Comparing GAAP to NIPA earnings

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Abstract: The U.S. Bureau of Economic Analysis produces a measure of aggregate corporate profits (NIPA earnings), which is an integral component of the accounting for GDP. Interesting features of NIPA earnings include consistent accounting rules over time, and determination with little or no managerial discretion. Thus, NIPA earnings provide a useful benchmark for GAAP earnings, especially in parsing out the effects of real-economy vs. the accounting in explaining the documented great temporal increase in volatility and decline in persistence of GAAP earnings. Using a sample of aggregate GAAP and NIPA earnings over 1950-2016, the main findings are as follows. GAAP and NIPA earnings are in remarkable sync in the early years, with similar means and standard deviations, and with earnings changes correlating at 0.90 during 1950-1983. This close relation substantially deteriorates, however, during the second half of the sample, 1984-2016. While the behavior of NIPA earnings remains roughly the same, the volatility of GAAP earnings increases ten-fold, and the correlation between GAAP and NIPA earnings changes falls to 0.39. Additional tests reveal that the increase in the volatility of GAAP earnings is mostly due to rapid earnings reversals, and especially the effect of large transient items during economic downturns. The frequency and severity of such downturns, however, are roughly the same across the two examined periods. In addition, there is little change in the properties of aggregate cash flow from operations and revenue over time. Overall, this evidence suggests that in addition to changes in the real economy, changing GAAP rules and their application are significant factors in the changing properties of GAAP earnings.

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1. Introduction

Earnings is the most important output of the accounting system, and is widely considered a key driver in the economic decisions of investors, managers, and other stakeholders. Recent trends in the characteristics of reported GAAP earnings, however, indicate significant deviations from both historical experience, and from what key stakeholders consider quality earnings.[1] For example, earnings have become considerably more volatile and less persistent over the last 20 to 30 years (Givoly and Hayn 2000), while survey evidence indicates that investors and managers dislike volatility (Graham, Harvey and Rajgopal 2005), and consider persistence and predictability the hallmarks of quality earnings (Dichev, Graham, Harvey and Rajgopal 2013, hereafter DGHR). In addition, a number of studies document that the relation between stock returns and earnings has deteriorated over time, which suggests a decline in the information content of earnings (Ryan and Zarowin 2003, Francis and Schipper 1999, and Ely and Waymire 1999).

There is less agreement on the causes of these changes in the properties of earnings. Some sources suggest that there has been a secular increase in the fundamental uncertainty of the economy, driven by rapid technological innovation and increased competition, and accounting earnings merely registers the unavoidable choppiness from these upheavals (Srivastava 2014, Corrado and Hulten 2010). Others have pointed to the role of accounting rules and their application, where the balance sheet orientation of FASB standard setting, and especially the sustained push for more fair value accounting trigger various asset and liability revaluations, which increase the volatility and reduce the persistence of earnings (Dichev and Tang 2008).

The major difficulty in these debates is "the counterfactual problem." In other words, we observe that GAAP earnings displays certain properties, and that these properties

[1] GAAP is the acronym for Generally Accepted Accounting Principles.

evolve through time – but it is hard to assess what these changes mean given that there is only one observable economic reality, and only one observable financial reporting system, and both changing over time. Ideally, we would like to answer questions like "How would the evolution of earnings look like if accounting rules and their application stayed the same over time?" Such questions are hard to answer without valid counterfactual benchmarks.

This study addresses the counterfactual problem by comparing GAAP to NIPA earnings. National Income and Product Accounts (NIPA) earnings are produced by the Bureau of Economic Analysis as an integral component of the comprehensive system of government accounting that produces Gross Domestic Product (GDP). The use of NIPA earnings as the counterfactual to GAAP earnings offers two key advantages. The first advantage is that the full history of NIPA earnings is derived under the same accounting rules, i.e., if the NIPA rules change, the entire history of NIPA rules is revised as well. This consistency is in contrast to GAAP earnings, that are never revised retroactively (except in rare cases like restatements), and the well-recognized considerable temporal changes in GAAP rules. Another advantage is that the determination of NIPA earnings involves little managerial discretion (see background on determination later). The consistency of NIPA rules and the absence of discretion allow the use of NIPA earnings as a GAAP counterfactual that separates real-economy vs accounting-based explanations for the changing properties of GAAP earnings.

The empirical specifications rely on comparing the properties of NIPA aggregate corporate profits and GAAP aggregate Net Income over two long periods, 1950-1983 and 1984-2016. Consistent with existing research, GAAP earnings has become dramatically more volatile and less persistent over time; specifically, the volatility of GAAP aggregate earnings changes has increased tenfold, from 4.7% to 50.4% over the two sample periods. In contrast, the volatility of NIPA earnings changes is nearly the same over time, at 5.1%

and 5.4% over the same periods. There has also been an accompanying substantial deterioration in the correlation between NIPA and GAAP earnings changes, from a near lock-step of 0.90 during 1950-1983 to only 0.39 during 1984-2016. Further tests reveal that GAAP earnings are not only very volatile during 1984-2016 but that this volatility is highly transient, with most earnings changes reversing within five years, mostly due to the effect of transient items during economic downturns. Using NBER data and definition of recessions, however, we find no evidence of an increase in the frequency and severity of downturns over the two examined periods, which suggests that the rise of transient items is not driven by more severe economic upheavals. In addition, GAAP cash flows from operations and revenues, which are less subject to the effect of the changing accounting, show little change in behavior over time.

Summarizing, parsing out the effects of changes in the real economy vs. the accounting is difficult because these two factors are entangled, e.g., accounting rules change in response to changes in the real economy, and accounting rules themselves likely trigger changes in how firms operate. Overall though, the impression from the totality of these findings is that changes in the real economy are unlikely to fully account for the dramatic changes in the properties of GAAP earnings over the last 20 to 30 years. Changing GAAP rules and their application seem to be a contributing factor as well, especially those that mandate or allow frequent asset revisions and the associated transient items in earnings. Note that the message of the paper is also subject to some limitations, chiefly that NIPA data is limited to aggregate specifications, and that it is difficult to trace the influence of changing accounting rules to specific examples. In that sense, the paper can be viewed as "providing one more piece of the puzzle" rather than as arriving at conclusive answers.

More broadly speaking, the paper is also part of the burgeoning recent literature that links accounting data to the macroeconomy. Examples include Konchitchki (2011, 2013)

and Shivakumar and Urcan (2017) exploring the relation between inflation and earnings, Khan and Ozel (2016) showing that aggregated information about loan losses helps predict economic activity at the state level, Konchitchki, Luo, Ma, and Wu (2016) investigating earnings downside risk and cost of equity capital and Patatoukas (2014) examining implication of aggregate accounting earnings for stock market valuation. While this sustained interest has produced a number of important insights, it seems that significant research opportunities remain in this area, including more use of national-accounts data like NIPA.

2. **Background on GAAP and NIPA earnings**

GAAP earnings are generally better known and widely used, so their discussion here is limited to relevant highlights. GAAP earnings are produced by public companies filing financial reports with the Securities and Exchange Commission (SEC) to maintain their stock exchange listing. The SEC mostly defers to the Financial Accounting Standards Board (FASB) to develop financial reporting standards. FASB develops the rules in an elaborate open process, which is designed to reflect the opinion of expert accountants but is also influenced by the broader interests of various stakeholders like preparers, auditors, investors, and government. Since these competing interests are often at odds, the standard setting process can become contentious and politicized, and thus the resulting financial reporting rules are often compromised. A hallmark of GAAP reporting is the considerable managerial discretion in applying the accounting rules. There is a long-running debate about the pros and cons of discretion in financial reporting; proponents maintain that discretion allows managers to optimally fit the accounting to the nature of the business, while detractors point to apparently wide-spread earnings management and other opportunistic distortions, which diminish the utility of earnings as a measure of firm performance (e.g., Bowen, Rajgopal,

and Venkatachalam 2008). GAAP earnings are extensively disseminated and used, and are a key factor in most firm stakeholders' economic decisions (Kothari 2001, Barth, Konchitchki, and Landsman 2013). A major development in financial reporting over the last 20 years has been FASB's push for "fair value accounting", essentially more reliance on market prices in the determination of financial results, including earnings.

The determination of NIPA earnings is quite different from GAAP earnings on several dimensions, highlights summarized in Table 1. The main reason for these differences is that NIPA earnings are produced by experts in the Bureau of Economic Analysis (BEA, a government agency within the U.S. Department of Commerce) as an integral part of the comprehensive economic and statistical framework that produces GDP, and various associated metrics. As an illustration, Table A1 in Appendix A provides an overview of how in year 2010 individual components, including employee compensation, proprietors' income and corporate profits, stack up to Gross Domestic Income (GDI), which is an accounting equivalent to GDP. The table is constructed with aggregates on top, and individual components listed below, with subcomponents listed to the right, matching the presentation in the NIPA tables. The measure of corporate profits is bolded.

Consistent with their role as a GDI component, the concept and derivation of NIPA earnings also differ from GAAP accounting. The formal definition of NIPA earnings is "Profits from current production;" summarizing, and perhaps oversimplifying the specifics from the NIPA handbook and BEA papers, what that means is profits designed to reflect operating performance, and especially neutralizing the effect of changing prices on inputs and outputs, including the elimination of unrealized and realized gains and losses on investments and long-term assets. NIPA accounting also eschews discretionary charges like provisions for restructurings, and discretionary changes in assets and liabilities. Laurion and

Patatoukas (2016) show that NIPA earnings provide neutral estimates of income from current production regardless whether economies are good or bad.

Operationally, NIPA earnings are derived from tax earnings after considerable adjustments to conform to the BEA concepts of national income and its components, including surveys for foreign-sourced income. The primary source for the determination of annual NIPA earnings is the tax accounting measures published by the Internal Revenue Service (IRS) in *Statistics of Income (SOI): Corporate Income Tax Returns*. Note that these tax data are only available annually, and with a 2-year lag. The estimation of NIPA profits for the most recent quarters and years is based on a different procedure, mostly cross-linking and extrapolating data from the Census Bureau, the Federal Deposit Insurance Corporation, financial accounting reports, and others to provide preliminary estimates, which are later revised as more reliable tax data becomes available.

Table A2 in the Appendix A presents a reconciliation of IRS earnings and taxes to NIPA earnings and taxes for year 2010, information is from NIPA Table 7.16. Key earnings lines are bolded, including the top-line IRS "Total receipts less total deductions" and bottom-line NIPA "Profits after tax." An examination of Table A2 reveals a number of adjustments between tax and NIPA earnings (essentially, NIPA accruals) with the more material ones including an adjustment for the misreporting of tax income, bad debt expense, the effect of foreign operations, and the exclusion of gains and losses from sale of property. Note that the top-line IRS item is close to but not the same as "Taxable Income," see *Statistics of Income* for definitions and comparison. Note also that NIPA adjustments include not only pre-tax but tax expense items as well, i.e., NIPA tax expense includes NIPA tax adjustments, and differs from IRS tax payable. [2]

[2] A possible question about NIPA earnings is whether they are materially different from IRS income. A pragmatic way to evaluate this concern is to compute the empirical correlations between IRS income from NIPA Table 7.16 and the two key NIPA measures of earnings examined in this study. Consistent with the specification later in the paper, we use after-tax measures, and compute the correlations in earnings changes

Clarifying the nature of NIPA earnings helps in understanding the resulting properties, which are key in the research design of this study. Most importantly, the determination of NIPA earnings is consistent over time. One aspect of this consistency is that the determination of GDP (and GNP in earlier years) has been conceptually roughly consistent since the early efforts to establish the accounting for national income in the 1930s. Of course, there have been numerous changes and improvements over the years but these have been more on the levels of developing and fine-tuning the implementation rather than from radical revisions in the concepts (Landefeld 2000). The other aspect of consistency is that when material changes are made, the entire time-series of NIPA numbers is retroactively revised to reflect the new definition. Thus, NIPA earnings are internally consistent over time, as a true counterfactual should be. This is also a critical difference from GAAP numbers, where the very notion of income has changed over time from one that is mostly "revenues minus matched expenses" to one that includes numerous balance sheet adjustments, including from the recent push for fair values. In addition, GAAP numbers are never revised retroactively except in rare cases like restatements due to errors or improper accounting.

The nature and derivation of NIPA earnings also explain why they are free from managerial discretion, earnings management, and political meddling.[3] As seen in Table A2, NIPA earnings are derived from aggregate tax data with numerous BEA adjustments (essentially, NIPA accruals). Since tax accounting is much more restrictive and closer to cash flows, and NIPA accruals are by definition safe from managerial influence, firm

over time. The correlation between IRS income and NIPA "Profits after tax" is 0.77 over 1950-2009, while the correlation between IRS income and NIPA "Profits after tax with IVA and CCAdj" (see explanation on page 9) is 0.51. Overall, the resulting impression is that NIPA earnings seem distinct from IRS income.

[3] A potential question is whether GAAP earnings management and more broadly managerial discretion are entirely idiosyncratic, and will therefore wash away in aggregate amounts. While some are undoubtedly idiosyncratic, there is also much evidence that a considerable part of earnings discretion and management are related to broad aggregate boom-bust patterns in investment, the stock market, and waves of option compensation, see for example, Dechow, Ge, Larson, and Sloan (2011) for AAERs that cluster in the early 2000's, Wang, Winton, and Yu (2010) for fraud during IPOs, and Ali and Gurun (2009) for more accrual anomaly during periods with high investor sentiment.

managers have little ability to manipulate NIPA numbers.[4] In addition, BEA is free to set its own accounting and statistical rules, and is governed strictly by expert considerations rather than political oversight or meddling. While there are several other considerable and interesting differences between the determination of NIPA and GAAP earnings, further discussion is omitted here to lighten the presentation. The interested reader is referred to Appendix B for further detail, especially about the internal cross-checks in the determination of GDP and NIPA earnings, and the elimination of capital gains and losses from NIPA earnings.

Note that the absence of managerial discretion in NIPA earnings is not necessarily an advantage, and more generally, it is difficult to say whether NIPA or GAAP provides a "better" measure of corporate profitability. The two systems have evolved to serve different needs, and there are likely unavoidable trade-offs in setting their comparative characteristics. For example, while NIPA earnings are free from managerial discretion, and that makes them more "reliable," there is much research showing that discretion can help to fit the application of the rules to the business, and can thus produce more relevant and timely numbers.[5] On a more specific level, GAAP employs a number of rules that mandate the recording of various asset impairments, which likely produce a more timely and sensitive earnings signal during economic downturns. GAAP earnings are also available at the firm level, while NIPA's are not, which is of course an important advantage since much of value-relevant information resides at the firm level. As explained above, NIPA earnings exclude gains and losses on transactions of capital assets, so the very definitions of income are somewhat different

[4] One caveat is that NIPA earnings are derived from IRS data, and firms have an incentive to reduce taxable income to minimize tax payments. Note, however, that BEA makes a large positive adjustment to IRS income for "misreporting income" (see table A2), counteracting this effect. The long history of doing such adjustments, and double-checks from independent sources (see description in Appendix B) provide some confidence that indeed these adjustments do a fairly good job. Note also that a lot of tax minimization revolves around tax credits, and the IRS definition of income used by NIPA is not affected by tax credits.

[5] There is also some evidence that GAAP likely dominates NIPA earnings in some relevance contexts, e.g., Konchitchki and Patatoukas (2014a) find that GAAP earnings dominates taxable earnings (close to NIPA earnings) in predicting GDP.

across the two systems. At a minimum, the intuition of "different earnings for different purposes" certainly applies here, and we need further work to map out the relative advantages and disadvantages of NIPA vs. GAAP earnings.

For the purposes of this investigation, the emphasis is on the two differences outlined in more detail above. Since NIPA earnings avoid managerial discretion, and are determined under consistent rules over time, they can be used to parse out the effect of the real economy vs. the accounting on the evolving characteristics of GAAP earnings. For example, if the characteristics of NIPA earnings have not changed much through time, one would conclude that real-economy changes are unlikely to fully account for the observed changes in the characteristics of GAAP earnings. In contrast, evidence that the temporal pattern of NIPA earnings matches that of GAAP earnings will point more directly to real-economy explanations.

3. Research design and main results

Turning to the empirical specification of NIPA earnings, the bottom-line in Table A2 named "Profits after tax", is the first of the two measures of NIPA after-tax earnings used in this study. Deriving the second measure involves two additional adjustments, the Inventory Valuation Adjustment (IVA), and the Capital Consumption Adjustment (CCAdj). The inventory valuation adjustment removes inventory holding gains from reported income to conform to the NIPA concept of "Profits from current production," i.e., profits from current operations without holding gains and losses.[6] The capital consumption adjustment is also included to conform to the notion of earnings from current production, adjusting depreciation to a current cost basis by removing the effect of the historical cost of assets.[7]

[6] In other words, NIPA accounting uses current cost of inventory to derive earnings as opposed to tax and financial accounting, which use historical cost.

[7] To be more precise, the capital consumption adjustment is a two-step process. First, tax-code depreciable lives and patterns are converted to uniform service life and empirically-based depreciation patterns.

The resulting measure of "Profits after tax with IVA and CCAdj" is the NIPA earnings included in the calculation of GDI, as illustrated in Table A1. Conceptually and empirically, NIPA "Profits after tax" is closer to GAAP earnings (Hodge 2011), and therefore we adopt it for the main specifications in the paper. The properties of "Profits after tax with IVA and CCAdj" are explored later in the robustness checks. All variables used in the study are also summarized in Appendix C.

Data for GAAP earnings is from Net Income for U.S. firms on Compustat. Since NIPA earnings are aggregate, GAAP earnings are aggregated as well, where earnings at the firm-year level are summed up across firms to produce one earnings observation at the year level. Aiming to maximize the time series, we use all available data in the interval 1950-2016. The starting date of 1950 is chosen because the U.S. government greatly expanded and improved NIPA accounting during World War II, and also because Compustat GAAP coverage becomes wide enough at about that time. One issue to keep in mind is that the GAAP sample coverage varies considerably over time, starting with only around 600 firms in the early 1950s, climbing to 4,000 in 1970 and 6,000 in 1980, hitting highs of over 9,000 firms in the 1990s, and subsiding to about 6,000 firms in the late 2000s. Since we use aggregate earnings, however, and the largest and earliest-covered firms are so much larger than the rest, this uneven coverage is less of a problem than one might expect. Specifically, to provide some feel for the effect of thin coverage in the early years, for each year we calculate the ratio of aggregate Net Income for the largest 500 firms (by Sales) to aggregate Net Income for all available firms. The average of this ratio over the years is 82%, and the

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Specifically, depreciation patterns are based on actual prices of used equipment, and thus approximate the "true" diminution of value of long-term assets; empirically, the patterns of depreciation indicate a geometric decline in asset value (i.e., similar to double-declining balance or sum-of-the-years' digits methods of depreciation). Note also that this adjustment removes the inconsistent and somewhat capricious nature of tax depreciation rules. For example, as part of the Job Creation and Worker Assistance Act of 2002, businesses were allowed to depreciate a "bonus" amount during the first year of depreciable lives, over and above regular tax depreciation, which leads to overstated tax depreciation in the first year, and understated tax depreciation in subsequent years. The CCAdj unravels such effects of bonus depreciation or other deprecation-distorting rules. Second, the CCAdj removes from profits capital gain or loss-like elements resulting from using equipment at historical cost vs. current cost.

ratio falls below 70% in only one year, which suggests that uneven sample coverage is not overly influential.[8] Robustness tests later in the paper provide further evidence on the effect of sample coverage in GAAP earnings.

One point that is also useful to keep in mind is that GAAP earnings are designed to reflect individual firm performance, and therefore aggregating them and comparing them to economy-wide NIPA earnings necessarily has some limitations. Nevertheless, there is a variety of sources that use aggregate GAAP earnings information, and apparently such aggregation is useful. For example, analysts commonly discuss industry earnings, and the S&P 500 earnings metric is a widely watched gauge of corporate profitability. In addition, a number of recent studies use aggregate GAAP earnings, and document considerable information content for such specifications. For example, Konchitchki and Patatoukas (2014a, 2014b) use aggregate GAAP earnings to forecast GDP growth, Kothari, Shivakumar, and Urcan (2013) find that aggregate earnings surprises predict future inflation, and Gallo, Hann, and Li (2016) document that the Fed's monetary policy reacts to aggregate earnings. Thus, existing research and practice suggest that aggregate GAAP earnings is a meaningful measure of corporate profitability.

Data for NIPA earnings is from the BEA website, http://www.bea.gov/iTable, using the definition of NIPA earnings for U.S. companies that includes the effect of foreign operations, to allow for apples-to-apples comparisons with Net Income for U.S. firms, specifically the data is from NIPA Table 1.12 (National Income by Type of Income). Since NIPA earnings are based on tax returns, sample coverage is much broader than that of Compustat, including a vastly greater number of smaller and private corporations, e.g., from 5.9 million corporate tax returns filed in 2007 (Hodge 2011). As explained earlier, NIPA earnings are estimated on a different and temporary basis for the most recent two years, and

[8] There are several years in which this ratio exceeds one, with an extreme of 11 in 2001 because the earnings of small firms drop off so much more during recessions. To eliminate the effect of such skewness, ratios of more than one are set to one in this calculation.

therefore the sample finishes in 2016. Sample coverage for NIPA earnings also changes over time but since tax return coverage is by nature comprehensive and mandatory, the changes are mostly driven by real changes in the business environment and tax treatment, for example the rise in the number of S corporations (Mead, Moulton, and Petrick 2004). Since data are not readily available, it is difficult to estimate the relative weight of public vs. private corporations in NIPA earnings, and thus there are some caveats in comparing NIPA earnings for all corporations to GAAP earnings for public corporations only. Nevertheless, some results from other studies suggest that the earnings of public corporations dominate. For example, Lisowsky and Minnis (2013) estimate that business income for all private companies with more than $10 million in assets (including partnerships and sole proprietorships) is $236 billion in 2010, while total NIPA earnings is over $1.4 trillion in 2010. Thus the comparison between NIPA and GAAP earnings seems reasonable.

Figure 1 provides a graphical view of the data, with aggregate NIPA and GAAP earnings plotted over time. The lines depicting NIPA and GAAP earnings indicate comparable empirical magnitudes for these measures, although NIPA earnings tend to be higher (as would be expected by the much more comprehensive NIPA coverage). There is a decisive difference, however, between the two earnings series in the second part of the sample period. While the two lines track each other closely until about the late 1980s, GAAP earnings becomes much more volatile than NIPA earnings thereafter. Note that even in the latter period GAAP and NIPA earnings seem to move together. But the swings in GAAP earnings are much more pronounced, with amplitudes that are times larger than those for NIPA earnings.

One shortcoming of Figure 1 is that it plots raw aggregate earnings, and due to the effect of compound growth over 66 years meaningful differences in early periods may fail to appear because of scaling. Since earnings growth is exponential, one way to handle this

issue is to plot the same time series with a log10 Y-axis, as depicted in Figure 2. An inspection of Figure 2 indeed reveals some insights, which are not apparent from the specification in Figure 1. One impression is that NIPA earnings (and to a lesser extent GAAP earnings) is reasonably close to a straight line, which indicates that the rate of long-run earnings growth has been relatively stable. Another insight is that GAAP earnings is lower than NIPA earnings during the early years but the gap steadily decreases and nearly disappears by about 1970. The most likely reason for this early difference is that, as discussed earlier, Compustat covers only about 600 firms in the 1950's but coverage greatly expands to about 4,000 firms in 1970. Note that while there is some difference in early magnitude, the two series closely track the same fluctuations until about the late 1980s. Finally, the message that GAAP income had become much more volatile than NIPA income in the latter half of the sample is emphatically confirmed in Figure 2.

While the graphical presentations in Figures 1 and 2 provide an intuitive feel for the data, a disadvantage of working with aggregate raw earnings in a long time-series is that the variable is clearly non-stationary, which creates problems in interpretation and statistical testing. One common way to deal with great differences in magnitudes across firms and time is to use scaled earnings, e.g., accounting researchers typically use earnings scaled by equity or assets. These scalars, however, are not available for NIPA earnings, and the few reasonable candidates in the NIPA system (e.g., GDP) do not have a natural equivalent in GAAP accounting. We deal with this issue by using log earnings changes (similar to Sadka 2007), specifically we define:

$$\Delta Earnings_t = \log10(Earnings_t/Earnings_{t-1})$$

where the logging takes care of the scale issue plus imparts some useful properties used in later tests.[9] In robustness checks later in the paper, we also explore GDP and aggregate market value as alternative common deflators for NIPA and GAAP earnings.

The resulting earnings changes are graphed in Figure 3. An examination of Figure 3 reveals that the earnings change variable is much more stationary, and generally allows more comparability over time. The principal insights from the levels specifications in Figures 1 and 2 are confirmed, however, and are arguably even clearer here. NIPA and GAAP earnings changes closely track each other until about the late 1980s but there is a dramatic divergence of behavior thereafter. Note that there is hardly any visible change in the behavior of changes in NIPA earnings in the late years as opposed to early years. In contrast, GAAP earnings changes become much more volatile in the second half of the sample period, both with respect to their NIPA contemporaries, and with respect to GAAP earnings in the early years of the sample.

To confirm and expand on the preceding graphical representations, following are more formal analyses of the data. Table 2 presents descriptive statistics for NIPA and GAAP earnings changes, and the correlations between them. Given the dramatically different behavior of GAAP earnings since about the late 1980's, the sample is split into two equal-sized time periods, 1951-1983 and 1984-2016, to explore and test these differences. An examination of the descriptive statistics in Panel A of Table 2 largely confirms the impressions from the Figures. NIPA and GAAP earnings changes have similar properties during 1950-1983, with nearly identical standard deviations, and extremes of the empirical

[9] Using change in earnings scaled by beginning earnings or scaled by the average of beginning and ending earnings produces similar results. The major difference is much bigger outliers in these alternative specifications.

distributions. GAAP earnings changes have a higher mean but the difference is not statistically significant.[10]

The behavior of NIPA and GAAP earnings changes sharply diverges in the latter half of the sample, however. While means are nearly the same, the standard deviation of GAAP earnings changes at 0.504 is more than 10 times the value of 0.047 in the early years, and this difference is highly statistically significant (p-value < 0.001). Note that while the standard deviation of NIPA earnings changes has increased in 1984-2016 as compared to 1951-1983, this difference is small (0.054 vs. 0.051), and is not statistically significant. Thus, if one considers NIPA earnings the benchmark for corporate profitability, the message is that the empirical properties of corporate earnings have been relatively stable over the last 66 years. The signal from GAAP earnings is quite different, however, indicating a sea-change in the volatility of corporate earnings in the last 20 to 30 years. Thus, the decision which earnings signal to rely on is rather consequential.

Panel B of Table 2 presents the Pearson correlations of NIPA and GAAP earnings changes over the two sample periods.[11] The results in Panel B confirm the impressions from Figure 3, with starkly different measures of co-movement over the two periods. The correlation over 1950-1983 is remarkably high at 0.904, indicating a nearly lock-step evolution of earnings across the two accounting systems. But this correlation tumbles to 0.392 over 1984-2016, reflecting much diminished agreement about the underlying changes in recent corporate profitability. Not surprisingly, the difference in the correlations across the two sample periods is highly statistically significant (p-value < 0.001).

Turning back to Figure 3, note that it is not just that GAAP earnings are becoming very volatile in the later years; the point is that this volatility is driven by rapid reversals,

[10] The higher mean for GAAP earnings changes captures the fact that GAAP earnings start considerably lower than NIPA earnings in 1950 but nearly catch up in magnitude by 1970. As previously discussed, the main explanation is likely the substantial expansion of Compustat coverage from 600 to 4,000 firms over these 20 years.

[11] Results for Spearman correlations are similar but the identified differences are less pronounced.

where great dips in earnings are immediately followed by opposing and offsetting spikes, especially in the two economic downturns in the early and late 2000s. This rapid reversibility is the signature of transient effects, which in this case is most likely due to the effect of deep write-offs and other asset devaluations during recessions, closely followed by earnings recoveries to normal levels. This observation motivates the tests in Table 3, which explore for predictable reversals in earnings changes, i.e., for negative autocorrelations in earnings changes.

Specifically, Panel A in Table 3 presents the results of a regression of current earnings changes on the five preceding earnings changes, for NIPA and GAAP earnings, and for both sample periods. Results in the panel reveal no evidence of reversibility during 1951-1983, for either NIPA or GAAP earnings; the coefficients on past earnings changes are small in absolute magnitude, and none of them is close to statistical significance. The evidence for NIPA earnings changes during 1984-2016 reveals no reliable signs of reversibility either. The results for GAAP earnings changes during 1984-2016, however, reveal clear evidence of earnings reversibility. All five regression coefficients are negative and large. In addition, the adjusted R^2 is 0.38, indicating that 38% of GAAP earnings changes reverse within 5 years.

To further assess the reversibility of earnings changes, Panel B in Table 3 presents the results from an actual-to-implied variance specification. The inspiration for this specification is from French and Roll (1986), based on the observation that stock returns should be serially independent in efficient markets, i.e., stock prices should behave as random walks and have persistence of one. The implication is that if stocks follow a random walk the variance of stock returns should grow linearly over the length of the return horizon, e.g., the implied variance of weekly returns is seven times the variance of daily returns. The implied variance of stock returns can then be compared to the actual variance as a test of the

random walk hypothesis, e.g., if the actual variance of weekly returns is lower than the variance in weekly returns implied by the variance in daily returns, the conclusion is that daily stock returns are negatively autocorrelated within the weekly horizon.

This intuition is useful here because perfectly persistent earnings are random walks, and therefore the ratio of actual-to-implied variances of earnings changes can be used to gauge the deviation from perfect persistence. The advantage of this specification is that it succinctly captures reversibility at various horizons, and indicates not only direction but also the magnitude of reversibility. For example, if the actual-to-implied earnings variance ratio is 0.75, this indicates that earnings are reversible, and about 25% of earnings variance is transient (since the expectation for this ratio is 1 under the null of perfect persistence). The specification in Panel B of Table 3 uses five-year horizons, so the results are to be interpreted as capturing earnings reversibility within five years (untabulated results for three-year horizons have the same tenor). Since the sample is rather short, we use overlapping five-year observations, which allows us to retain a total of 57 observations, split between 29 observations for the 1950-1983 period, and 28 observations for the 1984-2016 period.

An inspection of the results in Panel B of Table 3 reveals that NIPA earnings are highly persistent, consistent with the evidence of absence of autocorrelations in NIPA earnings changes in Panel A. The actual-to-implied ratio for NIPA earnings is 0.87 and 0.95 in the two periods, respectively, which indicates that only about 5-13% of NIPA earnings changes reverse over five-year horizons. The actual-to-implied ratio is also remarkably stable over the two periods, consistent with earlier evidence that the properties of NIPA earnings are largely the same over time. In contrast, GAAP earnings changes have a larger reversibility component, and the reversibility is much larger during 1984-2016. The actual-to-implied ratio is only 0.35 during 1984-2016, which indicates that nearly two thirds of GAAP earnings changes reverses over five-year horizons. This evidence is consistent with

the strong evidence of reversibility of GAAP earnings changes in Panel A, and with existing research that has documented a large decrease in the persistence of GAAP earnings over time (Dichev and Tang 2008). The novelty here is better calibrations of magnitude, and most importantly, the complete lack of such deterioration of persistence in the benchmark NIPA earnings.

Finally, a consideration of the combined results in Tables 2 and 3, together with the visual evidence in Figures 1 and 2, reveals that that the great increase in volatility and reversibility of GAAP earnings during 1984-2016 is mostly due to pronounced dips and recoveries during and around recessionary periods (1990-1992, 2000-2002, and 2008-2010). This pattern of results suggests that the increased volatility is likely due to the effect of massive write-offs, write-downs and other one-time charges during such periods, and more evidence later in the paper is consistent with this conjecture.

Just having economic downturns is not enough of an explanation, however, considering that the there were more recessions in the earlier period, and the severity of the recessions is roughly the same across the two periods. Specifically, Table 4 presents NBER data on recession frequency, duration, and severity; the first period has 7 recessions, a total of 77 recessionary months, and a mean decline in GDP from peak to trough of -2.4% vs. 3 recessions, a total of 34 recessionary months, and mean decline in GDP of -2.0% from peak to trough in the second period. Thus, the effect of recessions *per se* cannot explain the temporal patterns in GAAP earnings.

4. Robustness checks and extensions

In this section, the main results are extended in three directions. One extension is to check the results for the use of Earnings before Special items and Operating Income Before Depreciation (EBITDA) instead of Net Income. The motivation is to explore alternative

definitions of GAAP Earnings, and to provide evidence about the components of earnings that account for the increase in volatility and reversibility of Net Income changes during 1984-2016. The second extension is to explore the use of the other major measure of NIPA earnings, "Profits after tax with IVA and CCAdj." As discussed earlier, this measure essentially revalues depreciation and inventory expenses to current costs. The advantage of using this measure is that it is the bottom-line NIPA metric included in the actual computation of GDP; a disadvantage is that it is by design less comparable to GAAP earnings (Hodge 2011). Finally, we explore the behavior of GAAP revenue and cash flow from operations (CFO) across the two sample periods to provide further evidence on the relative effect of real-economy vs. accounting factors. The intuition for cash flows is that they are nearly immune to changes in the GAAP accounting rules and their application, and thus their evolution reflects mainly economic effects. Due to data limitations, cash flows from operations are only available since 1971.[12] The consideration of revenue is also helpful because revenue is more directly tied to economic fundamentals than net income, avoiding layers of discretion related to expenses. In addition, U.S. GAAP revenue recognition rules have been nearly the same over time, at least at the broad conceptual level.[13]

The five additional variables identified above are combined with the original two for a comprehensive consideration. For parsimony, the presented results are limited to the most relevant specifications, with Panel A in Table 5 presenting the standard deviation for all

[12] Cash flow from operations is from the Statement of Cash Flows after 1987. Before 1987, cash flow from operations is estimated from the Statement of Funds Flows as funds from operations minus the changes in working capital excluding cash and short-term debt (Bowen, Burgstahler, and Daley 1986).

[13] U.S. GAAP abounds in detailed rules about revenue recognition for specific industries, businesses, and transactions, e.g., revenue recognition in the construction industry or revenue recognition for transactions with multiple deliverables, and there has been much change in these specific rules. But the broad conceptual underpinnings of revenue recognition have never changed until the recent joint FASB/IASB project on revenue recognition, which was completed in May 2014.

seven measures across the two sample periods, and Panel B presenting the Pearson correlations among them.

The first impression from Table 5 is that NIPA Earnings (used in the main tests) and NIPA Adjusted Earnings (including the inventory and capital consumption adjustments) are distinct measures of corporate profits, and NIPA Earnings is indeed closer to GAAP earnings. The correlation between NIPA Earnings and NIPA Adjusted Earnings is 0.66 and 0.85 over the two sample periods, implying that the inventory and capital consumption adjustments make a material difference in the resulting measure of profits. Notice, however, that the standard deviations of earnings changes are roughly the same over the two NIPA measures and over the two sample periods, spanning a tight interval between 4.4% and 5.4%. The implication is that while the two NIPA measures are materially different, there is a certain stability in their relation, both in correlations and volatility, which is mostly lacking in the comparisons among GAAP measures considered here. Of the two NIPA measures, NIPA Earnings is closer to GAAP measures of earnings, with much higher correlations to GAAP Earnings and GAAP Operating Income in the first period, in line with expectations and existing research (Hodge 2011); this distinction, however, significantly deteriorates in the second half of the sample. Thus, the choice of NIPA Earnings as the NIPA variable for the main tests seems appropriate. Whether NIPA Adjusted Earnings offers some advantages over NIPA Earnings, especially in light of the interesting inventory and capital consumption accruals, is a possible venue for future research.

The second impression from the two panels of Table 5 is that the empirical behavior of GAAP Income Before Special Items, and EBITDA is quite different from that of GAAP Earnings (Net Income). Notice that the standard deviation of EBITDA stays roughly the same across the two sample periods, in contrast to the great increase for GAAP Net Income. The standard deviation of GAAP Income before Special Items significantly increases across

the sample periods but the increase is less than double as compared to the ten-fold increase in GAAP Earnings. In addition, while there is some attenuation in the relation between NIPA Earnings and these two alternative definitions of GAAP earnings over the two sample periods, the attenuation is economically small. The totality of these results implies that special and one-time items are the primary driver of the deteriorating correlation between NIPA Earnings and GAAP Net Income. Other items like interest income and expense, other non-operating income, and depreciation also play a role but it is secondary.

Finally, the consideration of aggregate GAAP Revenue and Cash Flow from Operations confirms that economic fundamentals are unlikely to fully account for the changing properties of GAAP Net Income. The standard deviations of these two variables are nearly identical over the two sample periods in Panel A, while their relation with GAAP earnings substantially deteriorates over time in Panel B of Table 5. A graphic view of this evidence is presented in Figure 4, plotting the log10 levels of aggregate GAAP Net Income, Cash Flow from Operations, and Revenue. Similar to Figure 2, GAAP Net Income is rising comparatively smoothly during the yearly years, with much more volatility since about the mid-1980s. In contrast, Cash Flow from Operations and Revenues rise at a similar pace as Net Income but there is no visible difference in smoothness between the early and late years.

We have also conducted several additional extensions and robustness checks, with results not tabulated but briefly discussed here. First, we explore the effect of changing sample composition in Compustat because, as discussed earlier, the sample varies between 600 and 9,000 firms over 1950-2016. Specifically, we check whether the tenor of the results changes by using a more consistent sample of the 500 largest firms (by Sales) as compared to all available firms in the main tests. We find that GAAP Earnings (the variable for all firms) and GAAP 500 Earnings (the variable for the largest 500 firms) have almost identical correlations with NIPA earnings over the two sample periods. Second, we explore

definitions of earnings changes deflated by GDP and aggregate market value (instead of using log changes as in the main results). Overall, the pattern of the identified results remains similar. Third, we explore the effect on the results from eliminating years 2000-2003 and 2006-2008, where the recessionary dips in GAAP earnings are the most pronounced.[14] As one would expect, the results are more muted for this specification. But even with the elimination of these extreme years, the standard deviation of GAAP earnings increases six-fold over the two periods, while the standard deviation of NIPA earnings remains roughly the same. Finally, we explore the intuition that financial firms hold assets and liabilities, which are more affected by the broad push for more fair-value accounting rules.[15] We find that when we exclude financial firms from the sample, the tenor of the results remains the same but magnitudes are more muted. Thus, the combined evidence of the paper suggests that while the identified effects have a broad reach, there are more concentrated in some components of income (special and non-operating items), and for some firms (financial firms).

5. Discussion of the results

One message of this study is simply the broad utility of NIPA earnings as a benchmark for GAAP earnings. Both NIPA and GAAP earnings reflect corporate profitability but in different ways, which allows for a variety of potentially useful investigations. This study is one take on these differences, using the empirical properties under the two systems to draw conclusions about the changing nature of GAAP earnings.

[14] The removal of recessionary periods has an appeal in terms of identifying whether the documented effects are more or less temporally concentrated. However, it also has some limitations, essentially risks of "throwing out the baby with the bathwater" effects. The point is that the intertemporal settling-up of accruals creates substantial problems of interpretation when eliminating only some extreme periods. To illustrate, suppose that the severe write-offs of PPE in recessionary periods are at least to some extent a catch-up effect from previous periods' too-optimistic low depreciation or they clear the decks for future low depreciation. Thus, the too-high earnings before and after the recession are tightly related to the too-low earnings in the recession, and so eliminating the recessionary periods distorts this necessary relation.

[15] A referee provided this insightful suggestion.

But the possible interactions of NIPA and GAAP earnings comprise a much broader landscape, which remains largely unexplored. For example, an interesting feature of NIPA data is that while preliminary estimates of NIPA earnings are released soon after the fiscal period-end, these estimates are revised several times due to the arrival of later and better information until final estimates are recorded about two years after the relevant period. Since GAAP earnings are based on estimates like the provision for bad debts but these estimates are never revised based on later information, the investigation of NIPA revisions could be informative about the pros and cons of using estimates in the determination of earnings.

Turning to more specific implications, the main message of this study is that economic fundamentals are unlikely to fully account for the well-documented temporal changes in GAAP earnings (greatly increased volatility and decreased persistence). NIPA earnings, which are derived under consistent accounting rules, show little change in behavior over the two examined periods, 1950-1983 and 1984-2016. In contrast, during this time span GAAP rules have changed from "generally-accepted" norms favoring historical costs and matching to a much more formal and structured FASB-led standard setting, which favors balance sheet orientation, and the associated frequent changes in asset values manifesting as transient items in earnings. Note that the evidence in this study points specifically to such items as the biggest factor that explains the increased volatility in GAAP earnings, and their decreased correlation with NIPA earnings over the second half of the sample. In addition, the recent dissonance between GAAP and NIPA earnings is mostly concentrated during economic downturns, while as shown in Table 4 there is little difference between the frequency and severity of downturns during the two sample periods. This pattern seems telling because the GAAP asset revaluation rules have the most bite during recessions, producing the transient items that increase GAAP earnings volatility and

decrease persistence. Thus, the evolution of GAAP rules seems to be a significant factor in the changing properties of GAAP earnings.

Of course, whether the evolution of GAAP accounting has been a net positive or negative is not clear from these results, and is ultimately beyond the confines of a single study. There are good reasons to believe that the evolution of GAAP rules has brought important benefits, for example more timeliness in earnings, and more uniformity and credibility in the application of the rules. In addition, there is evidence that the decline in the informativeness of earnings has been compensated by an increase in the informativeness of assets and liabilities (Collins, Maydew, and Weiss 1997). What is also not clear is the role of managerial behavior as likely enabling and magnifying the effect of the changing accounting rules favoring frequent asset revaluations. But with these qualifications in mind, the impression is that there has been deterioration in the information content of GAAP earnings as a guide to future recurring income, and this deterioration is mostly due to the rise of one-time and non-operating items. Such evidence is consistent with other research that documents a temporal decline in the informativeness of earnings (Ryan and Zarowin 2003, Francis and Schipper 1999, and Ely and Waymire 1999).

Note that the heuristic solution of eliminating one-time items from GAAP earnings, and/or focusing on some measure like Operating Income or EBITDA is not satisfying. Existing research suggests that one-time items are often a re-packaging or re-shuffling of regular expenses within or across periods (Burgstahler, Jiambalvo, and Shevlin 2002, Doyle, Lundholm, and Soliman 2003, McVay 2006). For example, a write-down of PPE may be driven by unforeseen technological obsolescence – but it may also be the catch-up effect of insufficient past depreciation, and the saving of future depreciation. Thus, the simplistic removal of one-time items obscures the assessment of not only current but also past and future profitability. And this problem is especially acute in the presence of large one-time

items, which is exactly the case in recent years. For the same reasons, one cannot just ignore the "bad" years in GAAP income, and focus on the "good" years as a guide to regular profitability. The point is that good and bad years are inextricably linked by the intertemporal allocation of accruals and income, and thus estimates of long-run profitability are both overstated and muddled when ignoring bad years.

In any case, the more important question is what can be done about improving the informativeness of GAAP earnings in assessing long-run profitability. There can be, of course, more far-reaching solutions to this problem, which involve changing the nature of GAAP standards and changing managerial incentives but such solutions are beyond the scope of this paper. The main interest here is on fairly low-cost changes, which fall in the proper domain of accounting, and provide minimal disruption to existing institutional arrangements.

One direction for such improvement is to provide better information about the critical difference between operating and asset-revaluation accruals. The point is that operating accruals that result from the normal and ongoing operations of the company (e.g., depreciation, and changes in accounts receivable, inventories, and accounts payable) are quite different in nature and in their implications for the volatility and persistence of earnings from asset-revaluation accruals, which result from external price changes, and are to a large extent accidental to company operations (fair value changes, asset write-offs, actuarial pension accruals). And perhaps this is precisely the lesson from NIPA accounting because NIPA profits are squarely about "profits from current production", i.e., profits from real operations, discounting the effect of changing prices and asset re-valuations either by ignoring them (gains and losses on disposals of PPE) or specifically adjusting for them (the inventory and capital consumption accrual). The good news is that GAAP can provide such

information simply by better presentation on the income statement or better disclosure, without really changing the existing accounting rules.

Another possible direction for improvement could be more clear delineation and quantification of the role of discretion in financial reporting. Managerial discretion is a key difference in the determination of NIPA and GAAP earnings, so it is probably related to the difference in reported numbers as well. The first step in identifying such discretion already exists. Since the early 2000s the SEC has required a discussion of "critical accounting estimates" as part of the MD&A. A way to enhance and empower such disclosures is to ask for a quantification of critical accruals, including a reconciliation of estimates and their eventual realizations. For short-term estimates, such reconciliation would bring into sharp focus possible aggressive accounting, for example, reversals of aggressive estimates of M&A integration costs will be clearly flagged as different from operating earnings. Longer-term estimates are more problematic because the resolution of estimates takes a while, and the distinction between aggressive accounting and unforeseen circumstances is murkier. But a reconciliation of long-term estimates can be still helpful because it will highlight the very nature of long-term accruals and the fact that certain estimates (and components of earnings) are "softer" than others.

6. Conclusion

This study investigates the use of NIPA earnings as a benchmark for GAAP earnings over 1950-2016. NIPA earnings offers two unique advantages as a measure of corporate profits: consistent accounting rules over time, and near-absence of managerial discretion. The main finding is that NIPA and GAAP profits closely track each other over the early years of the sample but this relation dramatically weakens during the most recent 20 to 30 years. While the properties of NIPA earnings remain largely the same over time, GAAP volatility increases tenfold, mostly due to the effects of transient items during economic

downturns. Additional results indicate that the frequency and severity of recessions is roughly the same across the two examined periods, and that the behavior of cash flows from operations and revenues are little changed over time. The resulting impression is that changing economic fundamentals are unlikely to fully account for the changing secular properties of GAAP earnings. Changing GAAP rules and their application seem to be a significant factor, especially those that allow or mandate various assets revaluations, which in turn manifest as transient items in earnings.

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Appendix A

Table A1: Excerpt from NIPA Table 1.10 for year 2010, illustrating how the NIPA measure of corporate profits fits in within the derivation of total Gross Domestic Income, all amounts in $ billion

Line	Account title	GDI and major components	Sub-components	Sub-sub-components
1	Gross domestic income	14,915.2		
2	Compensation of employees, paid	7,969.5		
3	Wages and salaries		6,385.6	
4	To persons			6,371.6
5	To the rest of the world			14.0
6	Supplements to wages and salaries		1,583.9	
7	Taxes on production and imports	1,057.1		
8	Less: Subsidies	(55.9)		
9	Net operating surplus	3,562.8		
10	Private enterprises		3,585.7	
11	Net interest and miscellaneous payments, domestic industries			670.6
12	Business current transfer payments (net)			128.5
13	Proprietors' income with inventory valuation and capital consumption adjustments			1,032.7
14	Rental income of persons with capital consumption adjustment			402.8
15	**Corporate profits with inventory valuation and capital consumption adjustments, domestic industries**			**1,351.2**
16-19	……..			
20	Current surplus of government enterprises		(22.9)	
21	Consumption of fixed capital	2,381.6		
22	Private		1,923.5	
23	Government		458.1	
	Addendum:			
24	*Statistical discrepancy*	*49.2*		

Data is from NIPA Table 1.10 "Gross Domestic Income by Type of Income". Table A1 strives to reflect the structure of the original NIPA table but has been reformatted and shortened for clearer presentation. The table starts with total Gross Domestic Income at the top of the first data column, with the underlying major components listed below, where the components below add up to Gross Domestic Income at the top. Breakdowns of the major components are presented in subcomponent hierarchies to the right. For example, Wages and salaries "To persons" and "To the rest of the world" add up to "Wages and salaries", which added to "Supplements to wages and salaries" rolls up to "Compensation of employees, paid." Lines 16-19 in NIPA Table 1.10 introduce two further hierarchies, and are here eliminated to lighten the presentation. "*Statistical discrepancy*" represents the difference between Gross Domestic Income and Gross Domestic Product, which arises because these two amounts are independently estimated from different sources, see Appendix B for further detail.

Table A2: Excerpt from NIPA Table 7.16, illustrating the derivation of NIPA profits and taxes from corresponding IRS measures for year 2010, amounts in $ billion

Total receipts less total deductions, IRS	***1,254.2***
Plus:	
Adjustment for misreporting on income tax returns	401.5
Posttabulation amendments and revisions	78.6
Income of organizations not filing corporation income tax returns	84.9
Federal Reserve banks	72
Interest payments of regulated investment companies	(129.7)
Bad debt expense	316.3
Less:	
Tax-return measures of:	
Gains, net of losses, from sale of property	(152.3)
Dividends received from domestic corporations	(176.1)
Income on equities in foreign corporations and branches (to U.S. corporations)	(336.1)
Plus: Income received from equities in foreign corporations and branches by all U.S. residents, net of corresponding payments	395.2
All other adjustments, total	32.2
Equals: Profits before taxes, NIPAs	**1,840.7**
Federal income and excess profits taxes, IRS	***358.4***
Amounts paid to U.S. Treasury by Federal Reserve banks	79.3
U.S. tax credits claimed for foreign taxes paid	(118.1)
All other tax adjustments, total	51
Equals: Taxes on corporate income, NIPAs	**370.6**
Profits after tax, NIPAs	**1,470.1**

Table A2 is based on NIPA Table 7.16, please see original table at http://www.bea.gov/iTable/ for full details and legend. The table has been re-formatted and shortened to compress all individual items that comprise less than 5% of the top line "Total receipts less total deductions, IRS", into two aggregate "All other adjustments" items, one for pre-tax amounts, and one for tax amounts. The table has two major parts, one for pre-tax adjustments, and one for tax adjustments. The pre-tax part starts with an IRS pre-tax category "Total receipts less total deductions", introduces various NIPA adjustments (essentially, the NIPA accruals), and arrives at the NIPA measure of corporate pretax profits. Similarly, the tax part starts with an IRS measure of taxes, makes some NIPA accruals to it, and arrives at the NIPA measure of taxes on corporate income. The IRS measures are based on aggregate tax data, and are available two years after the respective fiscal period. "Profits after tax, NIPAs" is equal to pretax NIPA profits minus NIPA taxes, and is the main measure of corporate profits used in this study.

Appendix B: More information on the relative characteristics of NIPA and GAAP earnings

An important feature of NIPA earnings is its rigorous determination and double-checks from independent sources. To illustrate, consider the bottom line in Table A1 called "*Statistical discrepancy*." This discrepancy appears because GDP is estimated in two independent ways, and there is some statistical or economic error in the resulting estimates. One approach estimates Gross Domestic Income (GDI), which shows the incomes that all economic agents derive during the current period; the other approach estimates Gross Domestic Product, which is what this income is spent on, including current consumption and business and government investment. By definition, these two approaches should produce the same estimate since the two sides of GDI/GDP reflect an accounting identity. But since the two sides of GDI/GDP are estimated independently and from completely different sources (essentially, GDP estimates are based on surveys of output, and GDI estimates are based on income data), there appears a modest discrepancy, e.g., the 49.2 number for 2010 indicates that the estimate for 2010 GDI was $49.2 billion lower than the corresponding estimate for GDP.[16] One takeaway from Table A1 is that the statistical discrepancy seems small compared to the magnitude of GDI/GDP. Turning to more systematic evidence, for the 1950-2010 period the average "Statistical discrepancy" as a percentage of GDI is 0.48%. Such statistical or economic slippage in the NIPA estimates seems rather small compared to the confidence intervals that likely prevail for GAAP numbers.[17] The upshot from the independent determination of GDI and GDP, and the small magnitude of the statistical

[16] GDP data are generally considered more reliable because they are mostly from consistent business surveys conducted by the Census Bureau, while GDI data are from a variety of sources including financial statements and data collected by regulatory and tax authorities (NIPA Handbook 2012).

[17] Specific estimates of errors or earnings management for GAAP earnings are rare. But even using a conservative definition, DGHR finds that 20% of the firms misrepresent earnings to the tune of 10% of EPS; note that this is just the intentional manipulation, not including performance signaling management or the potentially much larger category of unintentional errors of estimation.

discrepancy between them is that NIPA numbers have strong internal checks and balances to ensure that they are "correct."

Another important difference between NIPA and GAAP earnings is that GAAP earnings are anchored on realized cash flows because GAAP accruals are designed to true up to the associated cash flows.[18] For example, a firm can temporarily increase earnings by understating warranty expense. But by the nature of GAAP accruals, eventually there will be a catch-up effect, and long-run warranty expense converges to long-run warranty expenditure.[19] This truing-up to cash flows is absent in NIPA earnings, which often include or exclude items that have clear cash flow consequences, e.g., NIPA earnings exclude gains and losses on sales of property and securities.[20]

Further reflection reveals that the absence of truing-up to cash flows in NIPA earnings is not necessarily a hindrance, and in fact whether it is considered an advantage or disadvantage partly depends on the decision setting and the level of aggregation. Recall that NIPA earnings are defined as "profits from current production," where the idea is that from the whole economy's perspective value is added in real operations rather than in the re-shuffling of profits in transactions involving capital assets. The so-called "round-trip" transactions in capital assets provide an instructive illustration about this important distinction (e.g., the well-publicized swaps of telecom capacity between Qwest and Global Crossing). For example, assume that telecom firm A sells some PPE to telecom firm B, and soon after buys a nearly identical type and amount of PPE from the same firm B, where transaction prices on both sides exceed the cost basis. From the point of view of GAAP

[18] There are some narrow exceptions to this general intuition for GAAP accruals. For example, stock option expense does not true up to the ultimate cost of issuing options, i.e., to the difference between stock price and exercise price at exercise.

[19] Of course, when a firm is growing, there could be a large and growing disparity between cash spent and recognized expense. For example, cash spent on PPE will differ from PPE depreciation by the amount of PPE on the balance sheet, and this disparity will continue to grow for as long as the firm is growing.

[20] In that sense, NIPA earnings can be thought of as akin to "pro forma earnings", which often exclude items considered "non-operating" or "unusual", although they can have real cash flow effects. Unlike pro forma earnings, however, whose determination can be opportunistic and also inconsistent over firms and time (Doyle, Lundholm and Soliman 2003), NIPA earnings are crisply defined and temporally consistent.

accounting, narrowly interpreted, both firms record a profit, and the profit is "real" because it is backed by actual cash flows. But from the point of view of the whole economy these two transactions are a wash, and there is no profit or really any change in the firms' condition before and after the transactions (and eventually, GAAP accounting has also taken a dim view of such transactions).

The more general point is that while obvious round-trip transactions are more of an oddity at the level of identifiable firm-pairs, variations of them are common in more complicated multi-firm interactions. For example, when the stock market is booming, there is often a flurry of capital gains realizations, which makes it seem that firms are more profitable. But from the point of view of the whole economy these profits are illusory in the sense that they do not change the output and profits from continuing real operations (and become even more questionable when market prices can deviate from fundamental values). In that sense, aggregate NIPA profits correctly discount the effect of transactions in capital assets on reported profits. A more subtle point is that even at the level of the individual firm, while realized capital gains and losses are "real" in terms of cash flow realizations, they are typically transient and "illusory" in terms of the continuing productive capacity of the firm, and it is this continuing earning power that investors typically seek to find.

Appendix C: Variable definitions

Variable	Definition
NIPA ΔE_t	Earnings changes for time t (ΔE_t) are defined as log10(E_t/E_{t-1}). NIPA earnings is profits before tax without inventory valuation adjustment and capital consumption adjustment. The data is collected from BEA website Table 1.12 (National Income by Type of Income) line item 43.
GAAP ΔE_t	Earnings changes for time t (ΔE_t) are defined as log10(E_t/E_{t-1}). GAAP earnings is aggregate net income across firms in year *t*.
NIPA 5-year ΔEarnings	The ratio of actual to implied variances for 5-year NIPA earnings changes. The actual variance for five-year changes in earnings is computed as the variance of log(E_t/E_{t-5}). Implied 5-year variance is computed as five times the variance of annual earnings changes.
GAAP 5-year ΔEarnings	The ratio of actual to implied variances for 5-year GAAP earnings changes. The actual variance for five-year changes in earnings is computed as the variance of log(E_t/E_{t-5}). Implied 5-year variance is computed as five times the variance of annual earnings changes.
ΔNIPA Adjusted Earnings	The log of NIPA Adjusted Earnings changes. NIPA Adjusted Earnings is profits after tax with inventory valuation adjustment and capital consumption adjustment. The data is collected from BEA website Table 1.12 (National Income by Type of Income) line item 15.
ΔCash Flow from Operations	The log of Cash Flow from Operations changes. Cash Flow prior to year 1987 is calculated by subtracting changes in working capital, excluding cash and cash equivalents and short-term debts, from funds available from operations. Cash Flow after 1987 is operating activities net cash flow (Compustat: OANCF). The first year of Cash Flow availability is 1971.
ΔGAAP Revenue	The log of GAAP Revenue changes. Revenue represents aggregate gross sales (Compustat: SALE).
ΔGAAP Operating Income before Depreciation	The log of changes of GAAP Operating Income Before Depreciation. GAAP Operating Income Before Depreciation is aggregate GAAP operating income before depreciation (Using Compustat definition).
ΔGAAP Income before Taxes and Special Items	The log of changes of GAAP Income before Taxes and Special Items. GAAP Income Before Taxes and Special Items is the aggregate pre-tax GAAP income excluding special items (Compustat: OIADP-XINT+NOPI).

Table 1
Key differences between GAAP and NIPA Earnings

Differences	GAAP Earnings	NIPA Earnings
Prepared by	Firm managers	BEA experts
Reporting rules set by	FASB	BEA
Managerial discretion in determination	Considerable	Close to none
Political meddling in setting reporting rules	Some	None
Concept of Income	Mixed, Revenues – Expenses, adjusted for net asset changes	"Profits from current production", mostly Revenues – Expenses. Eliminates the effects of gains and losses on PPE and investments and most asset revaluations like asset write-downs.
Timeliness	Typically produced within 4-8 weeks of reporting period	Final estimates 2 years after reporting period. First estimates a month after the end of the reporting period, increasingly more precise estimates thereafter.
Revisions	Only by exception, in restatements	Routine, several revisions until finalized amounts. All amounts retroactively adjusted when BEA rules change.
Coverage	Publicly-traded companies	All corporations, including private
Audited	Yes, by public accountants	No
Internal cross-checks	Some, articulation between the balance sheet and the income statement	Extensive, as national income amounts are estimated from independent data sources on the output and the income side
Earnings true up to cash flows	Yes (with rare exceptions)	Mostly yes but with considerable exceptions. Most importantly, since NIPA earnings is "profits from current production", capital assets gains and losses are not included in income.

Table 2
Descriptive statistics and correlations between NIPA and GAAP earnings changes over 1950-1983 and 1984-2016

Panel A: Descriptive statistics for NIPA and GAAP earnings changes, by period.

Period 1: 1951-1983

ΔE_t	N	Mean	Std Dev	Minimum	Maximum
NIPA	33	0.026	0.051	-0.066	0.117
GAAP	33	0.039	0.047	-0.064	0.120
p-value on difference		*0.286*	*0.616*		

Period 2: 1984-2016

ΔE_t	N	Mean	Std Dev	Minimum	Maximum
NIPA	33	0.029	0.054	-0.085	0.117
GAAP	33	0.024	0.504	-1.673	1.533
p-value on difference		*0.956*	*<0.001*		

Earnings changes for time t (ΔE_t) are defined as $\log10(E_t/E_{t-1})$.

Panel B: Pearson Correlations between NIPA and GAAP earnings changes, by period.

Period	Corr(NIPA ΔE, GAAP ΔE)
1951-1983	0.904***
1984-2016	0.392*
p-value on difference in correlations across periods	*<0.001*

***, **, * denote significance at the 0.001, 0.01, and the 0.1 level, respectively. P-values on differences in means (standard deviations) are from t-tests (folded F-statistics).

Table 3
Reversibility of NIPA and GAAP earnings changes

Panel A: Regressions of earnings changes on lagged changes over 5-year windows
$$\Delta E_t = b_0 + b_1*\Delta E_{t-1} + b_2*\Delta E_{t-2} + b_3*\Delta E_{t-3} + b_4*\Delta E_{t-4} + b_5*\Delta E_{t-5}$$

Period: 1950-1983

Earnings		ΔE_{t-1}	ΔE_{t-2}	ΔE_{t-3}	ΔE_{t-4}	ΔE_{t-5}	Adj R^2
NIPA	Coefficient	0.126	-0.047	-0.122	-0.153	0.042	-0.15
	(t-stat)	*(0.60)*	*(-0.22)*	*(-0.56)*	*(-0.68)*	*(0.19)*	
GAAP	Coefficient	0.008	0.010	-0.315	-0.050	0.034	-0.12
	(t-stat)	*(0.04)*	*(0.04)*	*(-1.45)*	*(-0.22)*	*(0.16)*	

Period: 1984-2016

Earnings		ΔE_{t-1}	ΔE_{t-2}	ΔE_{t-3}	ΔE_{t-4}	ΔE_{t-5}	Adj R^2
NIPA	Coefficient	0.226	-0.231	0.007	-0.087	-0.175	
	t-stat	*(1.20)*	*(-1.25)*	*(0.04)*	*(-0.48)*	*(-0.98)*	-0.02
GAAP	Coefficient	-0.585	-0.612	-0.541	-0.461	-0.570	0.38
	t-stat	*(-3.70)*	*(-3.54)*	*(-2.98)*	*(-2.66)*	*(-3.60)*	

Regressions are run with an intercept but results on intercepts omitted here.

Panel B: Ratios of Actual/Implied Variance for NIPA and GAAP earnings changes over 5-year windows

Period	NIPA 5-year ΔEarnings	GAAP 5-year ΔEarnings
1951-1983	0.869	0.604
1984-2016	0.945	0.345

Panel B contains the ratios of actual to implied variances for 5-year earnings changes. Under the null of no serial correlation, implied 5-year variance is computed as five times the variance of annual earnings changes. The actual variance for five-year changes in earnings is computed as the variance of $\log(E_t/E_{t-5})$. Panel B contains the results for all possible 62 5-year windows, i.e., the windows are overlapping rather than independent. The 1950-1983 period contains 29 observations, and the 1984-2016 period contains 28 observations.

Table 4
NBER data on U.S. business cycle expansions and contractions, 1950-2016

Peak month	Trough month	Duration in months, peak to trough	Change in GDP, peak to trough
July 1953	May 1954	10	-2.6%
August 1957	April 1958	8	-3.7%
April 1960	February 1961	10	-1.6%
December 1969	November 1970	11	-0.6%
November 1973	March 1975	16	-3.2%
January 1980	July 1980	6	-2.2%
July 1981	November 1982	16	-2.7%
July 1990	March 1991	8	-1.4%
March 2001	November 2001	8	-0.3%
December 2007	June 2009	18	-4.3%

Period	Number of recessions	Total number of recessionary months	Mean change in GDP, peak to tough
1950-1983	7	77	-2.4%
1984-2016	3	34	-2.0%

NBER is the National Bureau of Economics Research. Data is from http://www.nber.org/cycles.html and http://en.wikipedia.org/wiki/List_of_recessions_in_the_United_States

Table 5
Volatility and correlations for changes in select NIPA and GAAP measures of earnings

Panel A: Standard deviations of changes for select NIPA and GAAP measures of earnings

Period	GAAP Earnings	NIPA Earnings	NIPA Adjusted Earnings	Cash Flow from Operations	GAAP Revenue	GAAP Operating Income Before Depreciation	GAAP Income before Taxes and Special items
1951-1983	0.047	0.051	0.050	0.069	0.025	0.037	0.051
1984-2016	0.504	0.054	0.044	0.074	0.023	0.041	0.077
p-value on difference	*<.0001*	0.796	0.483	0.845	0.664	0.563	*0.022*

Panel B: Pearson Correlations between select NIPA and GAAP earnings changes
Period 1951-1983

	NIPA Earnings	NIPA Adjusted Earnings	Cash Flow from Operations	GAAP Revenue	GAAP Operating Income before Depreciation	GAAP Income bef. Taxes and Special Items
GAAP Earnings	0.90***	0.59**	0.80**	0.39*	0.75***	0.84***
NIPA Earnings		0.66***	0.74**	0.42*	0.65***	0.79***
NIPA Adjusted Earnings			0.07	-0.02	0.40*	0.48**
Cash Flow				0.78**	0.47	0.71**
Revenue					0.58***	0.61***
GAAP Operating Income before Depreciation						0.91***

Period 1984-2016

	NIPA Earnings	NIPA Adjusted Earnings	Cash Flow from Operations	GAAP Revenue	GAAP Operating Income before Depreciation	GAAP Income bef. Taxes and Special Items

GAAP Earnings	0.39*	0.30*	-0.23	0.01	0.43*	0.61***
NIPA Earnings		0.85*** σ	-0.01 σ	0.22	0.52** σ	0.67*** σ
NIPA Adjusted Earnings			0.20	0.07	0.43*	0.59***
Cash Flow				0.31* σ	0.17	0.00 σ
Revenue					0.69*** σ	0.42* σ
GAAP Operating Income before Depreciation						0.89*** σ

Earnings changes for time t (ΔE_t) are defined as $\log10(E_t/E_{t-1})$. For any given year, GAAP Earnings is aggregate GAAP Net Income across firms for that year. NIPA Earnings is aggregate NIPA corporate profits after tax (excluding the inventory and capital consumption adjustment InvAdj). Cash Flow prior to year 1987 is calculated by subtracting changes in working capital, excluding cash and cash equivalents and short-term debts, from funds available from operations. Cash Flow after 1987 is operating activities net cash flow (Compustat: OANCF). The first year of Cash Flow availability is 1971. Revenue represents aggregate gross sales (Compustat: SALE). GAAP Operating Income before Depreciation is aggregate GAAP operating income before depreciation (Using Compustat definition). GAAP Income before Taxes and Special Items is the aggregate pre-tax GAAP income excluding special items (Compustat: OIADP-XINT+NOPI). ***,**, * in Panel B denote significant difference from 0 at the 0.001, 0.01, and the 0.1 level, respectively. P-values on differences in standard deviations are from folded F-statistics. P-values for differences in correlations across the two tables in Panel B are indicated in the second table with σ representing significance at the 5% level.

Figure 1
Aggregate NIPA and GAAP Earnings over 1950-2016, amounts in $ billion

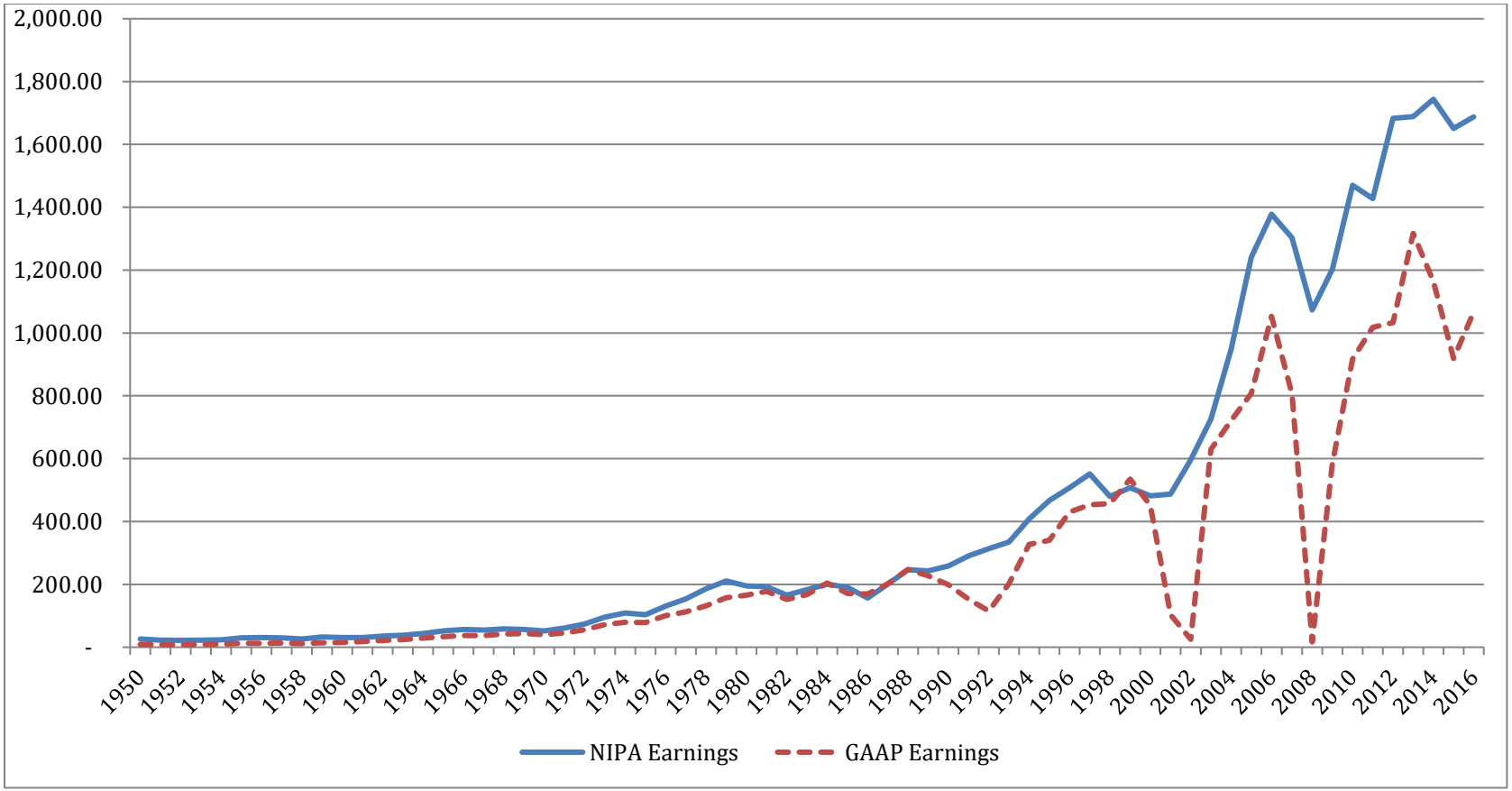


Figure 2
Aggregate NIPA and GAAP Earnings over 1950-2016, amounts in $ billion
Log10 scale on Y axis

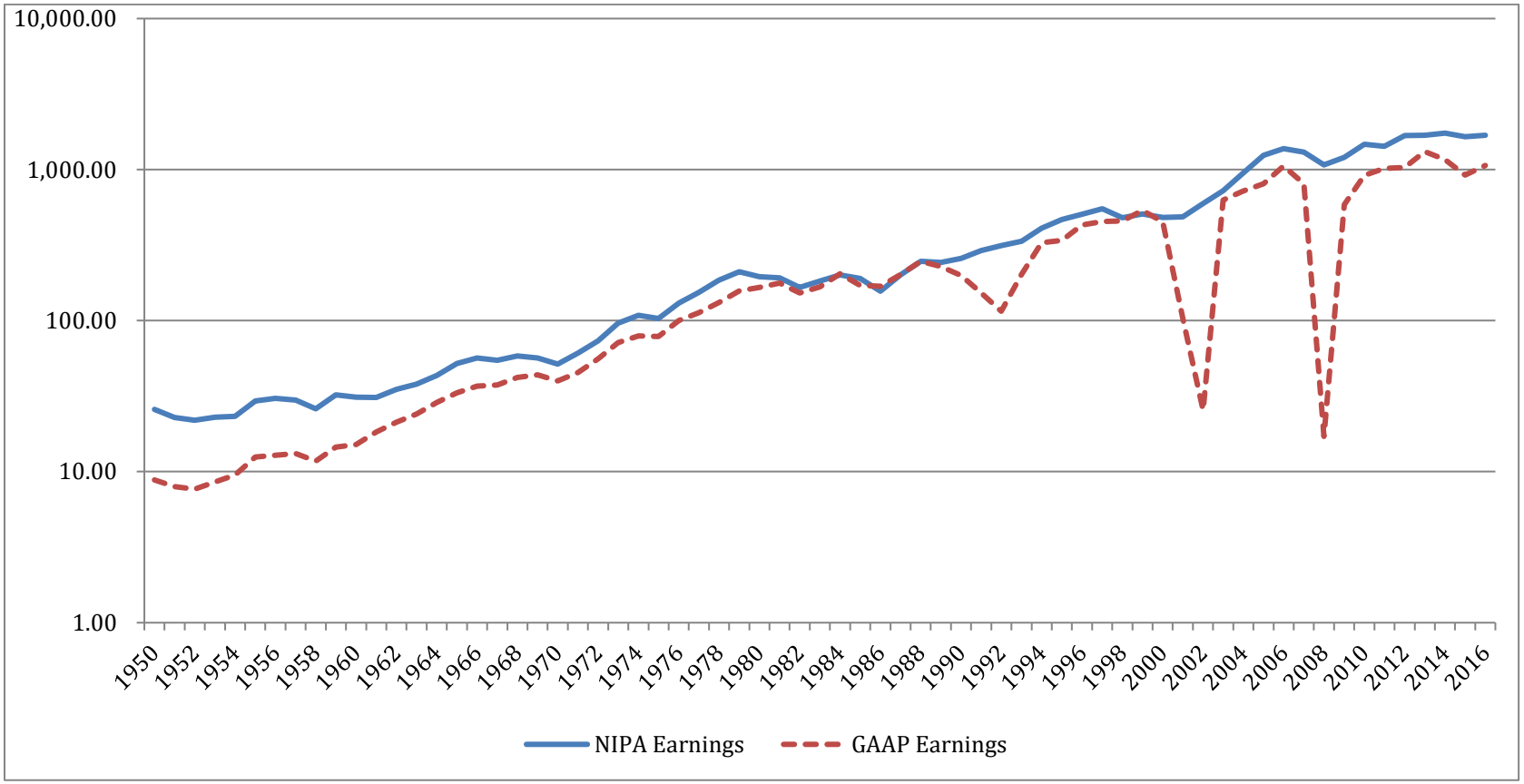
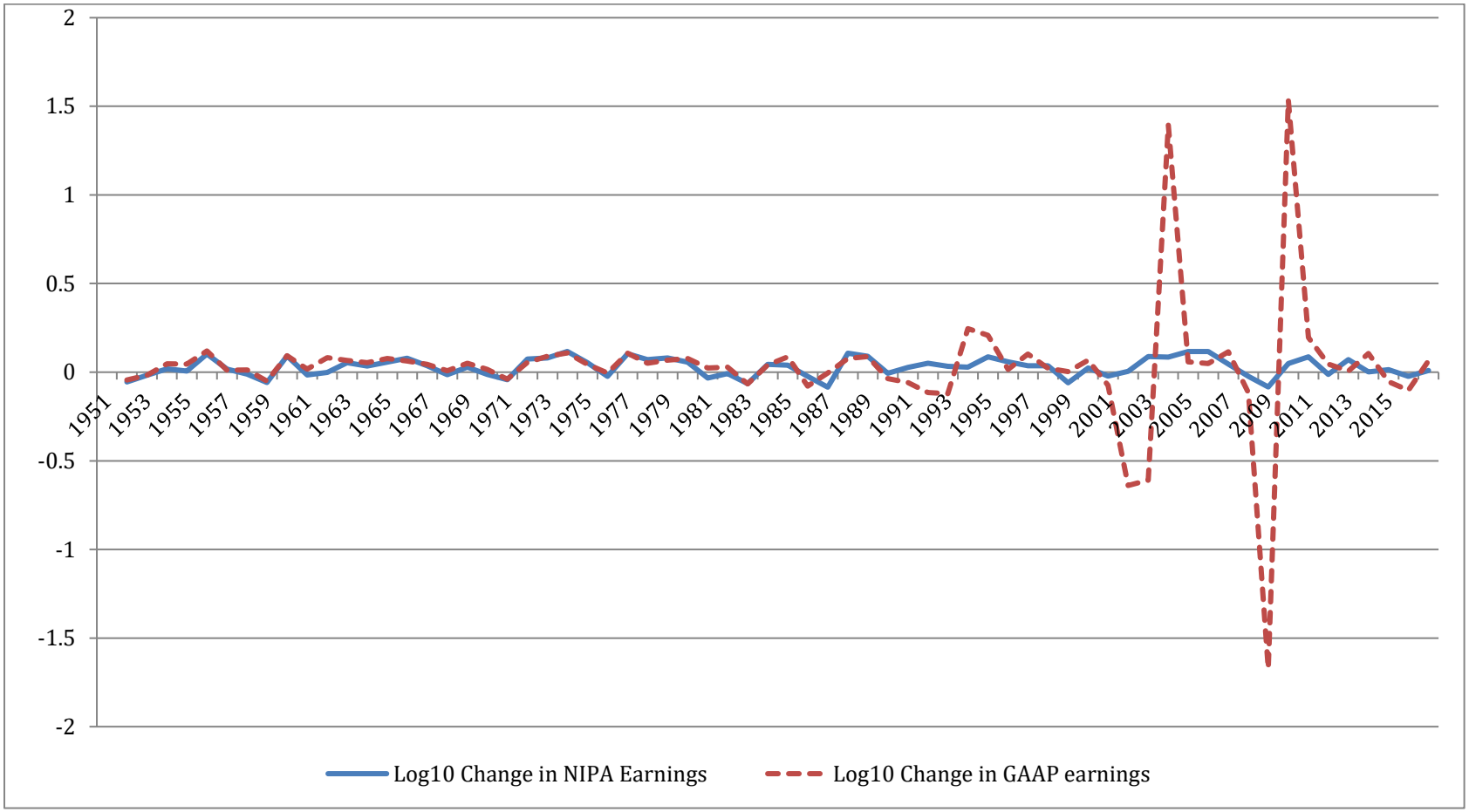


Figure 3
Log10 Changes in aggregate GAAP and NIPA Earnings over 1950-2016



Log10 changes in earnings for period t is defined as $\text{Log10}(E_t/E_{t-1})$

Figure 4
Log10 levels of aggregate GAAP Net Income, Cash Flow from Operations, and Revenue over 1950-2016