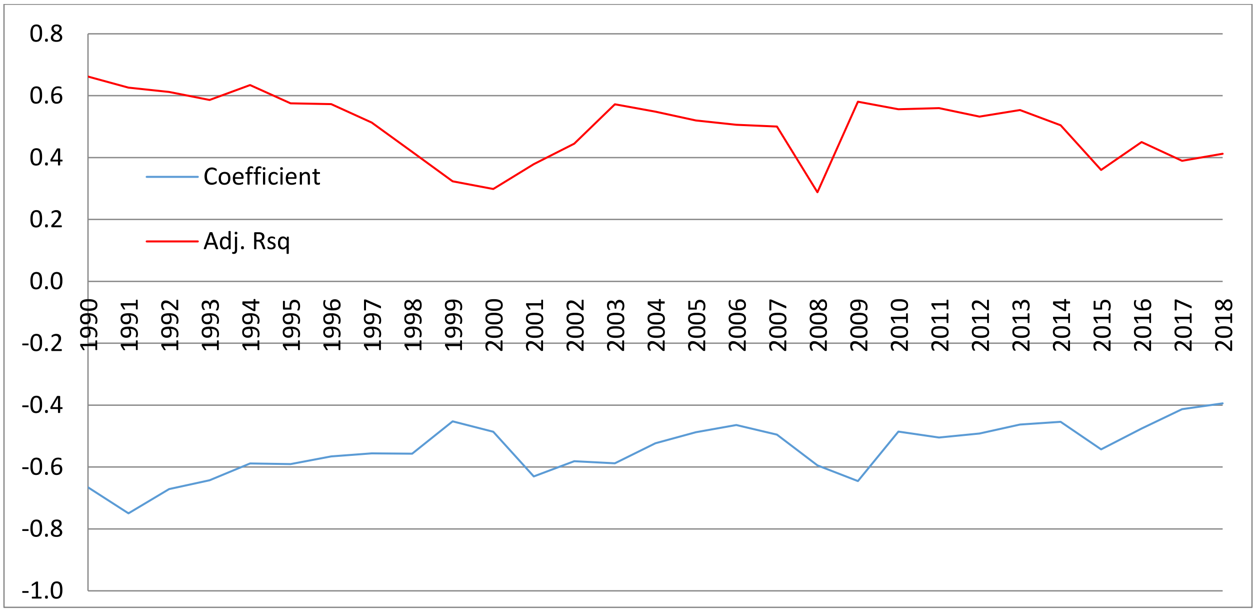


Figure 2: Time-series of key parameters from annual per share ACC/CFO regressions

Panel A: Slope (smoothing coefficient) and adj. R^2 for regressions of ACC on CFO.



Panel B: Variance of EARN, CFO, and ACC and 2*Covariance (ACC, CFO)

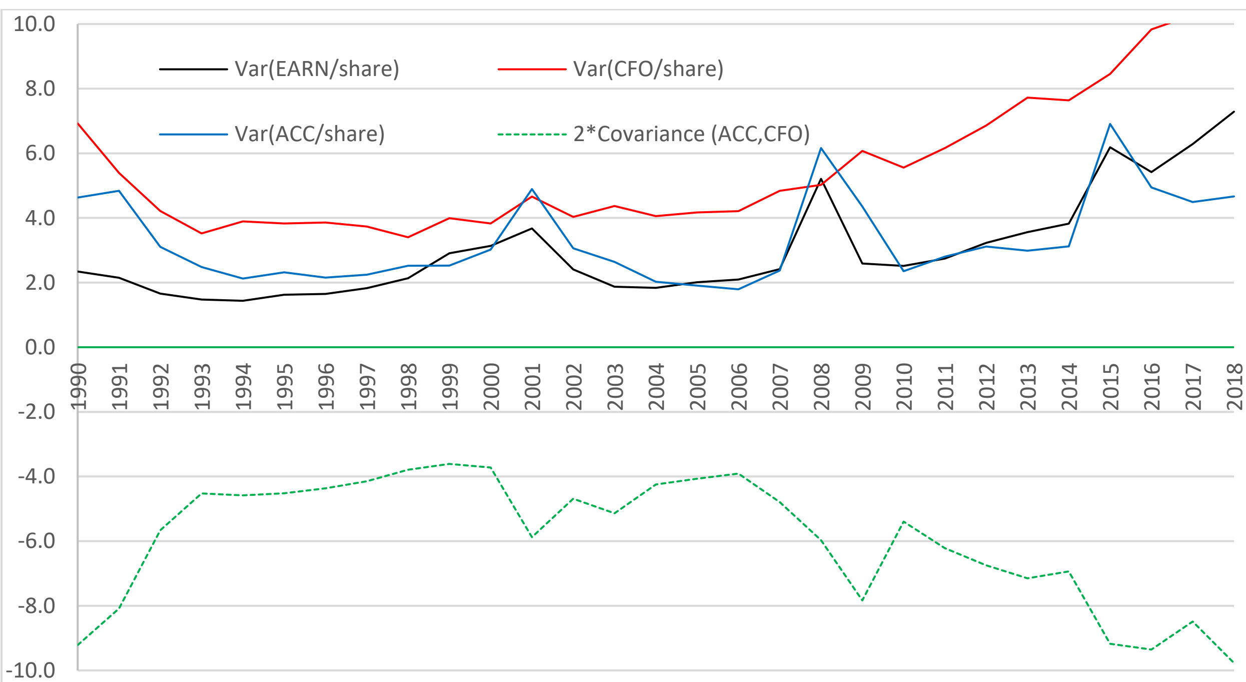
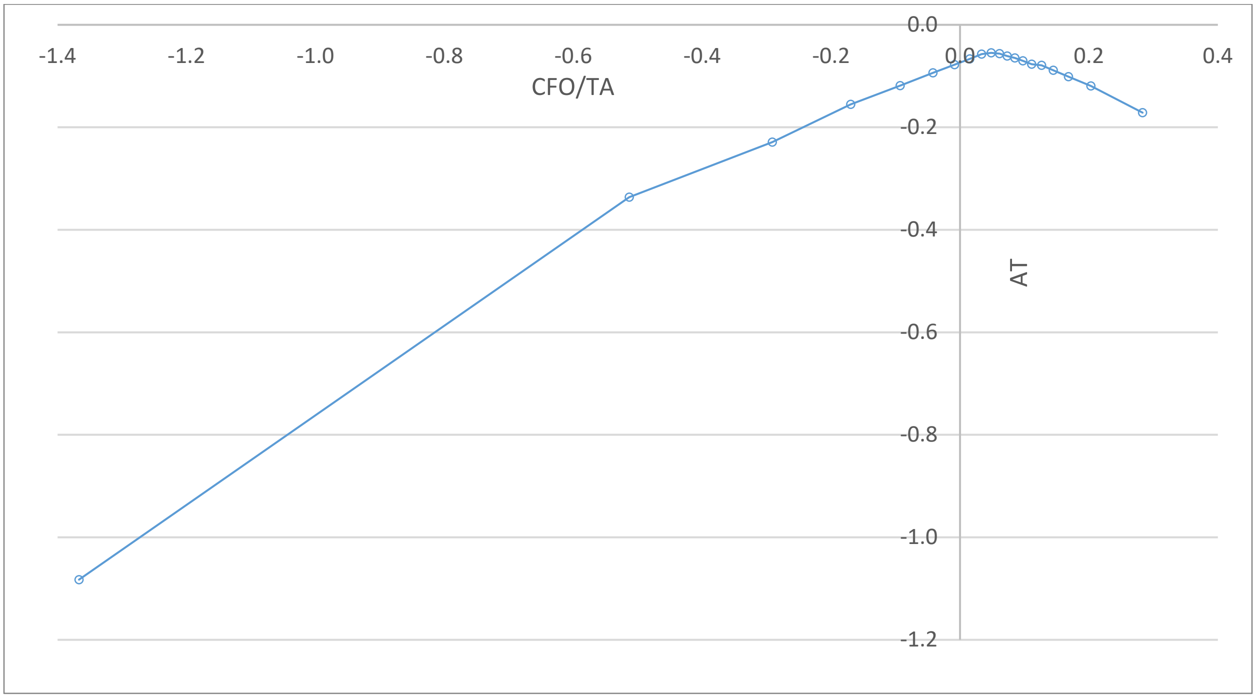


Figure 3: Nonlinear relation between ACC and CFO (based on sign of CFO)

Panel A: Mean ACC for CFO ventiles, both deflated by total assets (AT)



Panel B: Mean ACC for CFO ventiles, both based on per share data

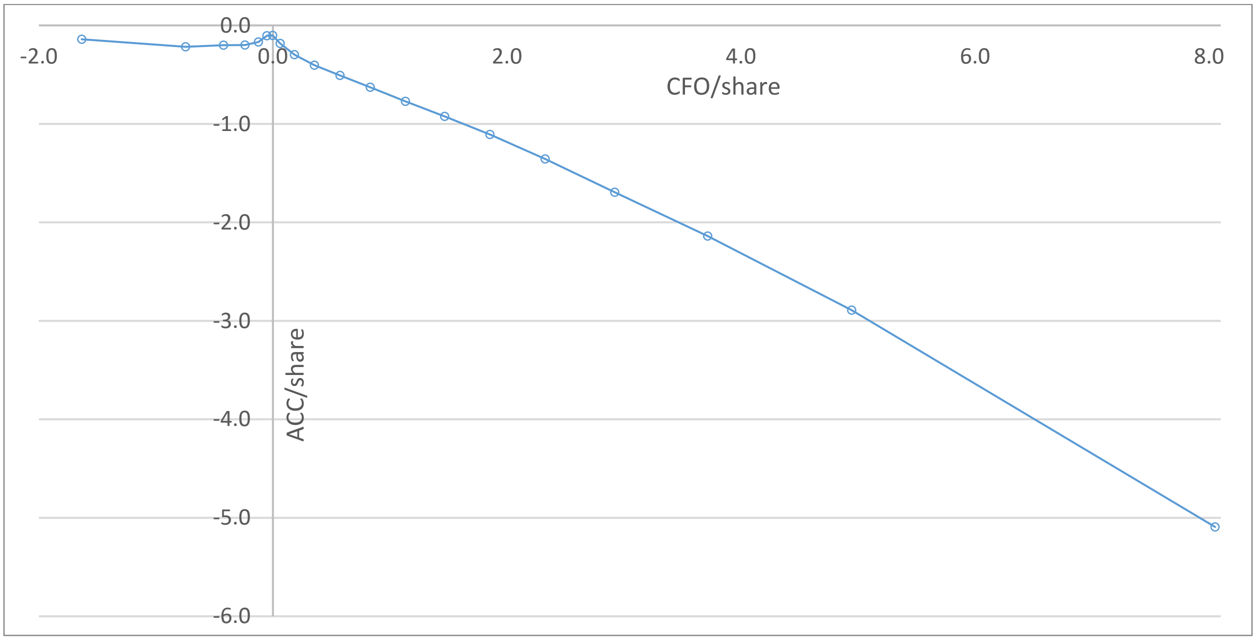
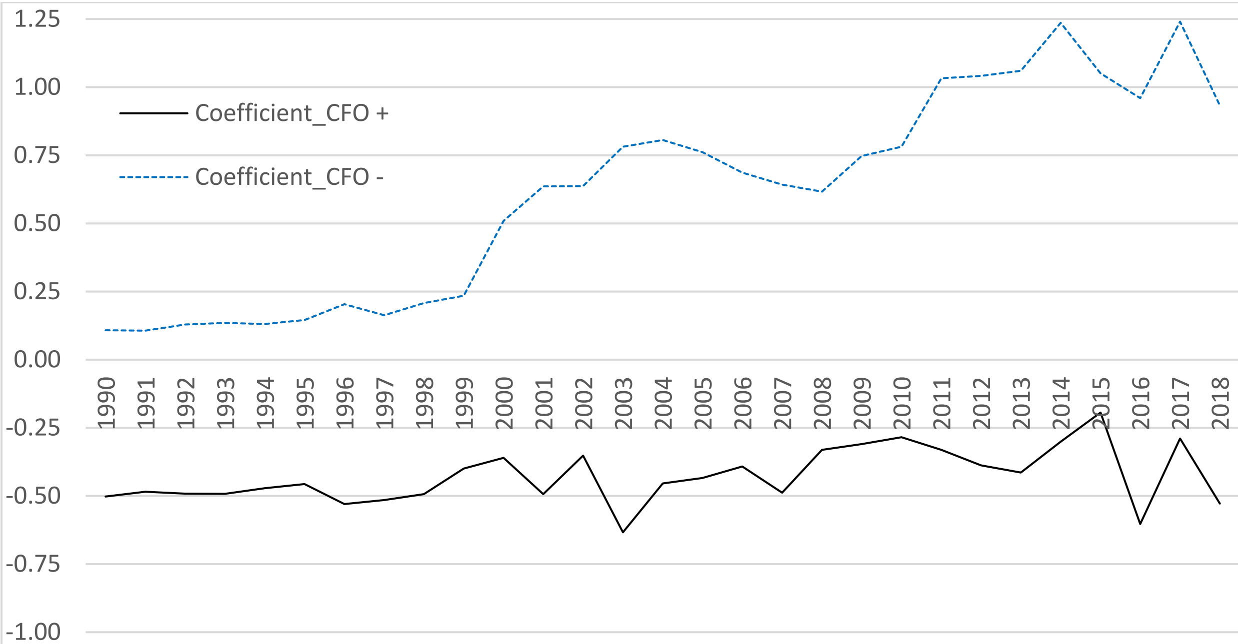


Figure 4: Time-series of smoothing coefficients for partitions based on CFO sign

Panel A: Slope from regression of ACC on CFO, both deflated by total assets (AT)



Panel B: Slope from regression of ACC on CFO, both based on per share data

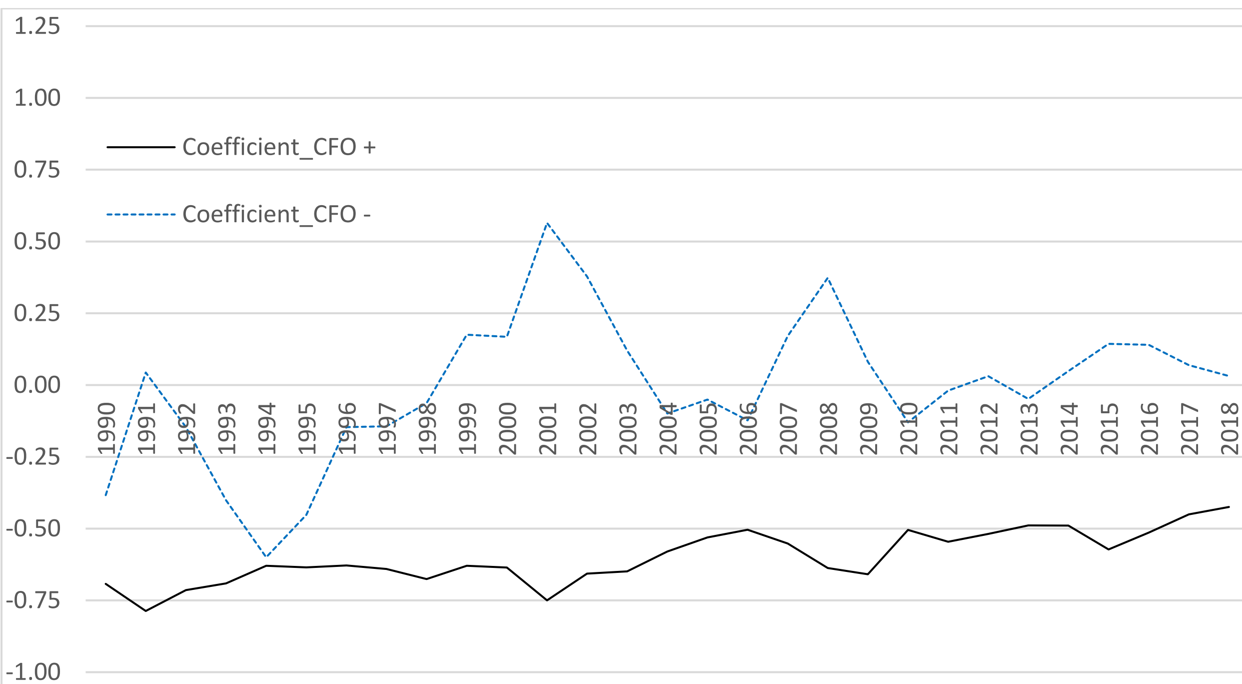
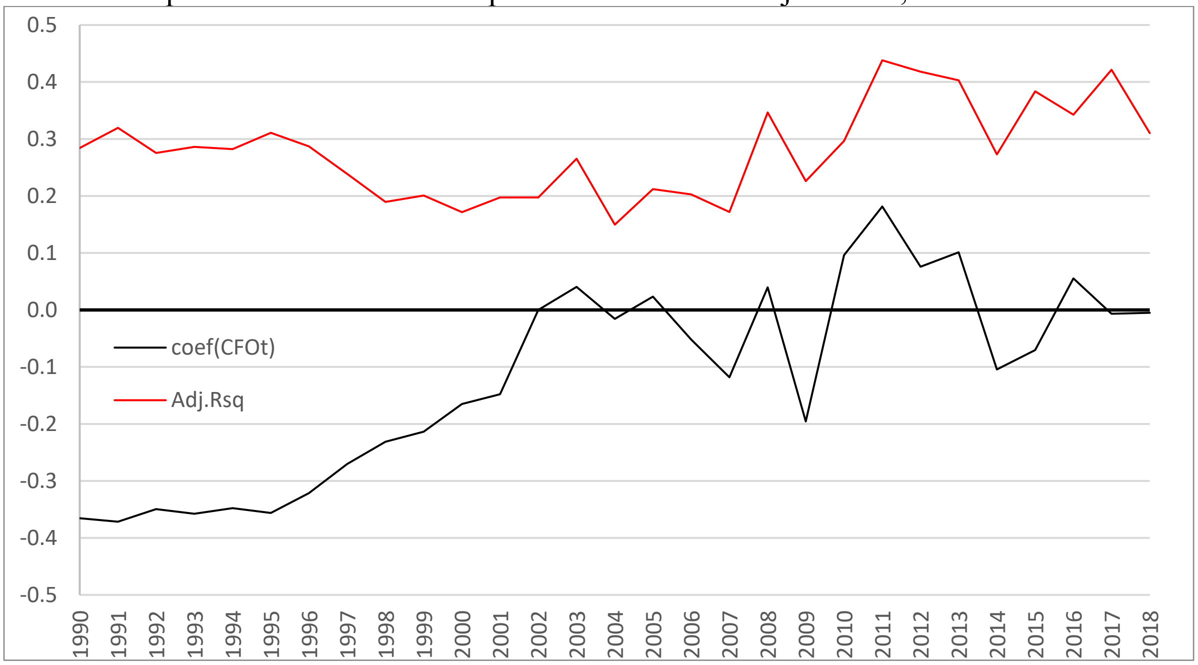


Figure 5: Switch from simple regression to multiple regression in Dechow/Dichev model

We estimate annual cross-sectional regressions for the Dechow/Dichev specification (includes CFO lags and leads to the ACC/CFO regressions). We also include changes in Sales and levels of net PP&E per Francis et al. (xx). Panel A (B) provides results for asset-deflated (per share) data. The corresponding results for ACC/CFO regression are in Panel A of Figures 1 and 2.

Panel A: Slope coefficient for contemporaneous CFO and adjusted R^2, for asset-deflated data.



Panel B: Slope coefficient for contemporaneous CFO and adjusted R^2, for per share data.

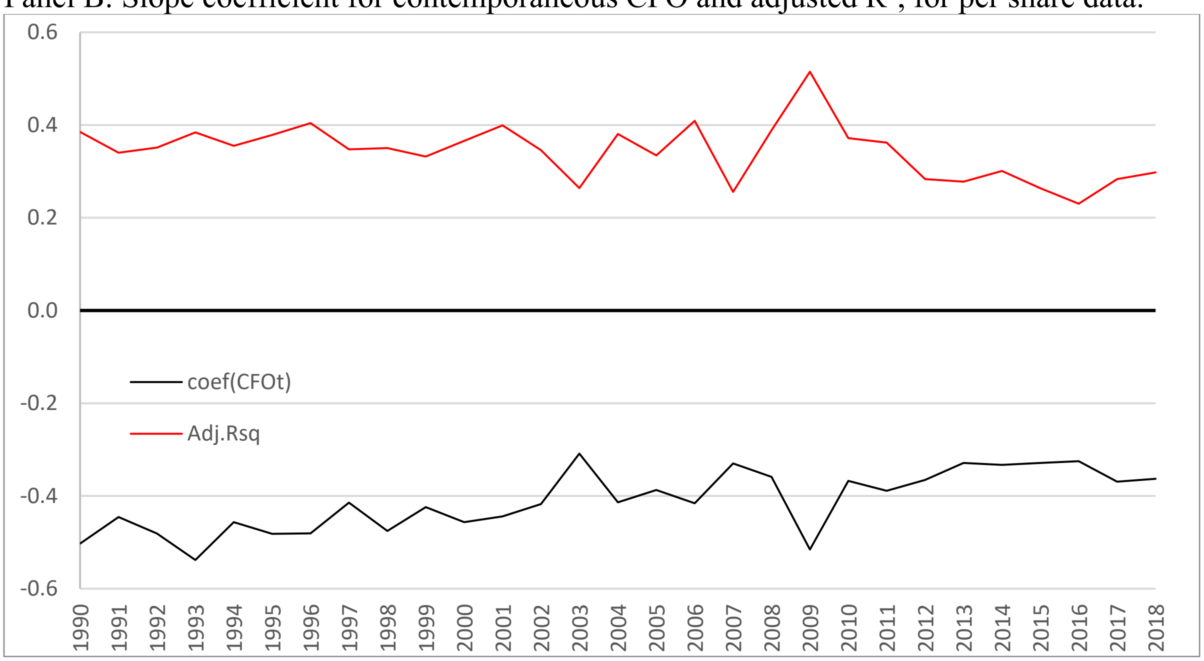


Figure 6: Distribution of share prices and incidence of splits/reverse splits

We report key statistics for the distribution of share prices for all publicly traded US firms for each quarter between .1971Q4 and 2018Q4.

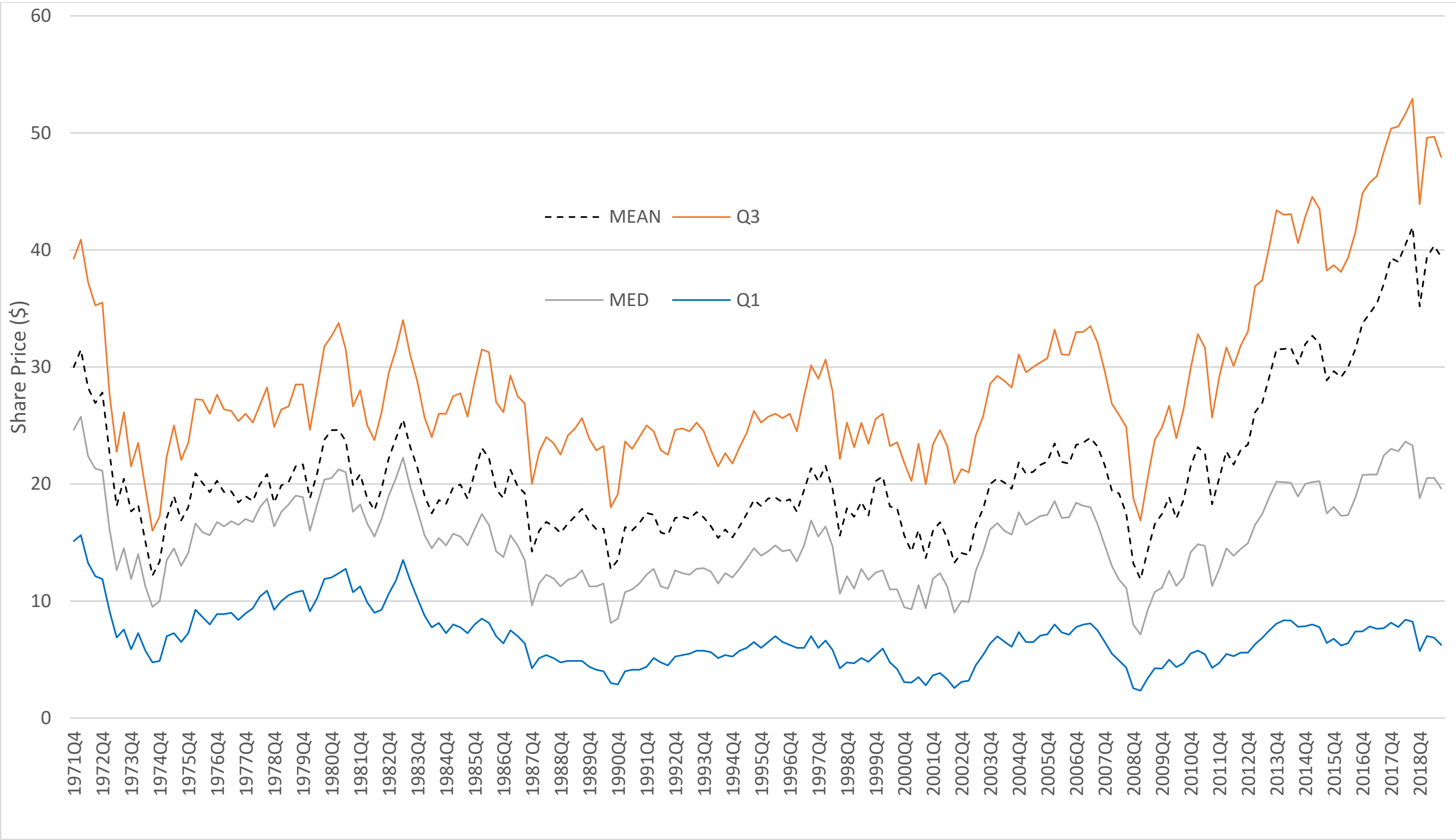
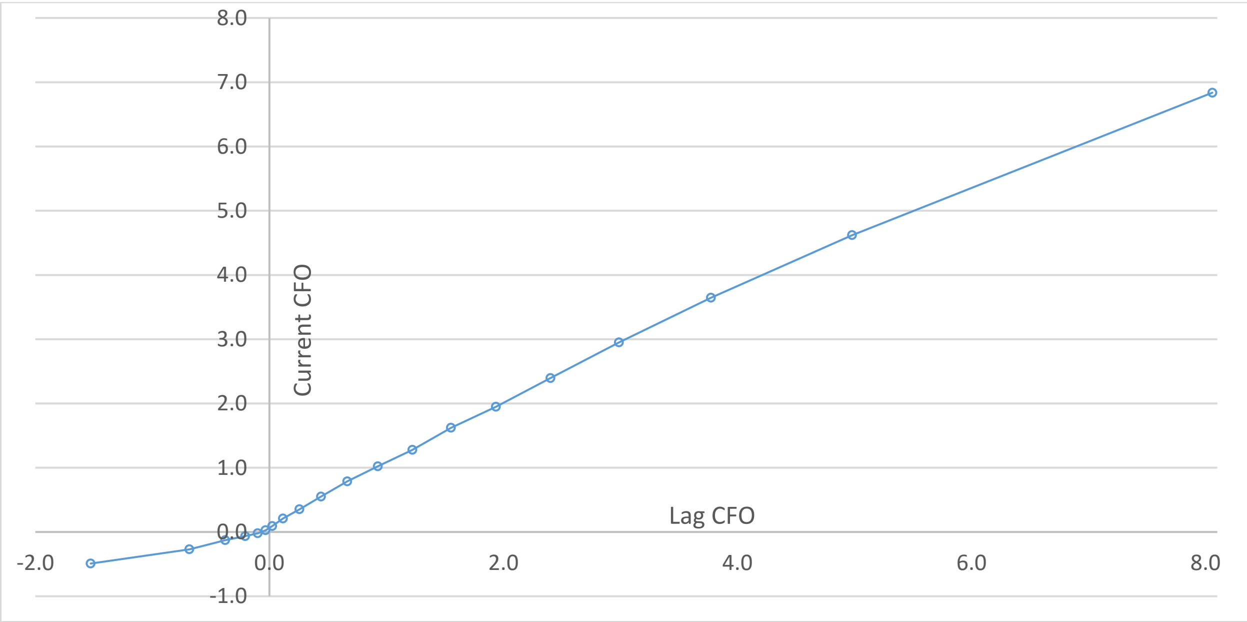


Figure 7: Nonlinear relation between current and lagged value of ACC and CFO

Panel A: Mean CFO for ventiles of lagged CFO, per share data.



Panel B: Mean ACC for ventiles of lagged ACC, per share data.

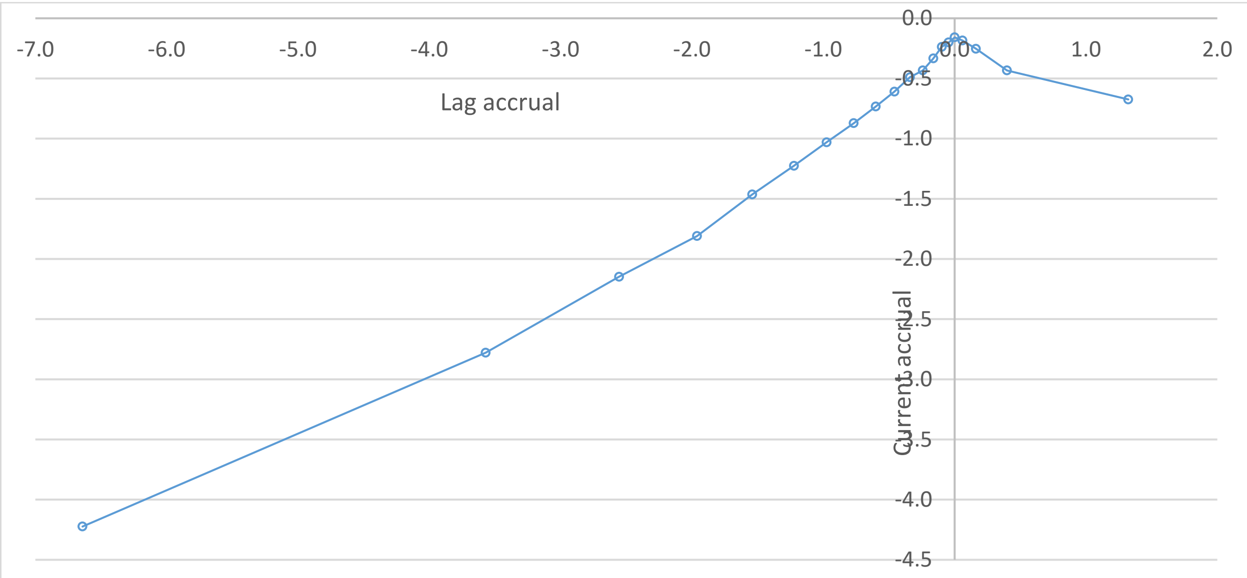
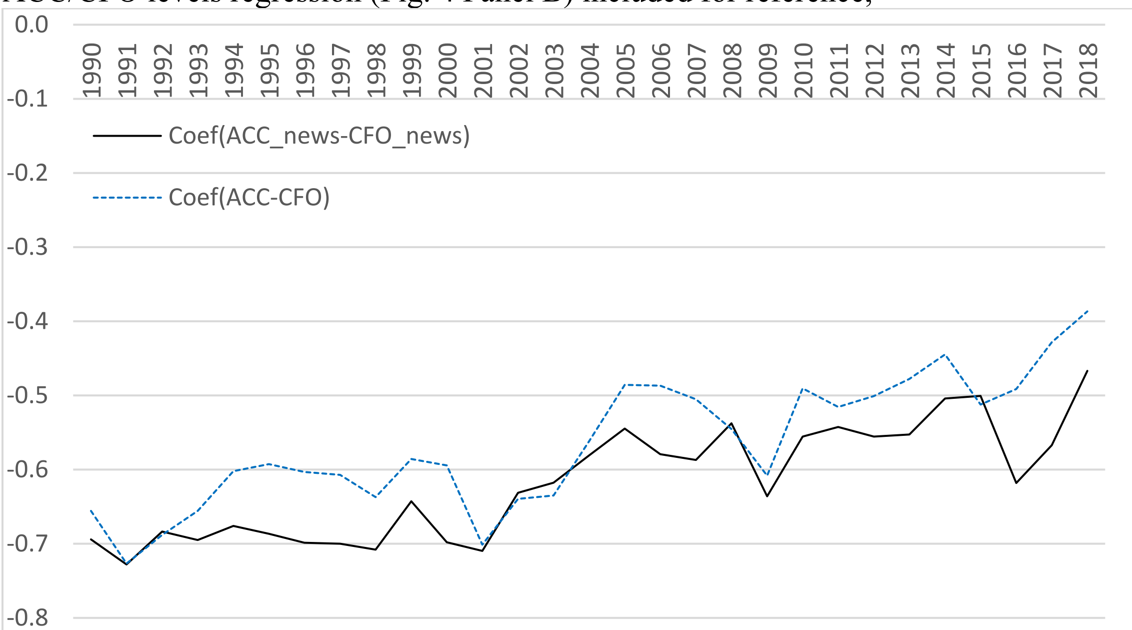


Figure 8: Time-series of smoothing coefficients based on unexpected components of ACC and CFO, for partitions based on CFO sign

We use the nonlinear relation between current and lagged CFO/ACC (see Figure 5) to estimate the unexpected components (news) of CFO/ACC. All plots based on per share data.

Panel A: CFO + group, Slope from regression of ACC news on CFO news. Slope from ACC/CFO levels regression (Fig. 4 Panel B) included for reference,



Panel B: CFO - group, Slope from regression of ACC news on CFO news. Slope from ACC/CFO levels regression (Fig. 4 Panel B) included for reference,

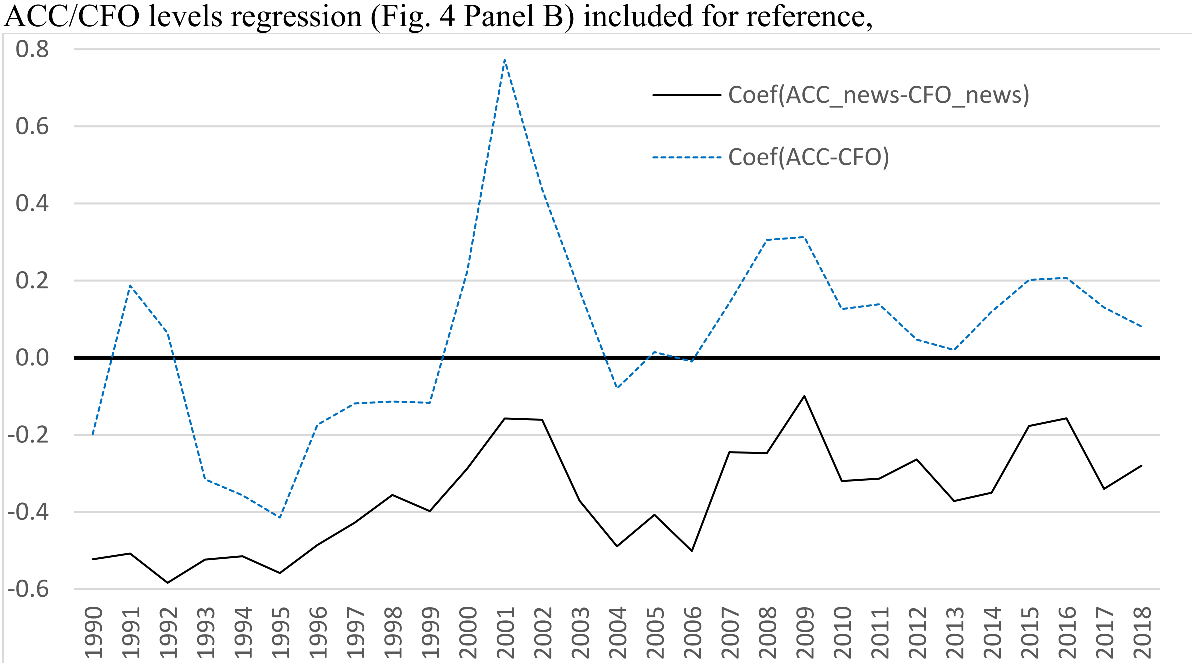
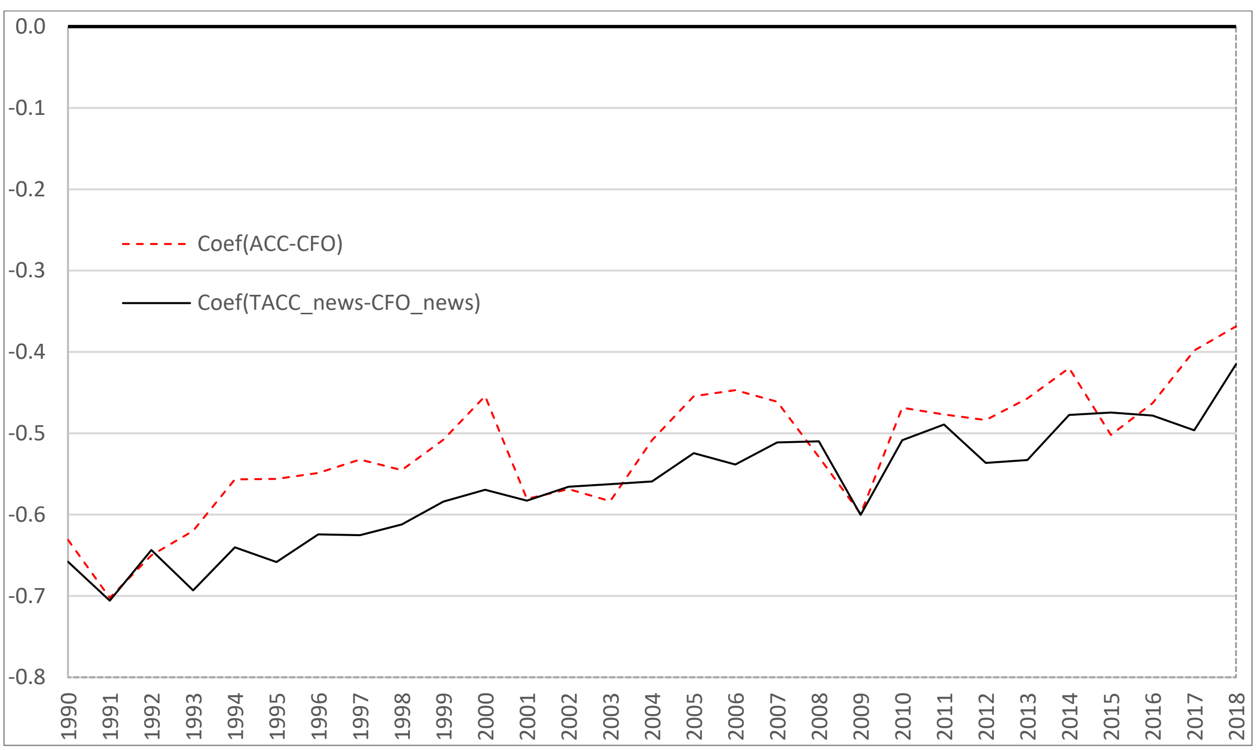


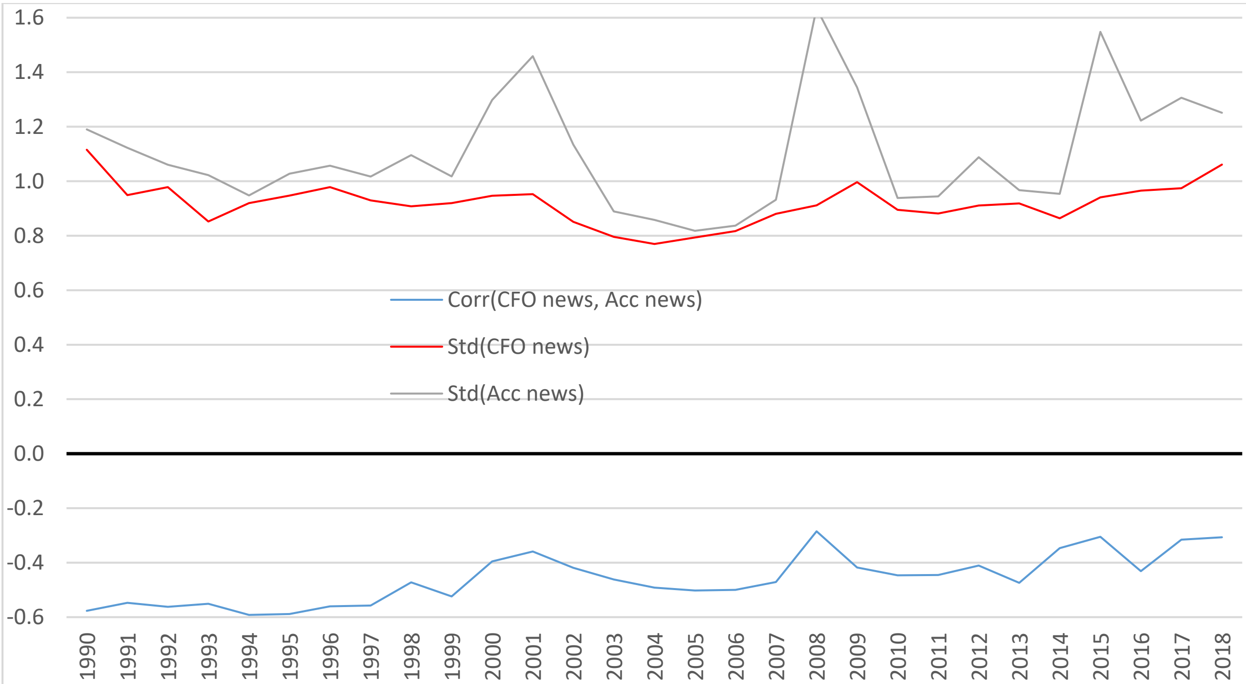
Figure 9: Explaining time-series increase (less negative) in annual smoothing coefficients

We follow a decomposition process to identify possible explanations for the increasing smoothing coefficient reported for the annual regressions of ACC news on CFO news (Panel A). Panel B provides trends for the three determinants of smoothing coefficients: the standard deviations of ACC news and CFO news, and their correlation. Panel C provides smoothing coefficients for four components of ACC news: short term accruals (STACC), one-time items (CCACC), depreciation and amortization (D&A), and other operating accruals (Other). Results suggest that STACC is the component that is most relevant. Panel D reports smoothing coefficients for three of the five components of STACC news that exhibit trends similar to STACC: changes in accounts receivable, inventory, and accounts payable., The other two components exhibit relatively flat trends. Panel E provides trends for the variance of news for those three components as well as the variance of CFO news (the variances of news in the accrual component and CFO determine the smoothing coefficients reported in Panel D.) Panel F provides trends for the median levels of the three STACC components to see if the decline in variance of news in Panel E is due to a reduction in the magnitudes of those STACC components. Requirements for non-missing data reduce sample size relative to the full sample. All analyses are on per share data.

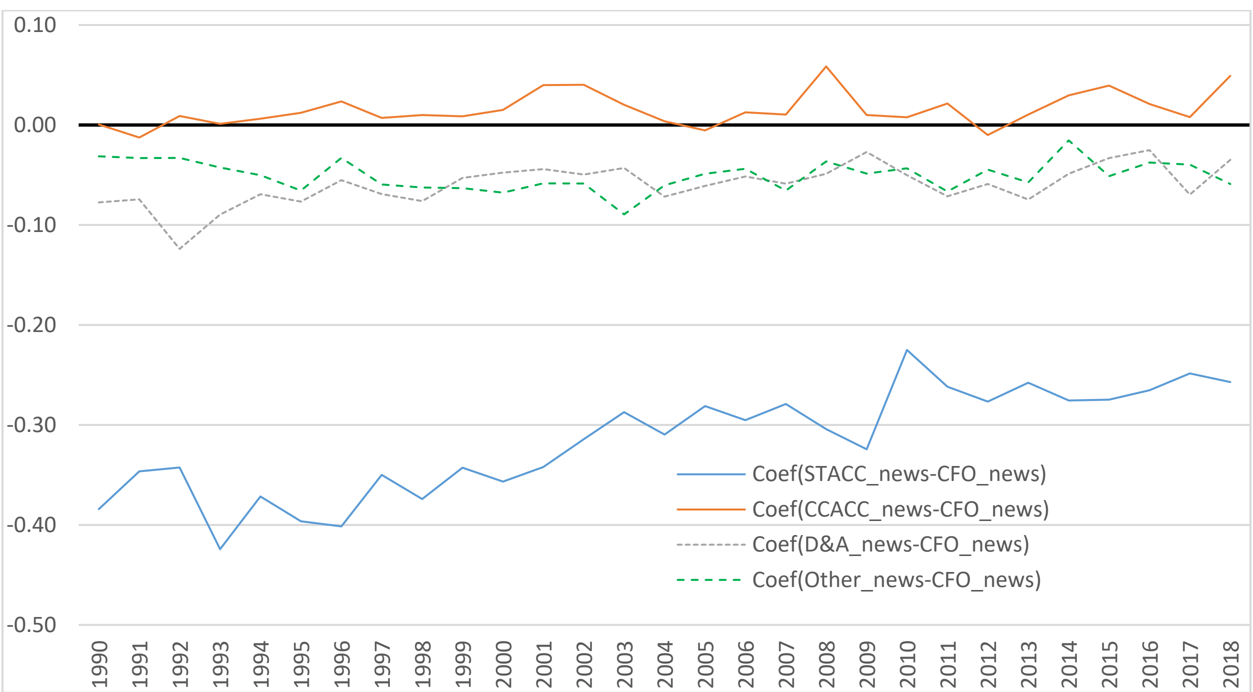
Panel A: Smoothing coefficient from regression of ACC news on CFO news. Coefficient from levels regression for the full sample (from Figure 2, Panel A) provided for reference. Slope from regression of smoothing coefficient based on ACC/CFO news on time is 0.0074.



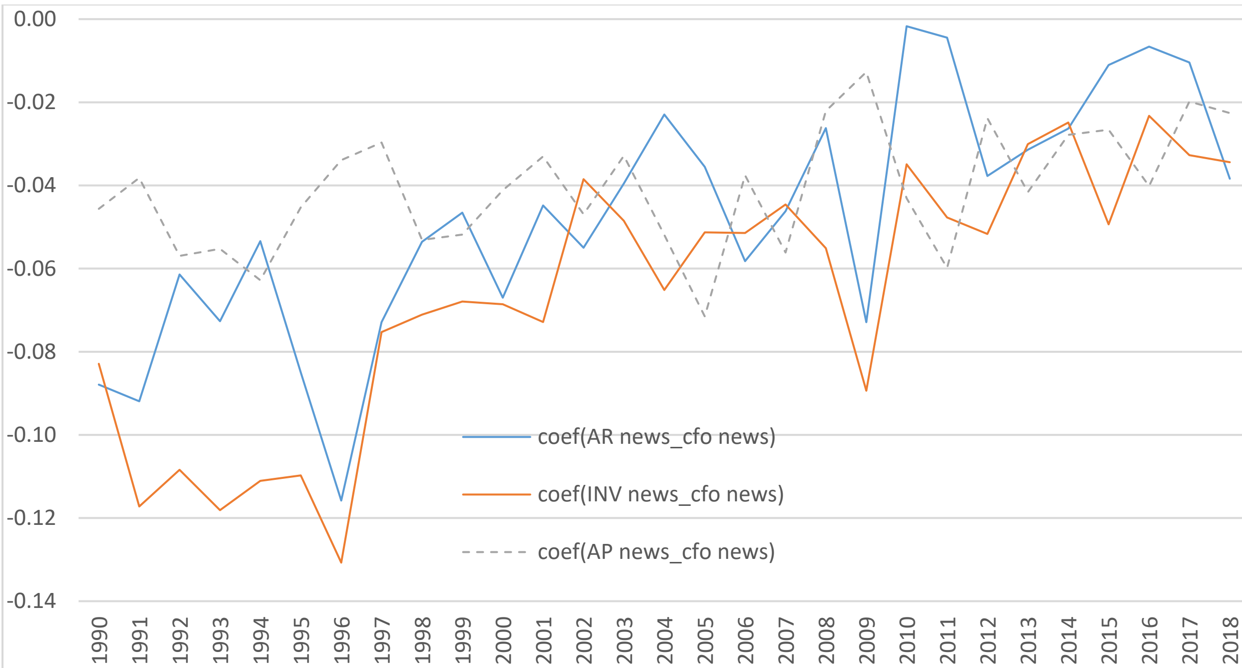
Panel B: Standard deviations and correlations underlying smoothing coefficient in Panel A.



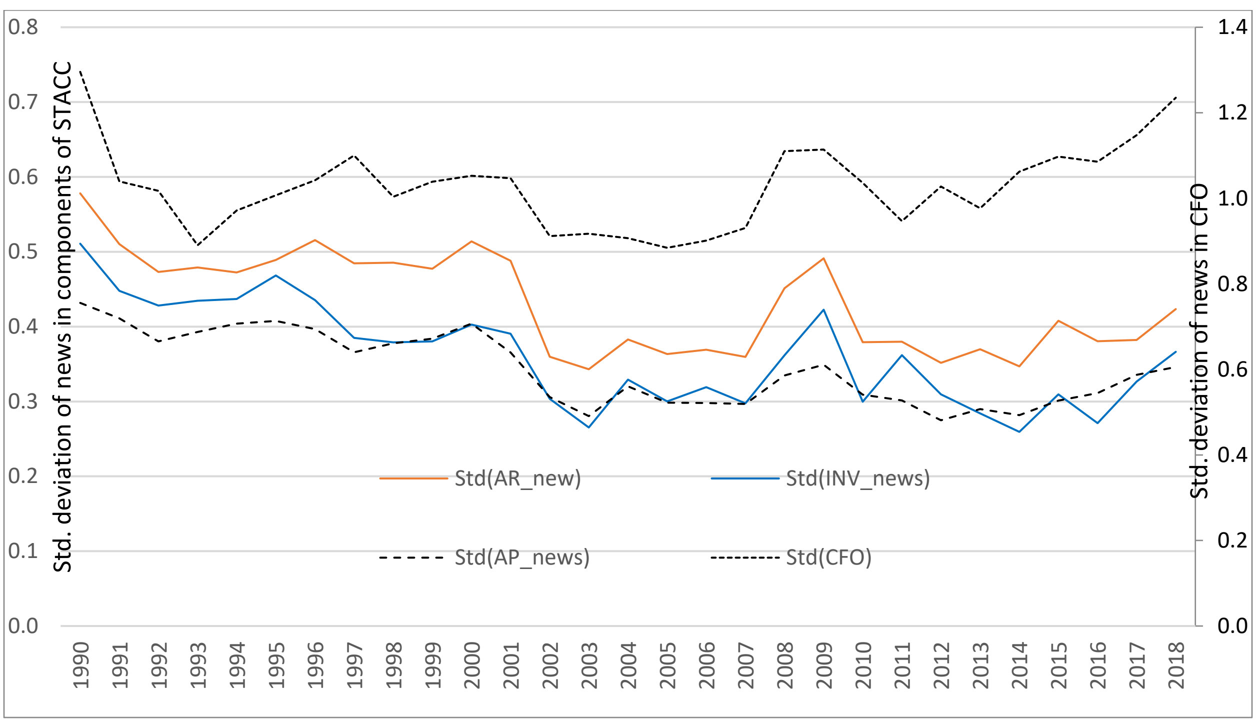
Panel C: Smoothing coefficient from regression of news in four accrual components on CFO news. The slopes from regressions of smoothing coefficients on time for news in STACC, CCACC, D&A, and Other are 0.0054, 0.0008, 0.0014, and 0.0000, respectively.



Panel D: Smoothing coefficient from regression of news in changes in three components of short term accruals on CFO news (the remaining two components show flat trends). The slopes from regressions of smoothing coefficients on time for news in accounts receivable (AR), inventory (INV), and accounts payable (AP) are 0.0026, 0.0030, and 0.0008, respectively.



Panel E: Std. deviation of CFO news and news in three components of short term accruals: accounts receivable (AR), inventory (INV), and accounts payable (AP)



Panel F: Median per share levels for three components of short term accruals: accounts receivable (AR), inventory (INV), and accounts payable (AP).