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Why Does Aggregate Earnings Growth Reflect Information about Future Inflation?

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ABSTRACT: We propose two explanations for the previously documented relation between aggregate earnings growth and future inflation: one based on firms changing their investment in response to earnings growth, and the other based on consumers varying their consumption in response to wealth effects of profitability growth. As the supply of goods and services is relatively inelastic in the short run, our arguments imply that changes to near-term demand for investment (consumption) will affect the prices of investment (consumption) goods and services. Consistent with the investment-based argument, we find that profitability changes predict investment and Producer Price Index (PPI) shifts in subsequent quarters. Our analyses also reveal that aggregate earnings growth predicts future investment and PPI forecast errors. We find, at best, weak evidence for the consumption-based link between aggregate earnings growth and future inflation.

Keywords: aggregate earnings; inflation; investments; macroeconomic forecasts.

I. INTRODUCTION

Prior studies have shown that aggregate earnings measures contain information about future inflation and future gross domestic product (GDP) growth.[1] Shivakumar (2007) documents that aggregate earnings growth is positively associated with future inflation levels. Patatoukas (2014) finds that aggregate earnings changes are positively associated with contemporaneous quarterly changes in expected inflation. Moreover, consistent with aggregate earnings providing inflation-related news to investors, Cready and Gurun (2010) document a negative relation between both stock and bond market returns and the contemporaneous earnings information measured over short event windows. Konchitchki and Patatoukas (2014a) document that aggregate earnings predict future GDP growth. Although these macro-accounting studies document important relationships, they do not explain why, or the mechanism through which, macroeconomic information and aggregate earnings growth are linked.

The current study proposes and empirically investigates potential pathways through which aggregate earnings growth is causally linked to future inflation. In so doing, we identify a common driver for both the link between aggregate earnings growth and inflation and the one between aggregate earnings growth and GDP growth. This common driver also enables us to uncover the sources of inefficiency in macroeconomists' GDP growth forecasts that was documented by Konchitchki and Patatoukas (2014a).

We offer two non-mutually exclusive hypotheses for why aggregate earnings growth predicts future inflation changes—the investment demand hypothesis and the consumption demand hypothesis. The investment demand hypothesis suggests that

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[1] Throughout, we refer to earnings aggregated across listed companies as "aggregate earnings."

aggregate earnings growth shifts the immediate demand curve for investments in inventories of goods held for resale and in goods and services needed to build or enhance a firm's operating capacity (hereafter, production goods), and that this demand shift impacts prices of production goods in the short term when their supply is relatively inelastic. In contrast, the consumption demand hypothesis predicts that aggregate earnings growth causes investors and employees to change consumption, which, due to the relatively inelastic supply of these goods in the short term, causes consumption goods' prices to adjust. The two hypotheses not only differ in the paths through which aggregate earnings growth affects subsequent inflation, but they also have different implications for which measures of inflation—the inflation of production or consumption goods—are affected by aggregate earnings. Failure to find empirical support for both of the hypotheses decreases the likelihood that the prior evidence linking aggregate earnings changes to inflation information is causal.

Using vector auto-regressions (VAR), our empirical analyses reveal that the innovations to aggregate earnings growth released over a quarter is positively correlated to subsequent quarters' innovations in macro-level investments, but is, at best, weakly related to short-term innovations in consumption-related variables (i.e., personal consumption expenditures or personal outlays). Additional Ordinary Least Squares (OLS) regressions confirm these findings in firm-level analysis. Examining the relation between aggregate earnings growth and changes in future inflation, proxied by the Producers Price Index (PPI) for production goods and by Consumer Price Index (CPI) for consumption goods, we find a positive impact of aggregate earnings growth on PPI innovations in the following one to two months. However, no significant relation exists between aggregate earnings growth and future innovations in CPIs. Also, although prior studies document a significant univariate relationship between CPI inflation and aggregate earnings growth, we document that this relation does not carry over to multivariate analyses that control for other known predictors of inflation, suggesting that the prior evidence of aggregate earnings' predictive power for CPI changes is not causal. Overall, these findings support the investment demand hypothesis, but not the consumption demand hypothesis.[2]

We next consider the evidence in Konchitchki and Patatoukas (2014a) that macro-forecasters do not fully consider the GDP growth information contained in aggregate earnings growth. As investment and consumption are the two main components of GDP, and as GDP is a nominal variable, our earlier findings raise the possibility that the GDP growth forecast inefficiency is driven by inefficiencies in forecasting macro-level investments or PPI. We test this by studying the efficiency of macroeconomists' forecasts for investment, consumption, and inflation and find that aggregate earnings changes predict errors in macroeconomists' forecasts of the subsequent quarter's investment and the next two months' PPI. No consistent inefficiency is observed for consumption or CPI forecast errors. Moreover, we find that investment and PPI forecast errors explain the ability of aggregate earnings to predict GDP growth forecast errors, suggesting that the earlier documented inefficiency in GDP growth forecasts is likely due to macro-forecasters overlooking investment and PPI information in aggregate earnings changes.

Collectively, our analyses consistently document evidence supporting the notion that firms adjust their investment plans in response to profitability growth, influencing the prices of production goods and services in the short run, and that macro-forecasters fail to efficiently incorporate this information in their forecasts. We also find that aggregate earnings growth has, at best, a weak effect on immediate demand or the prices of consumption goods. This evidence does not imply that aggregate earnings growth never affects consumption. To the contrary, our findings of increased short-term investments following positive aggregate profitability growth suggest that consumption demand is likely to increase in the future, which is needed to justify new investments. Further, consumption in the future will also increase as returns on new investments are distributed to investors. Our results simply document that in the short run, the investment channel is more important than the consumption channel to explain the link between aggregate earnings growth and future inflation.[3]

Our paper makes three main contributions. First, it identifies a causal mechanism for the previously documented relation between aggregate earnings growth and future inflation. Second, it provides a deeper understanding of the inefficiencies in macroeconomists' forecasts with regard to aggregate earnings growth. Finally, the paper shows that firms' accounting profits on an aggregate basis have real effects on the macroeconomy. Prior literature documents firm-level relation between reported profits and firms' operating and financial decisions (see, among others, Graham, Harvey, and Rajgopal 2005; Bergstresser, Desai, and Rauh 2006; Polk and Sapienza 2009). As reporting choices and earnings are known to have systematic components (e.g., Ball and Brown 1967; Leuz, Nanda, and Wysocki 2003; Burgstahler, Hail, and Leuz 2006), it is reasonable to expect such firm-level real effects to extend to the macroeconomic level. Our findings on macro-level investment and inflation effects of earnings growth confirm this implication.

Our findings also have implications for practitioners and regulators. By informing monetary authorities of the macroeconomic effects of profitability growth, this study contributes to their pursuit of organized economic growth and

[2] The documented relation between inflation and aggregate earnings growth cannot be mechanical (*viz.,* earnings being a nominal number), as the analyses focus on relations between aggregate earnings changes and innovations in future inflation.

[3] We also do not claim that the channels we examine here are the only ones through which accounting numbers could affect the macroeconomy.

controlled inflation. Understanding the channel through which corporate profitability affects future macroeconomic variables will also help macroeconomists to provide better forecasts. Although a vast literature in macroeconomics and finance has analyzed stock market reactions to macro releases and evaluated the efficiency of macro-forecasts, such studies do not consider the information about investments and prices of production goods reflected in aggregate earnings growth.[4]

The remainder of this paper is organized as follows. In the following section, we discuss the literature on the relation between aggregate earnings and inflation and present our hypotheses linking aggregate earnings growth to future inflation innovations. Section III discusses the CPI and PPI measures of inflation. Section IV explains our sample selection criteria and describes the data. Section V presents the results of our empirical analysis of aggregate earnings growth and macroeconomic activities. Section VI discusses our analyses of macroeconomic forecasts, and Section VII concludes the paper.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Although the past five decades of research in accounting, finance, and economics has closely tied accounting disclosures to firms' stock prices, the link between accounting numbers and macroeconomic information has been relatively under-studied. Early market-based accounting studies established that firm-level earnings changes have a substantial non-diversifiable component (e.g., Ball and Brown 1968), pointing to the importance of assessing the macroeconomic content of accounting numbers.[5]

The macro content of accounting numbers, although also relevant to macroeconomists, has been largely ignored by the macroeconomics literature. Empirical research in macroeconomics relies almost exclusively on the National Income and Product Accounts (NIPA) earnings produced by the Bureau of Economic Analysis as the measure of U.S. corporate profitability.[6] However, NIPA earnings suffer from a variety of drawbacks for short-term analysis, including that the numbers are based on taxable profits that do not necessarily align with firms' economic activities, are available only on a quarterly or annual basis, and are restated for several quarters past their initial release date. Possibly due to these limitations, we could not find any empirical study in the macroeconomics literature that evaluates how corporate profitability growth affects future macroeconomic activities.

Literature Linking Aggregate Earnings to Inflation

Accounting earnings is a nominal variable that is influenced by the level of inflation. Early empirical studies investigating the relation between inflation and earnings focused on the relevance of inflation-adjusted numbers for valuation and generally concluded that inflation-adjusted numbers are largely irrelevant to security markets (see Watts and Zimmerman 1980). Subsequent studies turned their attention toward analyzing the efficiency of investors' pricing inflation-related information in earnings. Chordia and Shivakumar (2005) argue and show that the sensitivity of earnings growth to inflation varies monotonically across stocks sorted on standardized unexpected earnings, and that investors' inefficiencies in incorporating this information causes the post-earnings announcement drift. Basu, Markov, and Shivakumar (2010) extend the above analysis to show that analysts' forecast errors are also systematically predictable based on lagged inflation.[7] Konchitchki (2011) provides theory and evidence for a positive relation between unrecognized inflation gains and losses and future cash flows from operations (CFOs). Konchitchki (2011, 2013) investigates whether investors fully impound inflation effects for future cash flows, and finds that this is not the case.

Kothari, Lewellen, and Warner (2006) extend the firm-level analysis of earnings and stock returns to the aggregate market level and document that aggregate earnings changes are negatively related to contemporaneous stock market returns. To explain this finding, they posit that aggregate earnings changes are associated with discount rate changes, resulting from both being tied to similar macroeconomic activities. Supporting this view, Shivakumar (2007) shows that aggregate earnings changes are primarily related to future CPI changes. Cready and Gurun (2010) show that aggregate earnings news from a three-day window is positively correlated with CPI changes reflected in treasury inflation-protected securities (TIPS). Patatoukas (2014) reports a positive relation between aggregate earnings changes and contemporaneous changes in forecasts of one-year-ahead GDP

[4] These studies include Pearce and Roley (1985), Hardouvelis (1987), McQueen and Roley (1993), Aggarwal, Mohanty, and Song (1995), Balduzzi, Elton, and Green (2001), and Flannery and Protopapadakis (2002).

[5] Emphasizing the need for macro-level analyses of accounting disclosures, Ball and Sadka (2015) observe that portfolio diversification makes equity investors potentially immune to several firm-level properties of earnings, but still leaves them exposed to aggregate information. This leads them to conclude that the design and evaluation of financial reporting must adopt, at least in part, an aggregate perspective.

[6] Dichev (2014) provides a detailed discussion on the differences between NIPA and generally accepted accounting principles (GAAP) earnings.

[7] Carabias (2016) and Li, Richardson, and Tuna (2014) extend the logic in Basu et al. (2010) to study whether investors correctly price information in real-time macroeconomic news or in firms' earnings' exposures to multiple countries.

deflator rates. Finally, Gallo, Hann, and Li (2016) contend that aggregate earnings changes predict federal funds rate changes and that this causes aggregate earnings to reflect discount rate news.[8]

Turning attention to GDP growth predictions, Konchitchki and Patatoukas (2014a) document that aggregate earnings growth predicts nominal GDP growth rates for the four quarters following the period in which earnings are announced, and show that macroeconomists do not fully incorporate this information in GDP forecasts. Konchitchki and Patatoukas (2014b) evaluate whether financial statement analysis of aggregate variables helps improve macro-forecasts of real economic activity, and find that aggregate changes in profit margins, as well as in asset turnovers, are leading indicators of real GDP growth.

Although prior studies make substantial contributions to our understanding of the links between aggregate earnings information and macroeconomy, they do not explain why aggregate earnings changes predict future inflation. That is the primary focus of this study.[9] This evaluation should help clarify whether aggregate earnings merely reflect macroeconomic information or whether they causally affect future macroeconomic activities. A finding consistent with the latter possibility implies that firm-level real effects of financial reporting translate into macroeconomic effects at the aggregate level.[10]

Hypotheses Development

Investment Demand Hypothesis

Profit growth of firms can affect aggregate demand for investment goods and services (*viz.,* raw materials, inventory, and capital goods and services) in a variety of ways. First, by signaling potential changes in the profitability of future investments, profit growth can alter managers' perceptions of investment opportunities and, thus, their investment strategies. Second, to the extent that profits are quickly converted into cash flows, higher profits translate into a greater availability of internal funds, which increases funds available for investments, especially for financially constrained firms.[11] Alternatively, reduced profits tighten financial constraints and lower funds available for investments. Last, improved profitability lowers a business's perceived credit risk (e.g., Altman 1968), which increases banks' and other lenders' willingness to lend, again increasing availability of funds for investments. Consistent with bank lending having real macro effects, Bassett, Chosak, Driscoll, and Zakrajsek (2014) document a significant increase in real GDP and inflation in the quarters immediately following a shock that relaxes bank lending standards.

Greater profitability can lead firms to invest in current operations by increasing inventory levels or in future operating capacity by increasing capital expenditures. Similarly, firms may respond to declines in profitability by cutting their inventory, or delaying or even canceling proposed capital expenditures. We propose that firms' investment responses to earnings growth manifest at the aggregate level as systematic shifts in the near-term demand curve for production goods, and that this shift alters the prices of production goods in the near term, when their supply is less than perfectly elastic. Thus, the investment demand hypothesis, formally stated in the alternative form, is:

H1: Growth (reduction) in aggregate corporate profits causes the near-term demand for production goods to increase (decrease), which results in the prices of these goods to increase (decrease) in the near term.

Consumption Demand Hypothesis

Profit growth affects individual agents' net worth either by generating greater returns to investors (i.e., higher dividends or share and bond prices), or by increasing employees' disposable income, as firms are known to share profits with employees through performance-related bonuses and commissions. Blanchflower, Oswald, and Sanfey (1996) document that movements in profitability are followed by changes in workers' remuneration, with an elasticity of wages to profit per employee of 0.08. Bronars and Famulari (2001) document that a 4 percent increase in the market value of a firm's equity raises employees' pay within the next three years by 0.3 percent. Similarly, earnings reductions lower the returns earned by investors, along with

[8] An alternative explanation for the negative aggregate earnings growth-returns relations is presented by G. Sadka and R. Sadka (2009), who claim that the aggregate earnings growth is related to expected risk premiums, rather than discount rate changes.

[9] Other aggregate-level accounting studies include Anilowski, Feng, and Skinner (2007) and Bonsall, Bozanic, and Fischer (2013), who evaluate the macroeconomic information content of management earnings guidance; Hirshleifer, Hou, and Teoh (2009) and Kang, Liu, and Qi (2010), who study the link between aggregate accruals and stock market returns; and Choi, Kalay, and Sadka (2013), who show that aggregate earnings news based on analyst forecast revisions is positively associated with aggregate stock market returns.

[10] In line with the causal mechanism running from aggregate earnings to the macroeconomic activities proposed by this study, a few other recent studies raise the possibility that financial reports have macroeconomic effects. For instance, Barth and Landsman (2010) scrutinize the role of financial reports in causing the financial crisis of 2007–2009, and opine that fair value accounting played little or no role in the crisis, but that opaqueness in financial reports likely affected investors' ability to properly assess the values and riskiness of banks' assets and liabilities.

[11] Relative to internal funds, external financing is also costlier due to both direct costs (e.g., underwriting fees) and indirect costs (e.g., adverse selection costs).

employees' disposable income, as decreased profits and losses lead firms to cut employee costs by lowering their discretionary payments and benefits or, ultimately, by laying off workers. As individual agents adjust their consumption following the effect of profit growth on their net wealth (e.g., Davis and Palumbo 2001), the demand curve for consumption goods is moved outward, which, in the short run, when supply of consumption goods is relatively inelastic, would lead to revisions in prices of consumption goods. Thus, the consumption demand hypothesis, formally stated in the alternative form, is:

H2: Growth (reduction) in aggregate corporate profits causes the near-term demand for consumption goods to increase (decrease), which results in the prices for these goods to increase (decrease) in the near term.

However, there are good reasons why the consumption demand hypothesis may not be empirically supported. First, it is unclear whether profit growth necessarily increases individuals' net worth in the short term, as Kothari et al. (2006) document a negative relationship between aggregate earnings and contemporaneous stock returns. Second, dividends, wages, salaries, etc., are typically only reset annually. Similarly, bonuses are often determined and set once a year. Hence, apart from the month in which wages, dividends, etc., are reset, profit growth is unlikely to translate into higher disposable income for employees and investors in the near term. These decision lags could lower the power of tests and cause near-term consumption demand to appear insensitive to changes in firms' profits.[12,13]

Yet another reason why the CPI may be less affected by aggregate earnings growth in the short run might be that retailers are slower to change the prices of consumption goods, compared to the price volatility faced by producers. This might occur, for instance, if retailers face greater "menu costs" than producers and so adjust prices of consumption goods with a lag, or if consumers smooth their wealth shocks so that any potential changes in wealth do not immediately affect consumption demand.[14] These arguments also indicate that the effect of aggregate earnings growth on the prices of consumption goods, if any, could occur in the long run rather than the short run.

It is worth emphasizing that both our hypotheses are necessarily focused on the short term, as the effects of profitability growth on long-term inflation depend on a variety of additional factors, such as the dynamics of monetary and fiscal responses to economic shocks, the process by which economic agents form their inflation expectations, and the elasticity of long-term supply curves. For instance, a monetary tightening following an inflation spike can cause investors to revise long-term inflation expectations that become self-fulfilling prophecies. Alternatively, monetary and fiscal policies can impact long-term inflation by altering long-term growth in real output. Due to problems inherent in studying long-term responses to profitability growth, we limit our focus to short-term responses.[15] This short-term focus is also consistent with the extant studies on aggregate earnings that typically relate aggregate earnings growth to macroeconomic changes in the immediate few months or quarters following an earnings release period.

III. INFLATION MEASURES

Tests of H1 and H2 require measures for the prices of production and consumption goods. We use the PPI to track inflation in the prices of production goods, as the main objective of the PPI is to track the prices of goods and services from a producer's perspective. As discussed below, the goods and services tracked by the PPI are those that are primarily purchased by other businesses. We use the CPI to capture the prices of consumption goods, as the main objective of the CPI is to track the prices paid by the final consumers.

The prices of production goods (i.e., the PPI) are measured at three different points in the production chain, giving rise to three related measures: (1) the PPI for crude materials, (2) the PPI for intermediate goods, and (3) the PPI for finished goods. Crude materials are unprocessed materials that serve as inputs for the production of intermediate goods. Intermediate goods are either partially or fully processed goods that are bought by businesses as inputs in their operations. Finished goods are

[12] If large numbers of consumers directly transact with producers, then it would cause CPI and PPI inflation to be even more correlated and make it difficult to distinguish CPI effects from PPI effects.

[13] In addition to the investment- and consumption-driven effects, we also considered the possibility that aggregate earnings affect government tax collections and, through this, short-term government spending. However, government tax collections are not directly based on reported accounting numbers, and government spending is typically based on annual budgets approved by Congress. Moreover, because corporations have several months after their fiscal year to file their tax returns, it is unlikely that government tax collections or spending will quickly adjust to profitability changes in the corporate sector. Consistent with these concerns, untabulated analyses reveal no significant relation between aggregate earnings growth and innovations in short-term government spending.

[14] Consistent with this possibility, we find the CPI inflation to be more stable and more predictable than the PPI inflation. Also, Adams, McQueen, and Wood (2004) find that stock responses to PPI news are more significant, but lower in magnitude than responses to CPI inflation. They attribute the lower statistical significance of CPI news to the better predictability of CPI by forecasters.

[15] Even though our analysis focuses on the short term, macroeconomic studies show that short-term economic shocks can have long-lasting effects. For example, Gürkaynak, Sack, and Swanson (2005) demonstrate that forward rates that are way into the future move significantly in response to a variety of short-term macroeconomic news. They attribute this to either imprecisions in or time-varying long-term expectations of economic agents.

commodities that are ready for sale to other businesses or consumers without any further processing. In contrast to these indices, the CPI captures prices at the point of purchase by end consumers. Thus, for example, the Bureau of Labor Statistics (BLS) includes the price of iron ore in the PPI for crude materials, the price of steel mill products that are produced with the iron ore in the PPI for intermediate goods, the price of metal-forming machine tools that rely on steel products as inputs in the PPI for finished goods, and the price of new vehicles that use metal-forming machine tools as capital equipment in the CPI. As the PPI also includes goods and services bought by consumers from retail sellers and directly from producers, we later check the sensitivity of our results linking aggregate earnings growth to the PPI by separately analyzing the link between the earnings changes of non-retail firms and the PPI. We discuss differences in the construction of the CPI and the PPI in greater detail in Appendix A.

Although the BLS reports several components of each inflation index, we focus on the headline indices, as these tend to be the broadest and most comprehensive measures that most closely correspond to the measurement of aggregate earnings across all sectors in the literature. This is also in line with prior studies that have typically focused on headline CPI to proxy for inflation. Thus, our measure for the CPI is the seasonally adjusted CPI Index for All Urban Consumers (CPI-U). Similarly, for the PPI, it is the seasonally adjusted PPI Finished Goods, seasonally adjusted PPI Intermediate Goods, and seasonally adjusted PPI Crude Materials.

Apart from the CPI and PPI, there are other measures of inflation, such as the GDP deflator (which tracks the combined price changes facing governments—federal, state, and local—and businesses and consumers), employment cost index (which measures changes in labor costs in private and governmental sectors), and employer costs for employee compensation (which tracks the average cost to employers for wages, salaries, and benefits per employee hour worked). Although these alternative measures of inflation could track the effects of aggregate earnings changes on the prices of goods and services for the overall economy and to labor costs, they are only released quarterly, which, compared to the monthly macro series, is more likely to lower one's ability to identify the immediate price effects of earnings growth. This is of particular concern as our analyses control for a variety of macro and financial variables, and using quarterly inflation measures allows more time for control variables to soak up the inflation information in the aggregate earnings changes. Consistent with this concern, we find little predictive relation between aggregate earnings changes and future inflation variables measured at a quarterly frequency in unreported results.

IV. SAMPLE SELECTION AND DATA DESCRIPTION

Sample Selection and Variable Definitions

Our initial sample comprises all NYSE, AMEX, and NASDAQ firms in the Compustat database, with data available on earnings announcement dates. For each firm and quarter in the sample period between April 1980 and June 2013, we compute firm-level earnings growth as seasonally differenced earnings before extraordinary items from Compustat, divided by the absolute value of the quarterly earnings before extraordinary items four quarters ago. We then obtain aggregate earnings growth as either the value- or the equal-weighted average of firm-level earnings growth.[16] In particular, *VCOMP* (*ECOMP*) is the quarterly value-weighted (equal-weighted) average of firm-level earnings growth. In calculating aggregate earnings growth, we exclude observations with a share price of less than $1, and earnings growth in the top and bottom 0.5 percent of the empirical distribution.[17]

We obtain the quarterly data on corporate investment and personal consumption from the Federal Reserve Economic Data (FRED) system of the Federal Reserve Bank of St. Louis (St. Louis Fed). Macro-level corporate investments are proxied by one of the following alternative measures: (1) The quarterly percentage change in gross private domestic investment (*AGPDI*), which measures physical investment in the productive capacity of the economy and includes replacement purchases, addition to capital assets net of depreciation, and investment in inventory. (2) The quarterly percentage change in private non-residential fixed investment (*APNFI*), which captures domestic spending by private sector enterprises and households on commercial or industrial buildings and other commercial or industrial structures with long economic lives. It specifically excludes investments in residential homes and other residential structures. (3) The quarterly change in private inventories (*ACINV*), which tracks changes in the value (valued in average prices of the period) of inventories owned by private businesses.

To measure personal consumption at the macro level, we focus directly on consumption outlays and expenditures. Our proxies for consumption expenditures are (1) quarterly percentage change in personal consumption expenditures (*APCE*),

[16] Prior studies on aggregate earnings use varied measures for aggregate earnings growth. We report results from the relatively straightforward definition of aggregate earnings growth, but have confirmed the robustness of our results to alternative definitions, such as scaling firm-level earnings changes by the book or market value of equity at the beginning of the quarter, and then computing the aggregate earnings changes as the average of these firm-level earnings changes. The results are also robust to using the ratio of the aggregate unscaled earnings changes to the aggregate book or market value of equity. In all of these analyses, the tenor of the results and the conclusions are identical to those presented in the study.

[17] Due to the small denominator problem, a few observations have magnitudes of firm-level earnings growth in excess of 10,000. Including such extreme observations generally lowers the statistical significance of the results. However, the results are qualitatively identical to those reported here when extreme observations are winsorized rather than deleted.

which is a component of personal outlays and consists of household expenditures on durable and non-durable goods and services, and (2) quarterly percentage change in personal outlays (*APO*), which primarily tracks personal consumption of goods and services, interest payments by households on non-mortgage debt, and transfer payments to governments or social services.[18] Although we report the results for a variety of investment and consumption proxies, we primarily focus our discussions on *AGPDI* and *APCE,* as they are the measures used by the Bureau of Economic Analysis to compute the investment and personal consumption components of the GDP. Throughout, the macro-variables are measured in the period in which they are released to be consistent with the timing of the measurement of the aggregate earnings variable.

To allay concerns that any observed relation between aggregate earnings growth and future investment, consumption, or inflation is confounded by the omission of correlated macroeconomic information, we follow Konchitchki and Patatoukas (2014a) and control for a variety of financial variables.[19] Specifically, the following control variables are included in our analyses: (1) quarterly change in percentage default spreads, calculated as the difference in interest rates between AAA bonds and BAA bonds ($\Delta DEFAULT_t$), (2) quarterly change in percentage yield spreads, calculated as the difference in interest rates between federal funds rate and risk free rate ($\Delta YIELD$), (3) quarterly change in percentage term spreads, calculated as the difference in interest rates between ten-year government bonds and the risk-free rate ($\Delta TERM$), and (4) quarterly percentage change in the Standard & Poor's (S&P) 500 index ($\Delta SP500$).[20]

We obtain inflation data from the BLS. The PPI and CPI numbers are generally released by the BLS at 8:30a.m. EST, before the stock markets open. For most months in the sample period, the PPI announcements precede the CPI announcements. Given that inflation data are available at a monthly frequency and because price effects are likely to be short-lived when the demand or supply of goods and services is relatively inelastic, we conduct analyses of the inflation variables at the monthly frequency. In these analyses, to ensure that the aggregate earnings changes are representative of all of the listed firms, for each month *t,* we compute value- and equal-weighted aggregate earnings growth ($VCOMP_{t,t-2}$ or $ECOMP_{t,t-2}$) using all of the earnings announced over a rolling three-month window from month *t* to month *t*−2. To be consistent, our macro and financial control variables are also measured over the same three-month window, although our results are robust to measuring these variables over the last month alone (i.e., over month *t*).[21]

As the inflation forecast data needed to analyze macro-forecast efficiency are only available from April 1980 to June 2013, we restrict all of our analyses to this period. However, our conclusions are robust when analyses that do not require macro-forecast data are based on a sample that starts in January 1972 to include all of the data available from Compustat.

Summary Statistics

Panels A and B of Table 1 report the summary statistics for the variables used in the quarterly and monthly analyses, respectively. When we look at the quarterly statistics, the mean of *VCOMP* is 0.200, while that of *ECOMP* is 0.133 during the sample period. These averages are significantly different from zero, as are the median aggregate earnings growth, reflecting the high earnings growth during the sample period.[22]

Our sample period is characterized by growth in investment and personal consumption in the U.S. Gross private domestic investment (*AGPDI*) and private non-residential fixed investment (*APNFI*) grew by about 1.2 percent in Table 1, Panel A. Similarly, private inventories (*ACINV*) increased by $25 billion per quarter. The personal consumption expenditure (*APCE*) and personal outlay (*APO*) grew by approximately 1.4 percent during the sample period. The averages and medians of the macroeconomic variables are significantly greater than zero. Among the quarterly control variables, the mean and median values for $\Delta DEFAULT_q$, $\Delta YIELD_q$, and $\Delta TERM_q$ are insignificantly different from zero, suggesting that there were no trends in these interest rate variables during the sample period. The average S&P 500 index increased by 2.4 percent during our sample period.

Not surprisingly, the summary statistics for the monthly aggregate earnings and the monthly control variables in Table 1, Panel B are similar to those reported in Panel A. The average PPI and CPI inflation rates during the sample period were 0.21 percent and 0.27 percent per month, respectively.

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[18] Although the data on personal consumption are available at a monthly frequency, we report our results based on the quarterly data to be consistent with the VAR results for investment proxies. However, our conclusions remain unchanged if we conduct these analyses using monthly observations.

[19] To ensure that we are not over-controlling through the inclusion of financial variables in the analyses, we test the sensitivity of our results by replacing the financial variables with alternative macroeconomic variables, such as unemployment and GDP growth. Our conclusions are unaffected by this change.

[20] The S&P 500 index data are from the Center for Research in Security Prices (CRSP).

[21] In monthly analyses, as the variables are measured over more than one month, we include two subscripts to the variables to indicate the starting and ending months over which they are computed.

[22] The averages for *VCOMP* and *ECOMP* are affected by firm-level observations with relatively low magnitudes of lagged earnings. Our results are robust to excluding firm-years with absolute value of earnings before extraordinary items less than $1 million. This change produces an average *VCOMP* (*ECOMP*) of 0.146 (0.081).

TABLE 1
Descriptive Statistics

Panel A: Quarterly Observations

	Mean	p-value (Mean)	Median	p-value (Median)	Standard Deviation	10th Percentile	90th Percentile
$VCOMP_q$	0.200	0.00	0.258	0.00	0.434	−0.169	0.577
$ECOMP_q$	0.133	0.00	0.211	0.00	0.472	−0.297	0.541
$AGPDI_q$ (%)	1.243	0.00	1.050	0.00	3.804	−2.427	5.210
$APNFI_q$ (%)	1.277	0.00	1.761	0.00	2.187	−1.539	3.895
$ACINV_q$ ($ billions)	25	0.00	25	0.00	48	−20	77
$APCE_q$ (%)	1.454	0.00	1.463	0.00	0.788	0.682	2.356
APO_q (%)	1.461	0.00	1.457	0.00	0.802	0.651	2.325
$\Delta DEFAULT_q$ (%)	−0.004	0.86	−0.000	0.48	0.276	−0.230	0.240
$\Delta YIELD_q$ (%)	−0.015	0.78	0.000	0.89	0.609	−0.440	0.400
$\Delta TERM_q$ (%)	0.035	0.65	−0.030	0.83	0.904	−0.730	0.890
$\Delta SP500_q$ (%)	2.434	0.00	3.146	0.00	8.208	−8.878	11.901

The sample excludes firms not traded on the NYSE, AMEX, or NASDAQ, those with a share price of less than $1, or those with firm-level earnings growth at the top and bottom 0.5 percent of the distribution. The sample for which *VCOMP* and *ECOMP* are available, which covers the period between April 1980 and June 2013, has 133 quarters. The p-values for the means (medians) are calculated based on t-tests (Wilcoxon signed rank tests).

Variable Definitions:
$VCOMP_q$ ($ECOMP_q$) = the value-weighted (equal-weighted) average of firm-level quarterly earnings growth using the earnings announced in quarter q. For each firm, earnings growth is calculated as seasonally differenced quarterly earnings before extraordinary items from Compustat, scaled by the absolute value of the quarterly earnings before extraordinary items four quarters ago;
$AGPDI_q$ = the quarterly percentage change in gross private domestic investment in quarter q;
$APNFI_q$ = the quarterly percentage change in private non-residential fixed investment in quarter q;
$ACINV_q$ = the quarterly change in private inventories in billions of US$ in quarter q;
$APCE_q$ = the quarterly percentage change in personal consumption expenditures in quarter q;
APO_q = the quarterly percentage change in personal outlays in quarter q;
$\Delta DEFAULT_q$ = the change in percentage default spreads (the difference in interest rates between AAA and BAA bonds) in quarter q;
$\Delta YIELD_q$ = the change in percentage yield spreads (the difference in interest rates between the federal funds and risk-free rates) in quarter q;
$\Delta TERM_q$ = the change in percentage term spreads (the difference in interest rates between ten-year government bonds and the risk-free rate) in quarter q; and
$\Delta SP500_q$ = the percentage change in the S&P 500 index in quarter q.

Panel B: Monthly Observations

	Mean	p-value (Mean)	Median	p-value (Median)	Standard Deviation	10th Percentile	90th Percentile
$VCOMP_{t,t-2}$	0.199	0.00	0.255	0.00	0.420	−0.188	0.593
$ECOMP_{t,t-2}$	0.134	0.00	0.208	0.00	0.460	−0.279	0.555
$APPI_t$ (%)	0.215	0.00	0.200	0.00	0.644	−0.400	1.000
$APPI\_INT_t$ (%)	0.225	0.00	0.200	0.00	0.673	−0.500	1.000
$APPI\_CRUDE_t$ (%)	0.299	0.08	0.300	0.06	3.410	−2.900	4.300
$ACPI_t$ (%)	0.272	0.00	0.300	0.00	0.306	0.000	0.600
$\Delta DEFAULT_{t,t-2}$ (%)	−0.003	0.79	−0.010	0.17	0.269	−0.240	0.250
$\Delta YIELD_{t,t-2}$ (%)	−0.012	0.65	−0.000	0.61	0.551	−0.360	0.350
$\Delta TERM_{t,t-2}$ (%)	0.025	0.53	−0.030	0.72	0.797	−0.720	0.760
$\Delta SP500_{t,t-2}$ (%)	2.360	0.00	2.555	0.00	7.915	−7.781	11.469

The sample excludes firms not traded on the NYSE, AMEX, or NASDAQ, those with a share price of less than $1, or those with earnings growth at the top and bottom 0.5 percent of the distribution. The sample for which *VCOMP* and *ECOMP* are available, which covers the period between April 1980 and June 2013, has 399 observations. The p-values for the means (medians) are calculated based on t-tests (Wilcoxon signed rank tests).

(continued on next page)

Table 2 reports the Pearson correlations (above the diagonal) and Spearman correlations (below the diagonal) among the variables of interest. Panel A reports the correlations for the variables employed in the quarterly analyses and Panel B for those in the monthly analyses. Not surprisingly, the equal- and value-weighted measures of aggregate earnings changes are highly correlated. These aggregate earnings changes also tend to be significantly positively correlated with changes in aggregate

TABLE 1 (continued)

Variable Definitions:
$VCOMP_{t,t-2}$ ($ECOMP_{t,t-2}$) = the value-weighted (equal-weighted) average of firm-level earnings growth using the earnings announced in months t to t–2, where earnings growth is calculated as seasonally differenced quarterly earnings before extraordinary items from Compustat, divided by the absolute value of the quarterly earnings before extraordinary items four quarters ago;
$ACPI_t$ = the actual monthly percentage change in the CPI released in month t;
$APPI_t$ = the actual monthly percentage change in the PPI released in month t;
$APPI\_INT_t$ = the actual monthly percentage change in the PPI for the intermediate goods released in month t;
$APPI\_CRUDE_t$ = the actual monthly percentage change in the PPI for the crude materials released in month t;
$\Delta DEFAULT_{t,t-2}$ = the change in the percentage default spreads (the difference in interest rates between AAA and BAA bonds) from month t–3 to month t;
$\Delta YIELD_{t,t-2}$ = the change in percentage yield spreads (the difference in interest rates between the federal funds and risk-free rates) from month t–3 to month t;
$\Delta TERM_{t,t-2}$ = the change in the percentage term spreads (the difference in interest rates between ten-year government bonds and the risk-free rate) from month t–3 to month t; and
$\Delta SP500_{t,t-2}$ = the percentage change in the S&P 500 index from month t–3 to month t.

investment and personal consumption variables. Also, the actual PPI and CPI measures of inflation are highly correlated with each other. The correlation coefficients across these alternative measures of inflation are about 0.6, suggesting a large overlap between the PPI and the CPI.

V. EMPIRICAL RESULTS

Vector Auto-Regression Analysis

As is common in the macroeconomic literature, we study the macroeconomic information content of aggregate earnings growth using VAR. This approach addresses the potential endogeneity in inter-related macroeconomic variables, which allows us to investigate the information content of aggregate earnings growth for innovations in future corporate investment and personal consumption. Specifically, we estimate the following VAR model:

$$z_q = Az_{q-1} + \varepsilon_q \tag{1}$$

where z_q is a vector. The variables included in the vector are: (1) change in corporate investment proxy released in quarter q (*AGPDI, APNFI,* or *ACINV*); (2) change in personal consumption proxy released in quarter q (*APCE* or *APO*); (3) aggregate earnings growth released in quarter q (*VCOMP* or *ECOMP*); and (4) control variables in quarter q ($\Delta DEFAULT$, $\Delta YIELD$, $\Delta TERM$, and $\Delta SP500$). All variables in the VAR system appear to be stationary, based on the Phillips-Perron tests for unit root. Our use of one lag in the system is identified by Schwarz's Bayesian information criterion.[23]

Using the standard approach for presenting VAR results, Figure 1 presents the impulse response functions (IRFs) from estimating Equation (1), along with 95 percent confidence intervals (shaded area). The IRFs describe how a "response" variable reacts to a unit (standard deviation) positive shock to an "impulse" variable over time.[24] Although the VAR model includes a variety of variables and lags of variables, to conserve space, we report only the impulse responses of the variable of interest (proxies for investment or consumption) to aggregate earnings growth for up to four periods ahead.

From Figure 1, Panel A, we find that aggregate earnings growth significantly predicts innovations in gross private domestic investment up to three quarters ahead. Consistent results are also obtained for other investment proxies, *viz.,* changes in private non-residential fixed investments and changes in private inventories. However, in Panel B, when we focus on the results of the VAR analysis of consumption, we find little evidence that aggregate earnings growth affects future personal consumption expenditures or personal outlays. With the exception of *ECOMP* weakly affecting one-quarter-ahead personal consumption expenditures and personal outlays, there is little evidence of any immediate effect of aggregate profitability growth on future consumption.[25]

Collectively, the VAR results show that aggregate earnings growth significantly predicts future corporate investment innovations, but has only weak predictive ability for future consumption innovations. The predictive ability for investment

[23] We obtain identical conclusions for number of lags when we focus on other criteria, *viz.,* the final prediction error criterion, Akaike's information criterion, or the Hannan and Quinn information criterion.

[24] IRFs are statistically significant when the 95 percent confidence intervals (shaded areas in the VAR plots) are entirely above or entirely below zero.

[25] The predictive ability of *ECOMP* for the one-quarter-ahead consumption expenditures is not robust to the alternative definitions of aggregate earnings changes discussed in footnote 14. Also, in VAR analyses of future aggregate earnings growth, consumption proxies tend to be statistically insignificant, consistent with the view that earnings of listed firms (which are primarily producers) are not immediately affected by shocks to consumption.

TABLE 2

Univariate Correlations

Panel A: Quarterly Observations

	$VCOMP_q$	$ECOMP_q$	$AGPDI_q$	$APNFI_q$	$ACINV_q$	$APCE_q$	APO_q	$\Delta DEFAULT_q$	$\Delta YIELD_q$	$\Delta TERM_q$	$\Delta SP500_q$
$VCOMP_q$		**0.987**	**0.499**	**0.551**	**0.439**	**0.462**	**0.456**	0.123	0.071	**−0.145**	0.049
$ECOMP_q$	**0.975**		**0.519**	**0.581**	**0.450**	**0.521**	**0.517**	0.108	0.055	−0.127	0.055
$AGPDI_q$	**0.447**	**0.469**		**0.576**	**0.517**	**0.300**	**0.295**	**0.203**	**0.147**	0.019	−0.027
$APNFI_q$	**0.474**	**0.492**	**0.462**		**0.586**	**0.470**	**0.482**	**0.227**	0.115	−0.088	−0.027
$ACINV_q$	**0.445**	**0.409**	**0.484**	**0.456**		0.141	**0.150**	**0.189**	0.065	−0.119	−0.029
$APCE_q$	**0.193**	**0.248**	0.081	**0.355**	−0.031		**0.995**	**0.175**	**0.174**	−0.042	0.091
APO_q	**0.192**	**0.250**	0.076	**0.372**	−0.009	**0.991**		**0.179**	**0.169**	−0.024	0.096
$\Delta DEFAULT_q$	−0.004	−0.032	0.057	0.133	0.071	0.124	0.128		**0.227**	0.120	**−0.239**
$\Delta YIELD_q$	**0.169**	0.139	0.122	**0.179**	0.141	**0.156**	**0.144**	**0.262**		**−0.243**	−0.031
$\Delta TERM_q$	**−0.289**	**−0.265**	−0.127	**−0.191**	**−0.243**	−0.125	−0.119	−0.038	−0.094		−0.014
$\Delta SP500_q$	−0.060	−0.068	0.001	−0.050	0.004	0.022	0.022	**−0.174**	−0.107	−0.051	

This panel provides the Pearson (above diagonal) and Spearman (below diagonal) correlations among the quarterly variables of interest. The variables and the sample are described in Table 1. The sample has 133 observations. Correlations with significance at the 10 percent level or higher are in bold.

Panel B: Monthly Observations

	$VCOMP_{t,t-2}$	$ECOMP_{t,t-2}$	$APPI_t$	$APPI\_INT_t$	$APPI\_CRUDE_t$	$ACPI_t$	$\Delta DEFAULT_{t,t-2}$	$\Delta YIELD_{t,t-2}$	$\Delta TERM_{t,t-2}$	$\Delta SP500_{t,t-2}$
$VCOMP_{t,t-2}$		**0.986**	**0.134**	**0.296**	**0.180**	**0.085**	0.074	0.079	**−0.137**	0.048
$ECOMP_{t,t-2}$	**0.975**		**0.141**	**0.293**	**0.178**	**0.133**	0.071	0.070	**−0.117**	0.046
$APPI_t$	**0.120**	**0.119**		**0.787**	**0.644**	**0.655**	**−0.176**	−0.007	0.057	0.032
$APPI\_INT_t$	**0.328**	**0.317**	**0.696**		**0.645**	**0.617**	**−0.205**	0.017	0.006	0.007
$APPI\_CRUDE_t$	**0.134**	**0.115**	**0.551**	**0.577**		**0.400**	**−0.202**	0.009	−0.027	**0.096**
$ACPI_t$	0.041	0.078	**0.590**	**0.536**	**0.341**		**−0.141**	0.045	**0.103**	0.008
$\Delta DEFAULT_{t,t-2}$	−0.029	−0.044	−0.062	**−0.146**	**−0.093**	−0.032		**0.285**	0.032	**−0.286**
$\Delta YIELD_{t,t-2}$	**0.173**	**0.162**	0.052	**0.106**	0.031	0.038	**0.196**		**−0.335**	−0.041
$\Delta TERM_{t,t-2}$	**−0.270**	**−0.260**	0.056	−0.004	0.038	0.080	**−0.085**	**−0.132**		−0.074
$\Delta SP500_{t,t-2}$	−0.043	−0.056	−0.032	−0.062	0.020	**−0.091**	**−0.194**	−0.056	**−0.106**	

This panel provides the Pearson (above diagonal) and Spearman (below diagonal) correlations among the monthly variables of interest. The variables and the sample are described in Table 1. The sample has 399 observations. Correlations with significance at the 10 percent level or higher are in bold.

innovations is particularly interesting, as our VAR analysis accounts for potential persistence in actual corporate investment and controls for the effects of a broad set of control variables, implying that the predictive ability of aggregate earnings is incremental to that of the predictive content of these control variables. Moreover, the weak predictive power of aggregate earnings growth for immediate consumption innovations suggests that changes in corporate profits, at best, affect consumption with a lag. These findings provide greater support for the investment demand hypothesis than the consumption demand hypothesis.

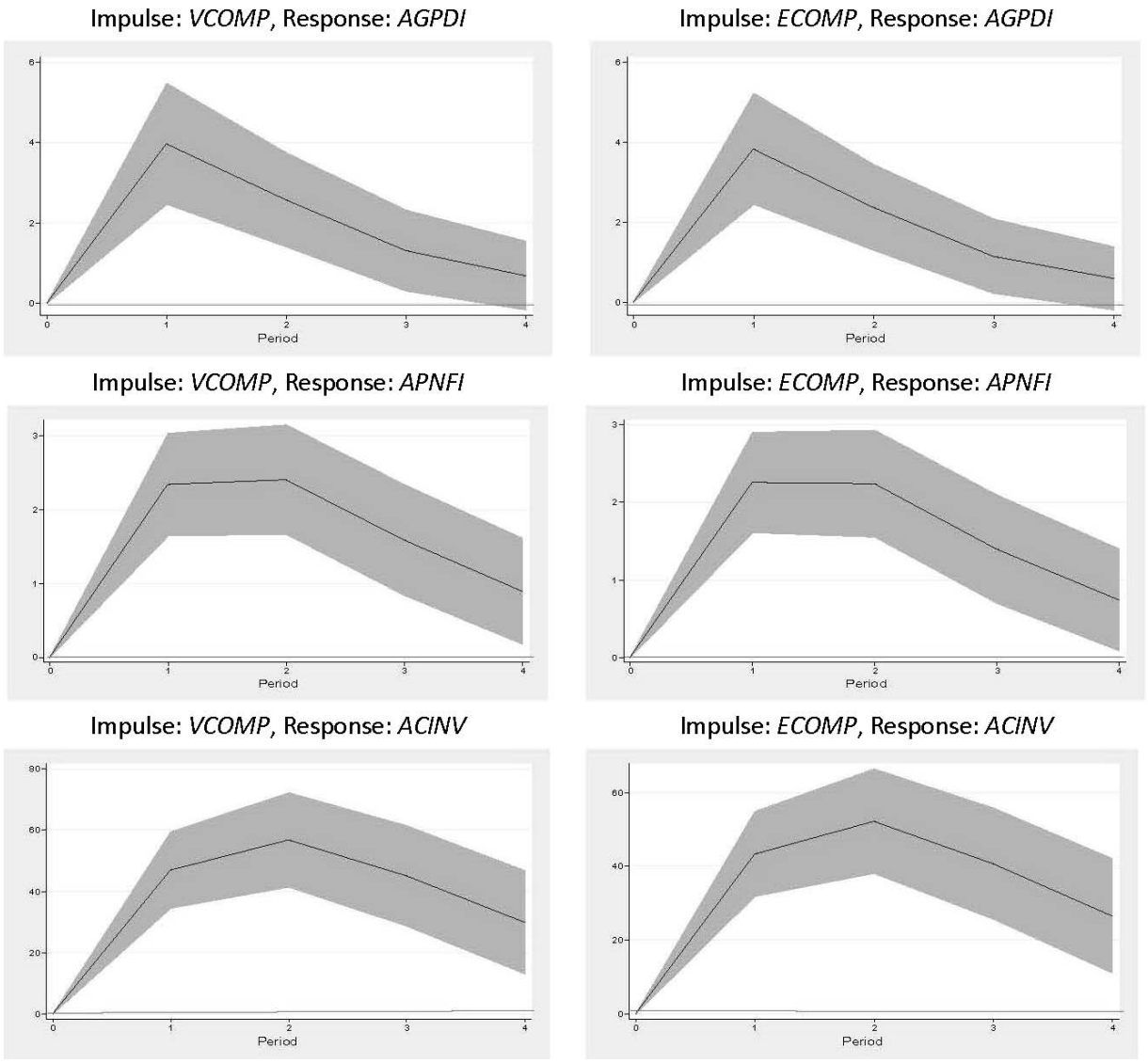
Firm-Level Investment Analysis

The VAR analysis provides strong evidence that aggregate earnings growth affects innovations in future corporate investment at the macro level. To gain a deeper understanding of the source behind this macro-level link, we study whether individual firms change their investment behavior in response to profitability changes. Evidence of a relationship at the firm-level provides corroborative evidence for the claim that profitability changes influence future investment by changing individual firms' behavior. By documenting causality at a finer level than shown by the VAR analysis, we provide a robustness check in response to concerns that the VAR analysis potentially omits relevant information variables.

To test the relationship between investment and earnings growth at the firm level, we follow the approach in Polk and Sapienza (2009) and regress the investment capital ratio (INV_q), calculated as capital expenditures scaled by beginning-of-the-

FIGURE 1
Impulse Response Functions for VAR Analysis of Inflation Channels on Aggregate Earnings Growth

Panel A: IRFs of Future Investment



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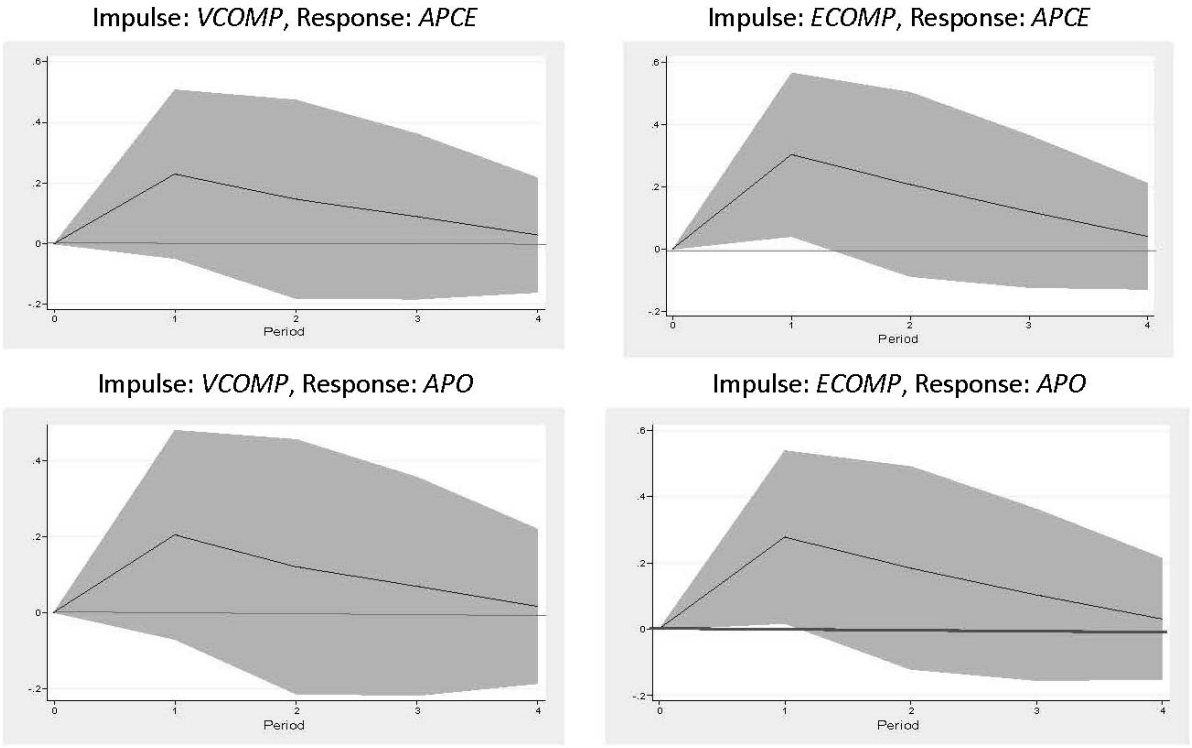
quarter net plant, property, and equipment, on firm-specific variables. Specifically, using quarterly data from Compustat, we estimate the following OLS regression:

$$INV_{q+j} = \beta_0 + \beta_1 ERN\_GROWTH_q + \beta_2 Q_q + \beta_3 CF_q + Firm\ Fixed\text{-}Effects + Year\ Fixed\text{-}Effects + \varepsilon_{q+j} \quad j = 1 \text{ to } 4 \qquad (2)$$

The firm-specific variables included in the regression are earnings growth (ERN_GROWTH_q), which is calculated as the seasonally differenced quarterly earnings before extraordinary items divided by the absolute value of the quarterly earnings before extraordinary items four quarters ago; Q_q is Tobin's Q at the end of quarter q, calculated as the market value of assets (book value of assets plus market value of common stock less the sum of book value of common stock and balance sheet deferred taxes) scaled by the book value of assets; and CF_q is the cash flows in quarter q, calculated as the sum of lagged

FIGURE 1 (continued)

Panel B: IRFs of Future Consumption



This figure presents the impulse response functions (IRFs) from the VAR analysis of investments and consumption proxies for lagged aggregate earnings growth. The VAR analysis includes one lag of each variable and control variables. The analyses are run at the quarterly level. The investment proxies are (1) gross private domestic investment (*AGPDI*), (2) private non-residential fixed investment (*APNFI*), and (3) change in private inventories (*ACINV*). The consumption proxies are (1) personal consumption expenditures (*APCE*), and (2) personal outlays (*APO*). The number of observations is 133. The variables and sample are described in Table 1.

earnings before extraordinary items and depreciation scaled by the beginning-of-the-quarter net plant, property, and equipment. To control for time-invariant firm characteristics and year-specific investment shocks, the regressions include firm and year fixed effects. Finally, the t-statistics are based on standard errors clustered at the firm and year levels.

The regression results reported in Table 3 indicate that firm-level earnings growth positively and significantly predicts capital investments up to four quarters ahead. In terms of economic magnitude, one standard deviation increase in ERN_GROWTH_q increases capital investment in quarter q+1 by 0.0014, which is 3 percent of median investment in quarter q+1. This finding suggests that our results at the macro-level extend to individual firm-level analysis, and supports the conjecture that aggregate earnings growth impacts future corporate investments, as predicted by the investment demand hypothesis.

Impact of Aggregate Earnings on Future Inflation

If, as observed earlier, aggregate earnings growth impacts inflation more through its effect on future investment demand than through its effect on future consumption demand, then we expect aggregate earnings growth to be more significantly related to future PPI innovations, and less so to future CPI innovations. To test this conjecture, we estimate the following VAR model:

$$w_t = Aw_{t-1} + Bw_{t-2} + \varepsilon_t \quad (3)$$

TABLE 3

Regression of Firm-Level Investment on Lagged Firm-Level Earnings Growth

	Dependent Variable			
	INV_{q+1}	INV_{q+2}	INV_{q+3}	INV_{q+4}
ERN_GROWTH_q	0.0006	0.0011	0.0013	0.0012
	(4.48)	(8.30)	(9.74)	(10.71)
Q_q	0.0145	0.0143	0.0129	0.0109
	(23.71)	(24.15)	(24.82)	(15.96)
CF_q	0.0027	0.0031	0.0034	0.0029
	(3.18)	(3.56)	(4.77)	(4.86)
Firm Fixed-Effects	Yes	Yes	Yes	Yes
Year Fixed-Effects	Yes	Yes	Yes	Yes
Percent Adj. R^2	6.86	7.07	6.46	5.49
n	254,131	254,131	254,131	254,131

This table presents the results from regressions of individual firms' investment capital ratios on individual firms' earnings growth and control variables. The sample for which *ERN_GROWTH* is available covers the period between April 1980 and June 2013. Analyses are conducted with quarterly data. The models include firm and year fixed effects. The t-statistics, based on standard errors clustered at the firm and year levels, are reported in parentheses.

Variable Definitions:
INV = the investment capital ratio, calculated as capital expenditures scaled by beginning-of-the-quarter net plant, property, and equipment;
ERN_GROWTH = firm-level earnings growth, calculated as seasonally differenced quarterly earnings before extraordinary items from Compustat, divided by the absolute value of the quarterly earnings before extraordinary items four quarters ago;
Q = Tobin's Q, calculated as market value of assets (book value of assets plus market value of common stock less the sum of book value of common stock and balance sheet deferred taxes) scaled by book value of assets; and
CF = cash flows, calculated as the sum of earnings before extraordinary items and depreciation scaled by beginning-of-the-quarter net plant, property, and equipment.

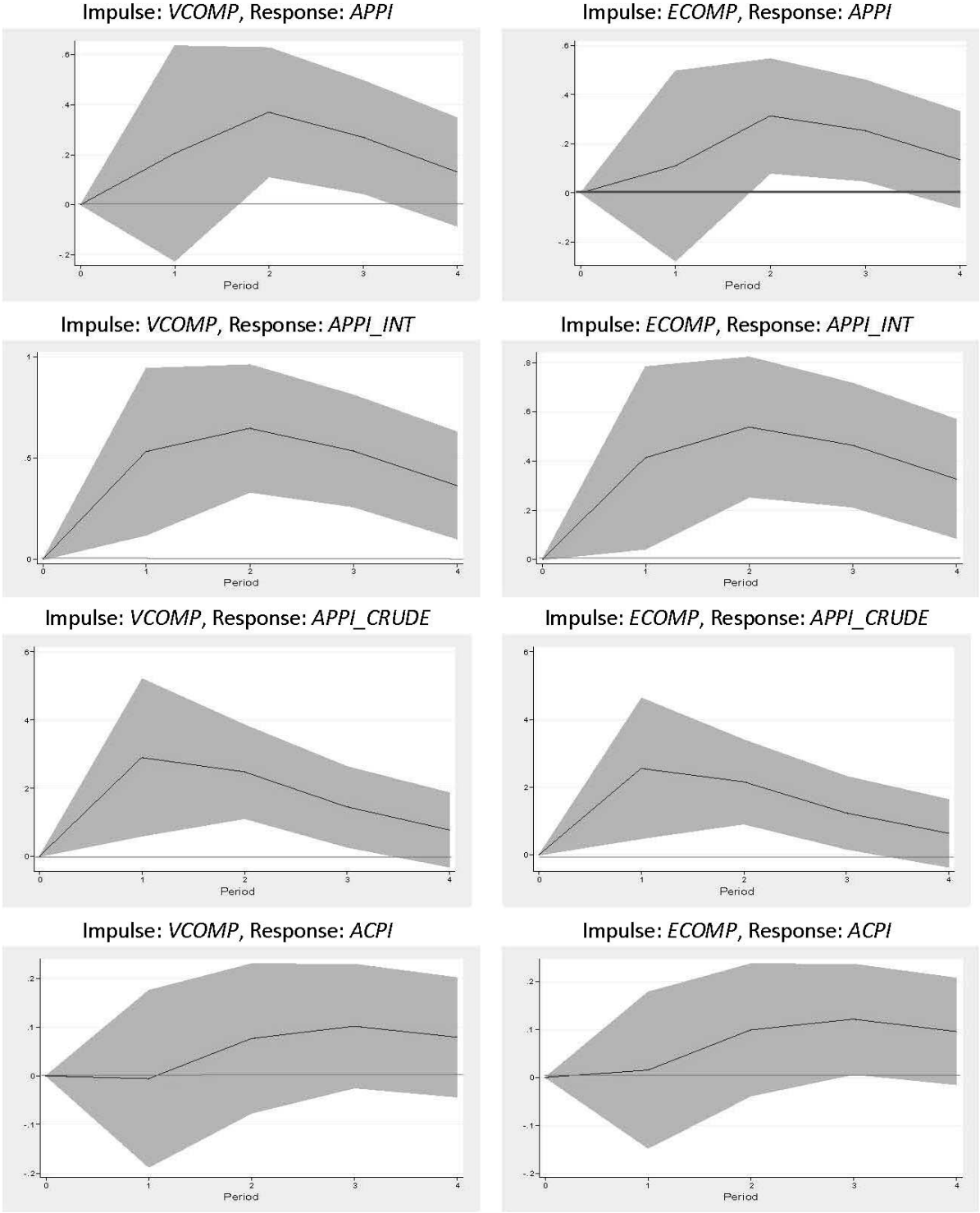
This VAR model essentially mirrors Equation (1) after replacing the investment or consumption proxies with actual inflation, measured either as PPI or CPI released in a month, and control variables being measured at monthly frequency. Given that inflation data are reported monthly, and because price reactions to investment or consumption demand shifts could be short-lived, we conduct this analysis at the monthly level.[26] As in the earlier VAR analysis, we confirm that the variables are stationary, based on the Phillips-Perron tests for unit root, and our use of two lags for the variables in the system follows the Schwarz's Bayesian information criterion.

Figure 2 reports the results for the VAR analysis of the PPI and CPI, with the PPI measured according to the prices of finished goods, intermediate goods, or crude materials. Regardless of whether we focus on *VCOMP* or *ECOMP,* we find that aggregate earnings growth predicts innovations in the PPI of finished goods, the PPI of intermediate goods, and the PPI of crude materials. It predicts innovations in the PPI of finished goods for months 2 and 3, and innovations in the PPI of intermediate and crude goods up to month 4. The significant predictability is particularly interesting, as the VAR analysis accounts for potential persistence in actual inflation and for information reflected in control variables, implying that the predictive ability of the lagged aggregate earnings is incremental to that of the predictive content of these variables. We find little evidence that aggregate earnings growth affects future CPI. The lack of significance for future CPI is consistent with our earlier results that aggregate profitability growth primarily affects the future demand for investment goods and services, and that it has only a weak effect on the future consumption of goods and services.

Collectively, the results thus far send a very consistent message. Aggregate earnings changes affect near-term demand for investment goods, which shifts the short-term price for these goods and services. These results strongly support the investment demand hypothesis. However, we find little evidence to suggest that profitability growth affects the consumption of goods and services or their prices. Our findings provide little support for the consumption demand hypothesis. Although this lack of observed consumption effect could potentially reflect a lack of power in the tests, the results unambiguously show that the explanations based on investment demand are the more dominant reason for the link between aggregate earnings growth and future inflation.

[26] In all monthly analyses, $VCOMP_{t,t-2}$ or $ECOMP_{t,t-2}$ is accumulated over a rolling three-month period so that our aggregate measures encapsulate the earnings information of all listed companies.

FIGURE 2
Impulse Response Functions for the VAR Analysis of Inflation Realizations on Aggregate Earnings Growth



This figure presents the impulse response functions (IRFs) from the VAR analysis of inflation proxies for lagged aggregate earnings growth. The VAR analysis includes two lags of each variable and control variables. The analyses are run at the monthly level. The inflation proxies are the (1) PPI for finished goods (*APPI*), (2) PPI for intermediate goods (*APPI_INT*), (3) PPI for crude materials (*APPI_CRUDE*), and (4) CPI (*ACPI*). The number of observations is 399.

The variables and sample are described in Table 1.

Subsample Analyses

One possible explanation for the lack of a significant relation between aggregate earnings growth and future CPI innovations is that aggregate earnings are contaminated by combining earnings across manufacturing and retail or financial firms, as manufacturing firms do not deal directly with end consumers. Retail and financial firms' strategies are more likely to have a direct impact on the prices facing end consumers. For instance, if financial firms loosen their credit policy to consumers following a highly profitable quarter, then it could potentially increase the demand for consumer goods and cause their prices to increase in the immediate future, due to a relatively inelastic supply of the consumption goods. Similarly, retail firms could share good profits with their consumers by offering greater price discounts, leading end-users to increase their demand for consumption goods and consequently drive up the CPI in the short term due to supply restrictions. However, in this latter case, the predictions for future inflation are more ambiguous, as the prices charged by retail firms are part of the CPI and, thus, the discounts offered to consumers could potentially reduce future CPI inflation.[27]

To examine whether the aggregate earnings growth of retail or financial firms predicts future CPI, we repeat the earlier VAR analysis by aggregating the earnings growth of retail or financial firms alone. Although our prime focus is only the predictability of future CPI by the aggregate earnings growth of retail or financial firms, for completeness, we also report the results for the PPI and for earnings aggregated across non-retail and nonfinancial firms. To conserve space and maintain focus, this and subsequent analyses only consider the CPI and PPI for finished goods to capture inflation.[28]

From Panel A of Figure 3, we observe that the aggregate earnings growth of financial firms (two-digit SIC codes between 60 and 69) has little predictive power for future CPI innovations. The IRFs are insignificant for all four of the future periods examined. The value-weighted aggregate earnings growth of the financial firms predicts the two-month-ahead PPI innovations. The relation between the equal-weighted aggregate earnings growth and future PPI innovations is insignificant for all of the months. In contrast, consistent with the results reported in Figure 2, the aggregate earnings growth of nonfinancial firms significantly and positively affects the PPI innovations in months two and three. There is little evidence that the aggregate earnings growth of nonfinancial firms is related to future CPI. The one exception to this is the predictive ability of *ECOMP* for three-month-ahead CPI. However, this result is not robust to using a value-weighted aggregate earnings growth measure.

Panel B of Figure 3 reports the results from estimating the VAR system separately for retail (two-digit SIC codes between 52 and 59) and non-retail firms. As with the financial firms, there is little evidence of earnings growth aggregated across retail firms predicting future CPI innovations. This is also generally the case in analyses of PPI innovations, except for the significant IRFs in month 2. However, when we look at the non-retail firms, we find qualitatively identical results to those reported in Figure 2. The aggregate earnings growth of non-retail firms is significantly positively related to the PPI innovations in months 2 and 3, and are insignificantly related to the CPI innovations, with the exception of *ECOMP* predicting the CPI innovations in month 3.

The results in Panels A and B of Figure 3 indicate that the PPI's greater predictive ability in Figure 2, compared with that of the CPI, is not simply due to listed firms dealing with other businesses. Even when we focus on the aggregate earnings of financial and retail firms, there is, at best, weak evidence to support the consumption demand hypothesis. Further, the lack of predictive power exhibited by financial and retail firms' earnings for the PPI suggests that the earlier documented predictive ability of aggregate earnings for the PPI innovations is also unlikely to be caused by changes in consumption demand. If consumption demand effects somehow lead aggregate earnings to predict PPI innovations, then such effects are more likely to be observed in the earnings of retail or financial firms.

Panel C of Figure 3 examines the impact of aggregate earnings growth on future inflation after dividing the sample in two at the median investment capital ratio. The investment capital ratio is calculated as industry-adjusted (at the two-digit SIC code level) capital expenditures scaled by lagged plant, property, and equipment. We compute the aggregate earnings separately for firms in the high investment capital ratio and for firms in the low investment capital ratio, and then conduct the VAR analyses separately for these groups. If the investment demand hypothesis is correct, then we expect to find a stronger PPI inflation reaction to aggregate earnings growth, mainly in the high investment capital ratio group. Consistent with our earlier results, the relationship between aggregate earnings growth and future CPI tends to be insignificant, regardless of whether aggregate earnings are computed for firms with low or high investment capital ratio. However, aggregate earnings growth is significantly related to future PPI innovations for firms in both the low and high investment capital ratio groups. Consistent with predictions based on the investment demand hypothesis, we find a stronger link between aggregate earnings growth and future PPI innovations for firms in the high investment capital ratio group.

[27] According to the BLS, one-off discounts are considered in the CPI computation if 50 percent or more of the sales of that specific item are at the discounted price.

[28] Our results in Figure 3 are qualitatively similar when we consider the PPI of intermediate goods and the PPI of crude materials instead of the PPI of finished goods.

FIGURE 3
Impulse Response Functions for the VAR Analysis of Inflation Realizations on Aggregate Earnings Growth: Subgroups Analysis

Panel A: Financial versus Non-Financial Firms

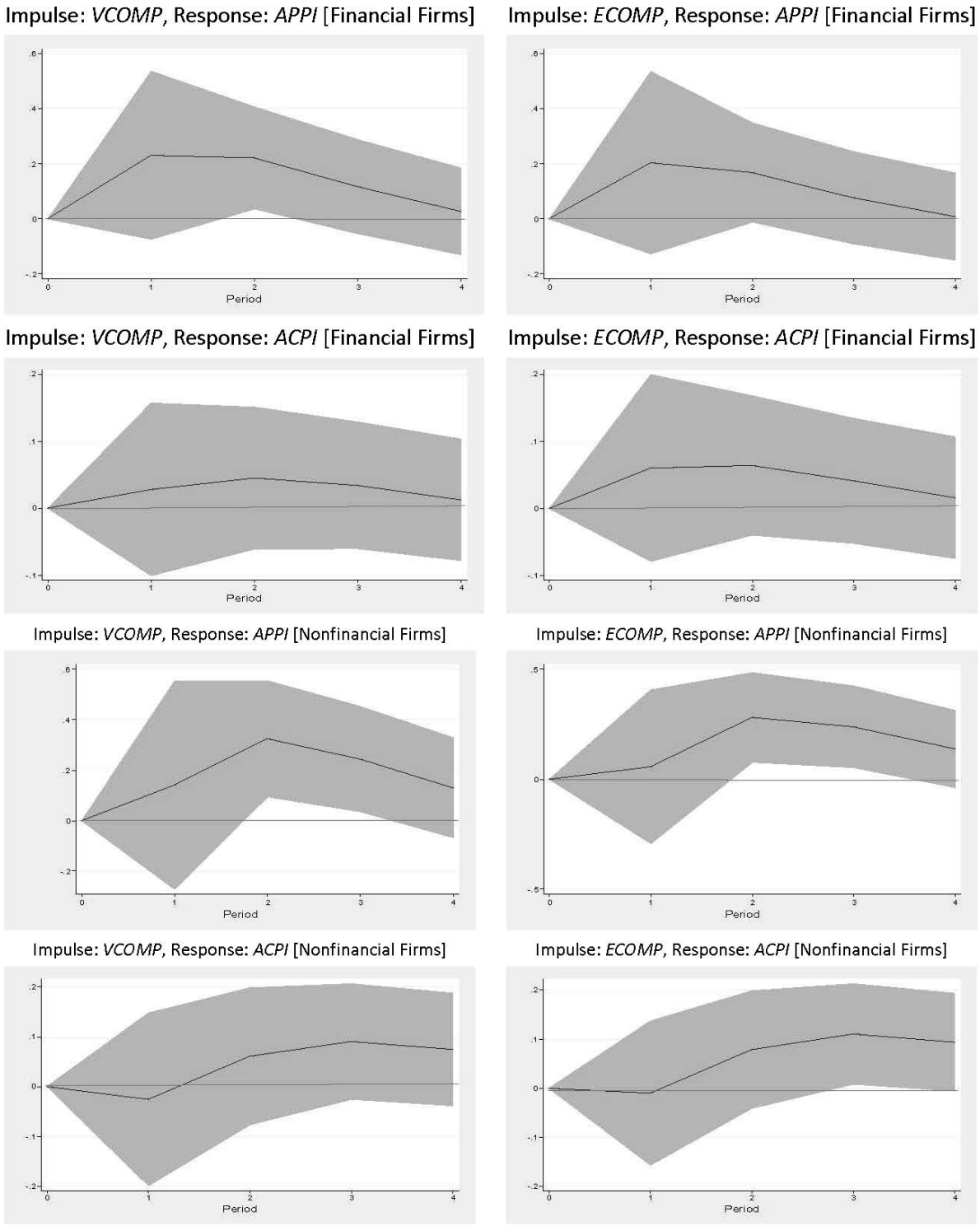


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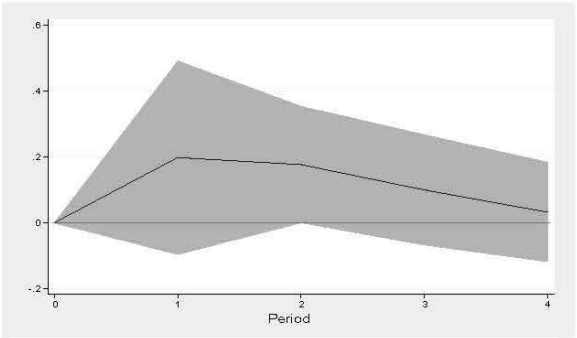
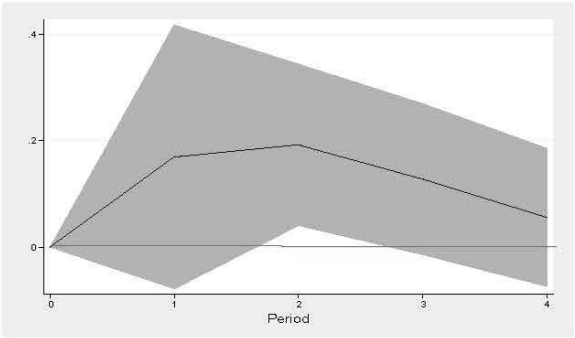
FIGURE 3 (continued)

Panel B: Retail versus Non-Retail Firms

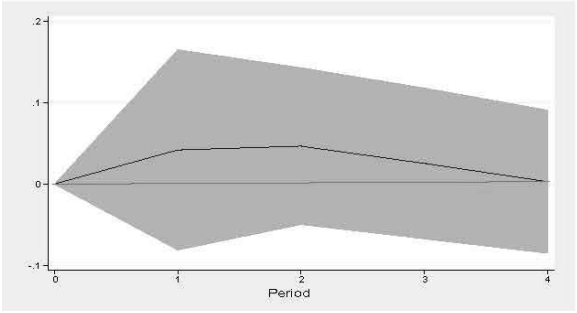
Impulse: *VCOMP*, Response: *APPI* [Retail Firms]



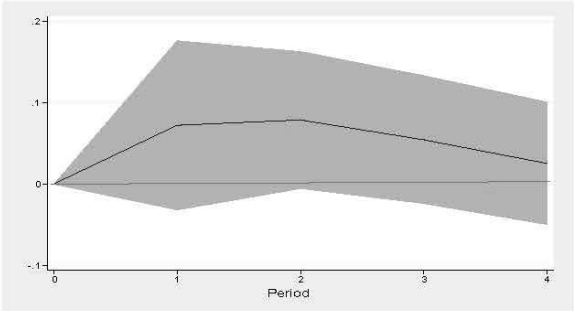
Impulse: *ECOMP*, Response: *APPI* [Retail Firms]



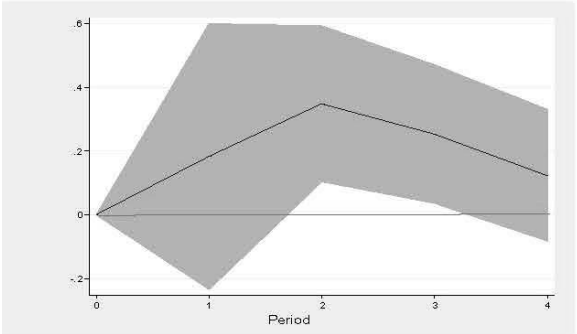
Impulse: *VCOMP*, Response: *ACPI* [Retail Firms]



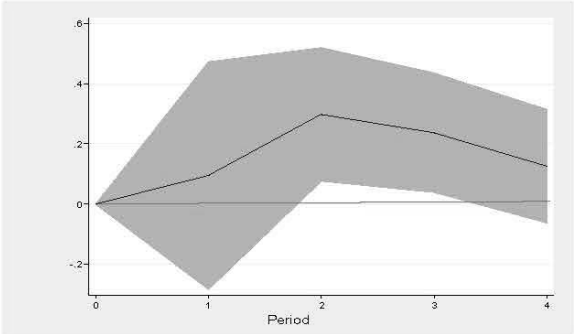
Impulse: *ECOMP*, Response: *ACPI* [Retail Firms]



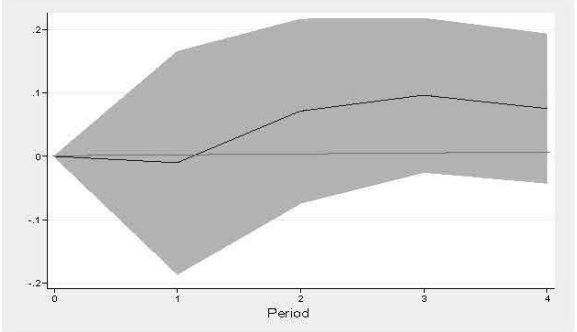
Impulse: *VCOMP*, Response: *APPI* [Non-Retail Firms]



Impulse: *ECOMP*, Response: *APPI* [Non-Retail Firms]



Impulse: *VCOMP*, Response: *ACPI* [Non-Retail Firms]



Impulse: *ECOMP*, Response: *ACPI* [Non-Retail Firms]

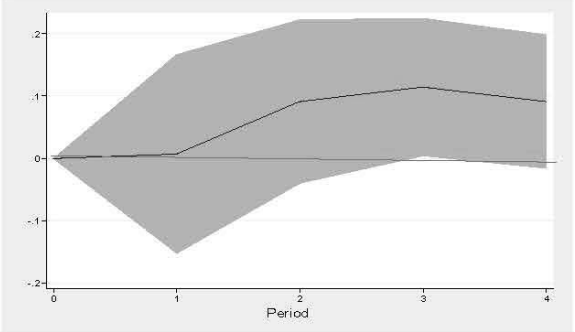


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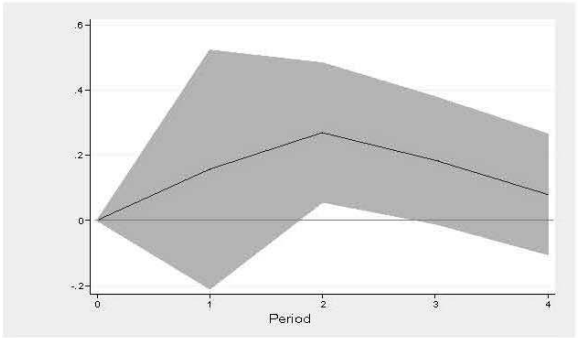
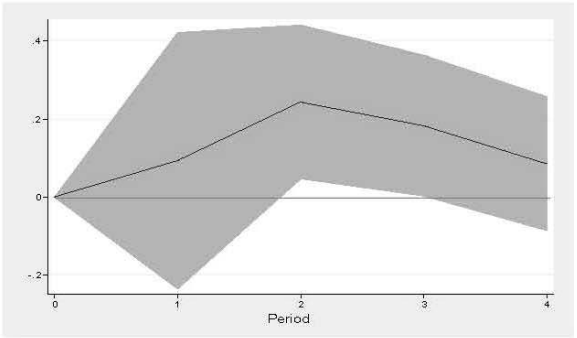
FIGURE 3 (continued)

Panel C: Low versus High Investment Capital Ratio (ICR)

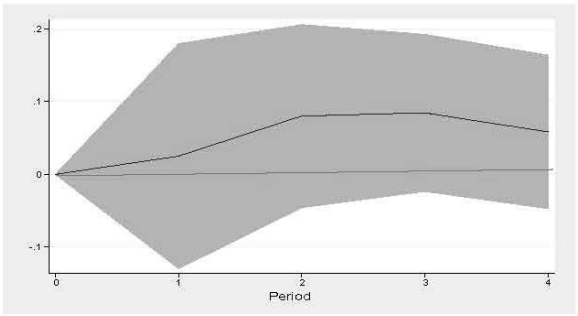
Impulse: *VCOMP*, Response: *APPI* [Low ICR Firms]



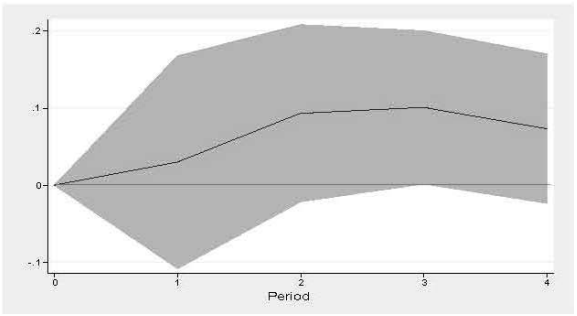
Impulse: *ECOMP*, Response: *APPI* [Low ICR Firms]



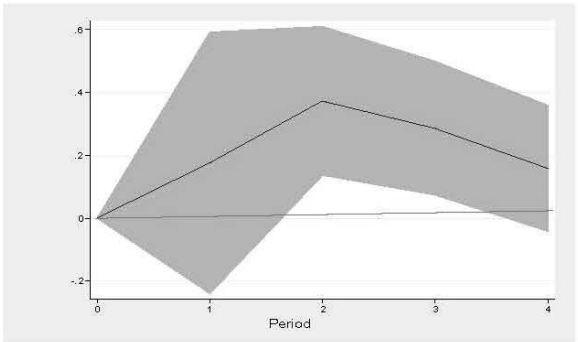
Impulse: *VCOMP*, Response: *ACPI* [Low ICR Firms]



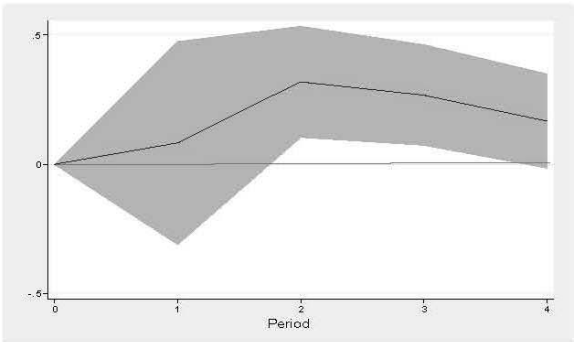
Impulse: *ECOMP*, Response: *ACPI* [Low ICR Firms]



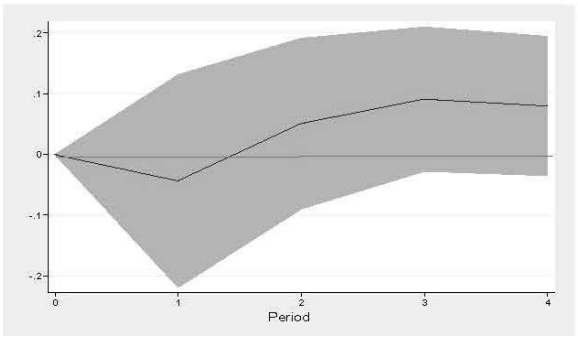
Impulse: *VCOMP*, Response: *APPI* [High ICR Firms]



Impulse: *ECOMP*, Response: *APPI* [High ICR Firms]



Impulse: *VCOMP*, Response: *ACPI* [High ICR Firms]



Impulse: *ECOMP*, Response: *ACPI* [High ICR Firms]

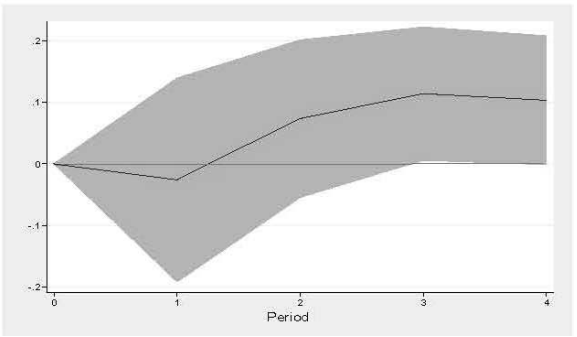


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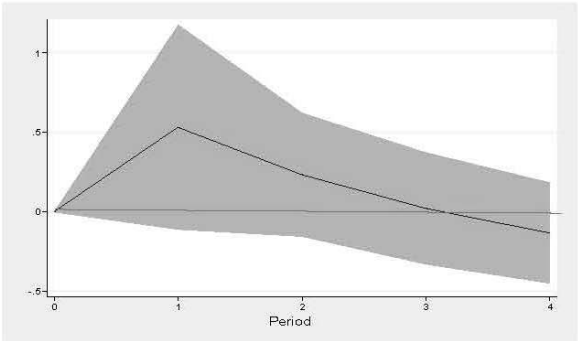
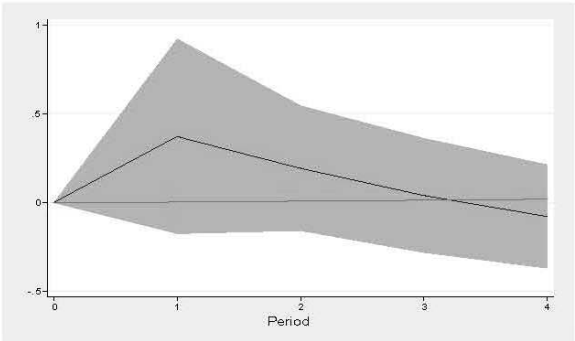
FIGURE 3 (continued)

Panel D: Periods with Low versus High Industrial Production

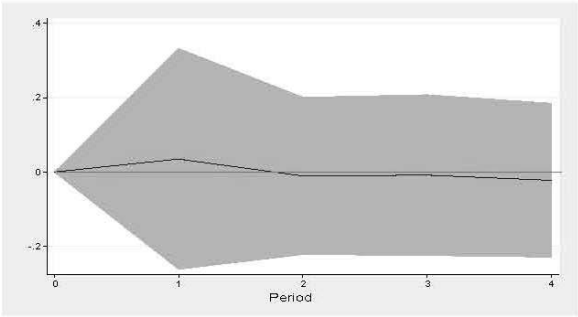
Impulse: *VCOMP*, Response: *APPI* [Low *INDPRO*]



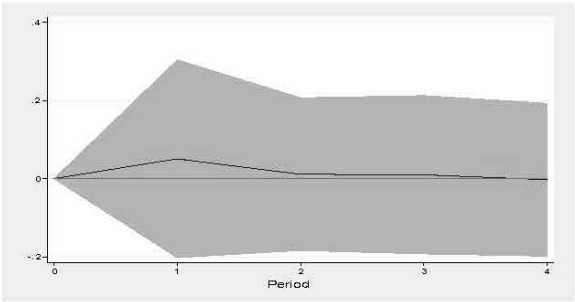
Impulse: *ECOMP*, Response: *APPI* [Low *INDPRO*]



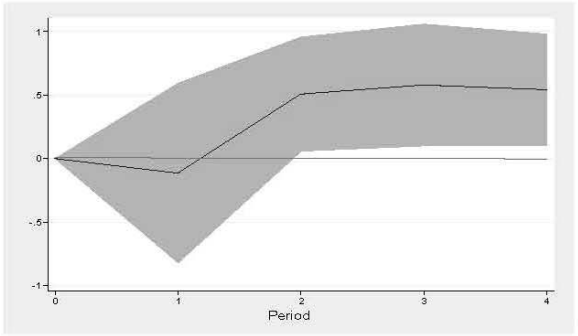
Impulse: *VCOMP*, Response: *ACPI* [Low *INDPRO*]



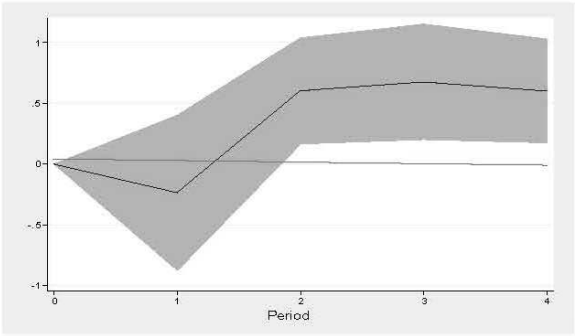
Impulse: *ECOMP*, Response: *ACPI* [Low *INDPRO*]



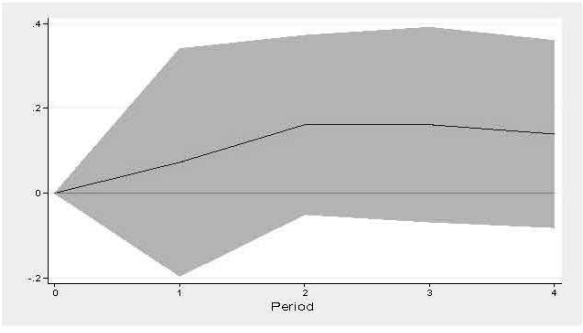
Impulse: *VCOMP*, Response: *APPI* [High *INDPRO*]



Impulse: *ECOMP*, Response: *APPI* [High *INDPRO*]



Impulse: *VCOMP*, Response: *ACPI* [High *INDPRO*]



Impulse: *ECOMP*, Response: *ACPI* [High *INDPRO*]

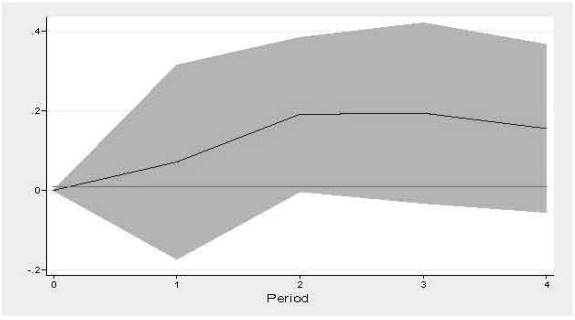


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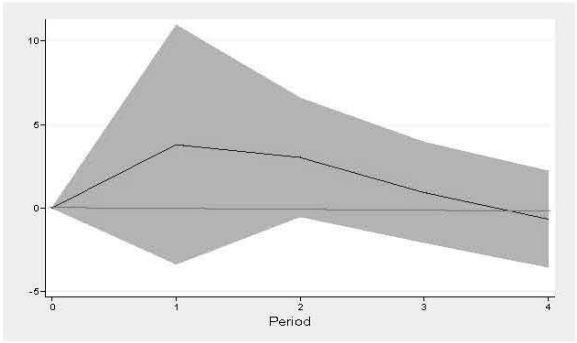
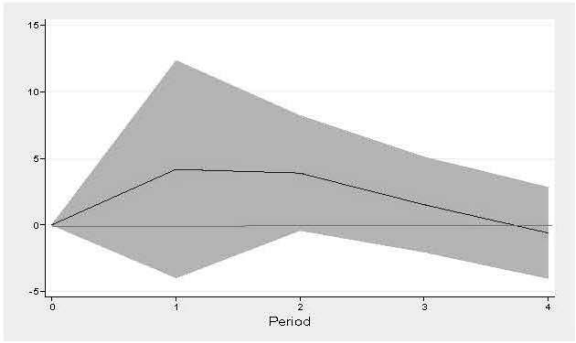
FIGURE 3 (continued)

Panel E: Small versus Large Earnings Growth Magnitude

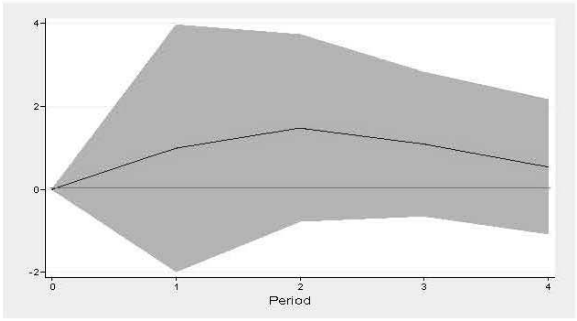
Impulse: *VCOMP*, Response: *APPI* [Small Changes]



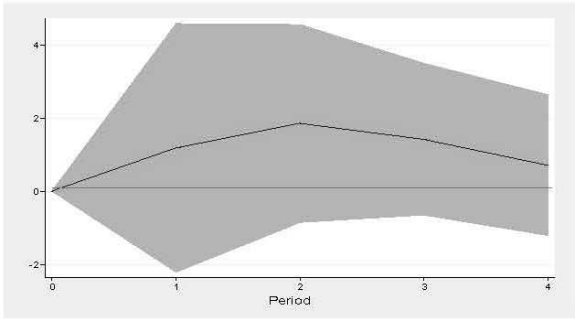
Impulse: *ECOMP*, Response: *APPI* [Small Changes]



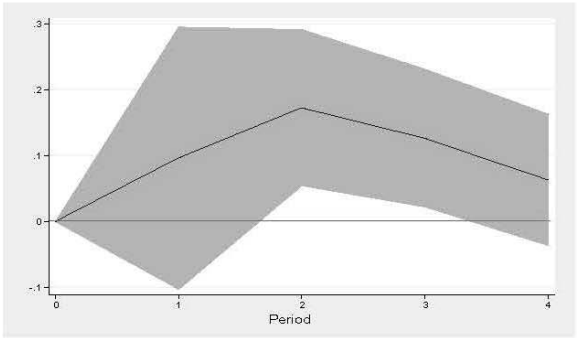
Impulse: *VCOMP*, Response: *ACPI* [Small Changes]



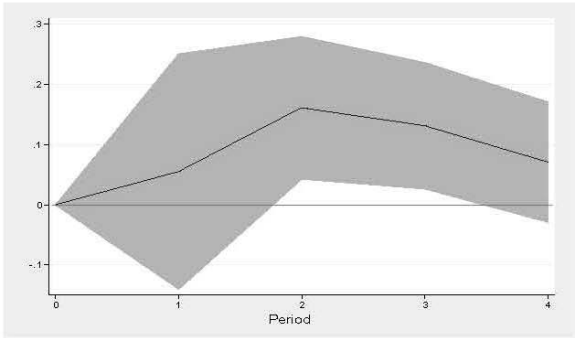
Impulse: *ECOMP*, Response: *ACPI* [Small Changes]



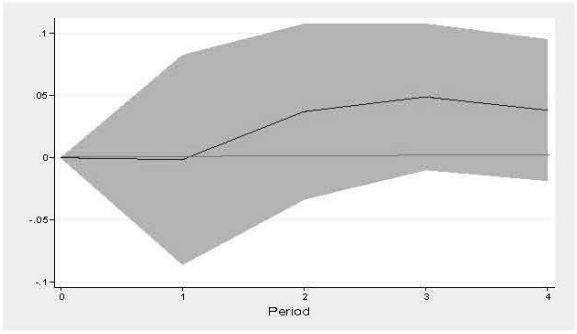
Impulse: *VCOMP*, Response: *APPI* [Large Changes]



Impulse: *ECOMP*, Response: *APPI* [Large Changes]



Impulse: *VCOMP*, Response: *ACPI* [Large Changes]



Impulse: *ECOMP*, Response: *ACPI* [Large Changes]

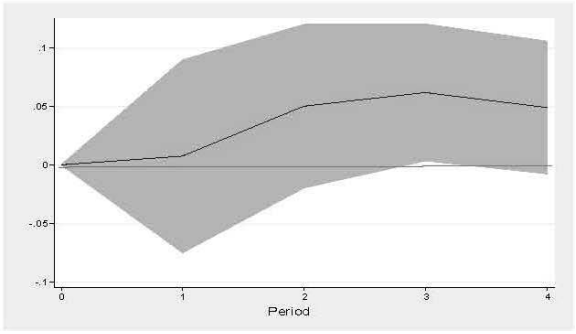


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FIGURE 3 (continued)

This figure replicates the VAR analyses in Figure 2 for the PPI and CPI inflation measures when aggregate earnings are computed separately for firms sorted into subgroups. Panel A presents the results when firms are sorted into financial and nonfinancial firms. Panel B presents the results for retail and non-retail firms. Panel C presents results when the observations are sorted into low versus high industry-adjusted (at the two-digit SIC code level) investment capital ratio (capital expenditures scaled by lagged plant, property, and equipment). Panel D presents results when the observations are sorted into periods based on whether industrial production index is low (defined as periods when industrial production index is below 90 percent) or not. Panel E presents results when the observations are sorted into small versus large magnitude of firm-level earnings growth. We deem observations with an absolute value of firm-level earnings growth that is less (more) than the sample median to be small (large). The VAR analysis includes two lags of each variable and control variables. The number of observations is 399.
The variables and sample are described in Table 1.

We next study how the effect of aggregate earnings growth on inflation varies over time. During periods of strong economic expansions, prices of production goods are likely to be more sensitive to investment demand shocks as the slack in productive capacity would be more limited in these periods. This predicts that the effect of aggregate earnings growth on inflation should be stronger during periods of greater economic expansion. We test this implication by sorting the sample into high and low economic expansion periods based on whether the industrial production index is less than 90 percent. Consistent with expectations, Figure 3, Panel D shows that aggregate earnings growth significantly affects future PPI mainly during periods of high economic expansion. This relation tends to be insignificant in low industrial production index periods. Also, in line with our earlier findings, the relation between aggregate earnings growth and CPI is statistically insignificant in both periods.

To further test whether lack of power in tests explains the weak results observed for CPI predictability, we split our sample firms into two groups at the median based on the absolute value of firm-level earnings growth, and then conduct a VAR analysis using aggregate earnings growth calculated separately for each of these groups. Larger magnitudes of earnings changes are more likely to have larger impacts on corporate plans and values, so we expect the aggregate earnings growth of the large earnings changes group to have greater aggregate effects on investment, consumption, and inflation. The results from the test of this prediction are presented in Panel E of Figure 3.

Consistent with our expectation, the effect of the aggregate earnings growth of the small earnings changes group is statistically insignificant, whether we focus on the PPI or CPI.[29] However, when we focus on the aggregate earnings growth of the large earnings changes group, the results are qualitatively identical to those reported in Figure 2. Specifically, the aggregate earnings growth is significantly related to two- and three-month-ahead PPI innovations, but not to CPI innovations.

Collectively, the results confirm that the aggregate earnings growth primarily affects the prices of production goods in the immediate future.

OLS Regression Analysis

As a robustness check for the results from the VAR analysis, we analyze the relation between aggregate earnings growth and future macroeconomic variables using OLS regressions, as in previous studies. The results are presented in Table 4.

In univariate regressions, we find all of the investment and consumption proxies to be significantly positively associated with aggregate earnings growth. This is not entirely unexpected, given the earlier documented correlations across aggregate earnings and macro-variables. When we include one lag of the dependent variable and control for financial variables to check for the incremental predictive ability of aggregate earnings growth, we find that the latter continues to predict future investment proxies.[30] However, we find weaker, and sometimes no, evidence of predictive ability for future consumption proxies once control variables are included. The coefficient on *VCOMP* becomes insignificant in regressions of personal consumption expenditure (*APCE*) and personal outlay (*APO*). However, *ECOMP* has a statistically significant coefficient even when we include control variables, suggesting that equal-weighted aggregate earnings growth affects future personal consumption.

In terms of the economic magnitude of the effects, the coefficient of 3.827 (Table 4, Panel B) in the regressions of *AGPDI* suggests that a one-standard-deviation increase in *ECOMP* increases *AGPDI* by 1.80 percent, which is more than the average

[29] The aggregate earnings growth of the small earnings changes group significantly predicts *PPI_INT* and *PPI_CRUDE* in the subsequent two and three months, respectively.

[30] We follow Konchitchki and Patatoukas (2014a) and control for financial variables and lags of dependent variables to estimate the incremental predictive ability of aggregate earnings growth.

TABLE 4

OLS Regression of Macroeconomic Variables on Lagged Aggregate Earnings Growth

Panel A: The Impact of Value-Weighted Aggregate Earnings on Future Investment and Consumption

	Dependent Variable									
	$AGPDI_q$	$AGPDI_q$	$APNFI_q$	$APNFI_q$	$ACINV_q$	$ACINV_q$	$APCE_q$	$APCE_q$	APO_q	APO_q
Intercept	0.357	0.272	0.582	0.306	10.109	1.872	1.333	0.744	1.338	0.705
	(1.12)	(0.82)	(3.73)	(1.92)	(2.90)	(0.62)	(18.60)	(6.13)	(18.39)	(5.93)
$VCOMP_{q-1}$	4.405	3.964	3.377	2.343	72.286	46.971	0.550	0.230	0.554	0.205
	(6.62)	(5.02)	(10.34)	(6.44)	(9.92)	(7.20)	(3.67)	(1.58)	(3.64)	(1.42)
Control Variables	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Percent Adj. R^2	24.64	24.06	44.72	53.18	42.65	63.70	8.67	19.03	8.55	36.82

Panel B: The Impact of Equal-Weighted Aggregate Earnings on Future Investment and Consumption

	Dependent Variable									
	$AGPDI_q$	$AGPDI_q$	$APNFI_q$	$APNFI_q$	$ACINV_q$	$ACINV_q$	$APCE_q$	$APCE_q$	APO_q	APO_q
Intercept	0.681	0.587	0.833	0.515	15.628	5.729	1.361	0.803	1.365	0.760
	(2.29)	(1.85)	(5.79)	(3.29)	(4.79)	(1.94)	(20.65)	(6.39)	(20.43)	(6.16)
$ECOMP_{q-1}$	4.182	3.827	3.187	2.257	67.113	43.333	0.615	0.303	0.624	0.278
	(6.91)	(5.26)	(10.85)	(6.64)	(10.09)	(7.19)	(4.58)	(2.20)	(4.58)	(2.04)
Control Variables	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Percent Adj. R^2	26.29	25.28	47.11	53.90	43.48	63.69	13.21	35.29	13.22	37.87

Panel C: The Impact of Aggregate Earnings on Future Inflation

	Dependent Variable							
	$APPI_t$	$APPI_t$	$APPI_t$	$APPI_t$	$ACPI_t$	$ACPI_t$	$ACPI_t$	$ACPI_t$
Intercept	0.177	0.143	0.190	0.158	0.260	0.137	0.259	0.139
	(5.00)	(3.81)	(5.70)	(4.35)	(15.57)	(6.66)	(16.57)	(6.82)
$VCOMP_{t-1,t-3}$	0.178	0.198			0.048	0.013		
	(2.34)	(2.52)			(1.34)	(0.42)		
$ECOMP_{t-1,t-3}$			0.166	0.180			0.074	0.030
			(2.39)	(2.51)			(2.28)	(1.01)
Control Variables	No	Yes	No	Yes	No	Yes	No	Yes
Percent Adj. R^2	1.12	6.71	1.17	6.70	0.20	25.33	1.04	25.49

This table presents the results from OLS regression of investments, consumption, and the inflation proxies on lagged aggregate earnings growth. The control variables are one lag (three lags) of the dependent variable, $\Delta DEFAULT_{q-1}$, $\Delta YIELD_{q-1}$, $\Delta TERM_{q-1}$, and $\Delta SP500_{q-1}$ ($\Delta DEFAULT_{t-1,t-3}$, $\Delta YIELD_{t-1,t-3}$, $\Delta TERM_{t-1,t-3}$, and $\Delta SP500_{t-1,t-3}$) in quarterly (monthly) regressions. The coefficients on control variables are not reported. The number of observations is 133 (399) in quarterly (monthly) regressions. The t-statistics are reported in parentheses.

quarterly *AGPDI* of 1.24 percent. In comparison, the coefficient on *ECOMP* is 0.303 in regressions of *APCE,* which implies that a one-standard-deviation increase in *ECOMP* increases quarterly personal consumption by 0.14 percent, which is less than 10 percent of the average quarterly *APCE* of 1.45 percent. Thus, while the OLS regressions reveal some evidence that *ECOMP* is related to future personal consumption, the economic magnitude of this effect is limited in comparison to the economic magnitude of the effect of *ECOMP* on future investment.

Panel C of Table 4 reports the results from the predictive regressions of future PPI and CPI. The univariate regressions reveal a significant relation between aggregate earnings growth and future PPI. These results continue to hold even when the regressions include controls for lagged PPI, interest rate effects, and stock market returns. When the control variables are included, the magnitudes of the coefficients on aggregate earnings growth remain relatively unchanged. In contrast, we find that the relation between aggregate earnings growth and future CPI obtains only in the univariate regressions of the CPI on *ECOMP*. The significant relation between the CPI and *ECOMP* is consistent with the findings of Shivakumar (2007). However,

our analyses reveal that this finding for the CPI does not carry over to the value-weighted measure of aggregate earnings growth (*VCOMP*) or to regressions that control for lagged CPI, interest rate effects, and stock market returns.[31]

Overall, the results from the OLS regressions are consistent with those obtained from the VAR analysis, and suggest that our findings are unlikely to be driven by model misspecifications. Both the OLS regressions and VAR analysis indicate that aggregate earnings growth affects future inflation primarily through its effect on aggregate investments, and that any effects through aggregate consumption are relatively weak and limited.

Effect of Investment and Consumption Growth on Future Inflation

Our findings that aggregate earnings growth is related to future investments, as well as to future PPI, supports the investment demand hypothesis. This hypothesis is, however, built on the premise that shocks to investment cause near-time shocks to PPI. To test this premise, we estimate OLS regressions of PPI as done in Panel C of Table 4, but after replacing aggregate earnings growth with investment growth. Since our inflation analyses use monthly data, we employ the seasonally adjusted index of manufacturers' total inventories for all manufacturing industries (*AMINV*) as a proxy for investment in this analysis, as this investment measure is available at a monthly frequency. However, we confirm that earlier conclusions on the investment effects of aggregate earnings growth obtain even when *AMINV* is used as the investment proxy.[32] Although our main focus is on the relation between investment and PPI, for completeness, we also report results from similar analysis linking consumption growth (measured either as growth in personal consumption expenditures or in personal outlays) to CPI.

The results, reported in Table 5, reveal that the coefficient on investment growth is significantly positive in the PPI regression. This result continues to hold after including control variables in the regression, suggesting that shocks to investment growth increase prices of production goods in the subsequent month. The coefficient of 0.306 suggests that one standard deviation increase in inventory growth increases one-month-ahead PPI by 0.197 percent, which is more than the average PPI of 0.190 percent in this sample. When we focus on CPI regressions, we find a significantly positive coefficient on both consumption growth proxies. These results confirm that investment growth affects the near-term price of production goods, while consumption growth affects the short-term price of consumption goods.[33]

These findings suggest that our earlier results on the lack of a relation between aggregate earnings growth and CPI inflation innovations is not due to consumption goods' prices being insensitive to demand shifts, but rather is due to aggregate earnings growth not sufficiently shifting near-term demand for consumption goods. The results also confirm that the link between aggregate earnings growth and PPI inflation is due to investment demand shifts affecting prices of production goods.

VI. IMPLICATIONS OF INVESTMENT DEMAND VERSUS CONSUMPTION DEMAND HYPOTHESES

Predictive Ability of Aggregate Earnings Growth for Macroeconomic Forecast Errors

Konchitchki and Patatoukas (2014a) show that macro-forecasters do not efficiently incorporate the information contained in aggregate earnings changes about nominal growth in future GDP. As business investment is a major component of the GDP, inefficiencies in GDP forecasts could be due to inefficiencies in their investment component.[34] Alternatively, as GDP is a nominal figure, GDP forecast inefficiencies could be caused by inefficiencies in inflation forecasts, which our earlier findings suggest should occur mainly through PPI forecast inefficiencies. To test these implications, we first study whether macroeconomic forecast errors for investments, consumption, and inflation (PPI or CPI) are predictable based on aggregate earnings growth.

We obtain the quarterly forecasts of private non-residential fixed investment growth, changes in private inventories, and personal consumption expenditures growth from the Survey of Professional Forecasters (SPF) provided by the Federal Reserve Bank of Philadelphia.[35] The SPF is conducted quarterly among economists through questionnaires at the beginning of the second month in the quarter to which the macro-activity pertains. The SPF is released in the fourth week of the second month.

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[31] Our results for future inflation are qualitatively similar to those reported when we focus on the prediction of two-month-ahead inflation.

[32] The *AMINV* data are available only from 1992 and so all analyses using these data are based on a shorter sample period. Also, in line with the lack of predictive ability for aggregate earnings growth for quarterly inflation, we find little relation between quarterly investment growth and quarterly PPI changes.

[33] In untabulated analyses, we estimate VAR Equation (3) after replacing aggregate earnings growth with corresponding growth in investments or consumption, and obtain the same conclusions as those discussed here.

[34] Consumption expenditure is the largest component of the GDP, whereas business investment is the most volatile component. The other components of the GDP are government spending and net exports.

[35] We restrict this analysis to investment and consumption proxies, for which we are able to obtain quarterly forecast data.

TABLE 5

OLS Regression of Inflation Proxies on Lagged Investment and Consumption Proxies

	Dependent Variable					
	$APPI_t$	$APPI_t$	$ACPI_t$	$ACPI_t$	$ACPI_t$	$ACPI_t$
Intercept	0.139	0.160	0.582	0.152	0.118	0.152
	(3.09)	(3.40)	(3.73)	(5.86)	(4.94)	(5.82)
$AMINV_{t-1}$	0.249	0.306				
	(3.73)	(3.65)				
$APCE_{t-1}$			0.196	0.097		
			(4.80)	(2.35)		
APO_{t-1}					0.205	0.101
					(4.93)	(2.37)
Control Variables	No	Yes	No	Yes	No	Yes
Percent Adj. R^2	4.82	10.28	7.95	24.60	8.38	24.63

This table presents the results from OLS regression of inflation proxies on lagged investment and consumption growth proxies. The investment growth proxy is the percentage change in seasonally adjusted value of manufacturers' total inventories for all manufacturing industries (*AMINV*). The consumption growth proxies are percentage change in (1) personal consumption expenditures (*APCE*), and (2) personal outlays (*APO*). The control variables are three lags of the dependent variable, $\Delta DEFAULT_{t-1,t-3}$, $\Delta YIELD_{t-1,t-3}$, $\Delta TERM_{t-1,t-3}$, and $\Delta SP500_{t-1,t-3}$. The coefficients on control variables are not reported. The analyses are run at the monthly frequency. The sample, which covers the period between March 1992 and June 2013, has 256 months. The t-statistics are reported in parentheses.

Thus, for example, forecasts of investments made in the first quarter of a calendar year are publicly released in the fourth week of February.

As hypothesized earlier, because the inflation effects of aggregate earnings growth are more likely to be short-lived, and given that inflation information is released monthly, we obtain monthly forecasts of the PPI and the CPI from Money Market Services (MMS), provided by Haver Analytics (see: http://www.haver.com/). The MMS surveys are conducted every Friday morning among senior economists and bond traders in major commercial banks, brokerage houses, and some consulting firms, mostly in the greater New York, Chicago, and San Francisco areas. The dataset provides median-polled forecast values for the PPI and the CPI.[36]

We compute the forecast errors for each macro-variable as the difference between the actual and corresponding forecast. Thus, for example, the forecast error for private non-residential fixed investment growth ($EPNFI\_SPF_q$) is computed as the actual growth rate in the private non-residential fixed investment released in quarter q, less its median forecast. The other quarterly forecast errors pertain to changes in private inventory ($EINV\_SPF_q$) and personal consumption expenditures growth ($EPCE\_SPF_q$). Using a parallel approach, the monthly forecast errors for the PPI ($EPPI_t$,) are computed as the percentage monthly change in actual PPI released in month t, less the median forecasted percentage change in the PPI. The forecast errors for the CPI, $ECPI_t$, are calculated similarly.

If macroeconomic forecasters efficiently incorporate information contained in aggregate earnings growth, then the latter should be unrelated to the forecast errors revealed in subsequent periods. This is similar in spirit to the rationale underlying the tests of the efficiency of analysts' earnings forecasts. To test this prediction, we estimate the following time-series regressions using observations from April 1980 to June 2013:

$$Forecast\ Error_q = \beta_0 + \beta_1 Aggregate\ Earnings\ Growth_{q-1} + Control\ Variables_{q-1} + \varepsilon_q \quad (4a)$$

$$Forecast\ Error_{t+j} = \beta_0 + \beta_1 Aggregate\ Earnings\ Growth_{t-1,t-3} + Control\ Variables_{t-1,t-3} + \varepsilon_{t+j} \quad (4b)$$

where *Forecast Error* is one of the abovementioned forecast errors revealed in quarter q or in month $t+j$ ($j = 0$, 1, or 2). *Aggregate Earnings Growth* is either *VCOMP* or *ECOMP*, computed using earnings announced in quarter $q-1$ or in months $t-1$ to $t-3$. The control variables are $\Delta DEFAULT_{q-1}$, $\Delta YIELD_{q-1}$, $\Delta TERM_{q-1}$, and $\Delta SP500_{q-1}$ ($\Delta DEFAULT_{t-1,t-3}$,

[36] Balduzzi et al. (2001) observe that the MMS data are the most commonly used in studies of economic announcements. Studies that use MMS data to estimate macroeconomic expectations include Urich and Wachtel (1984), McQueen and Roley (1993), Elton (1999), Balduzzi et al. (2001), Flannery and Protopapadakis (2002), Andersen, Bollerslev, Diebold, and Vega (2003, 2007), Bernanke and Kuttner (2005), and Gürkaynak et al. (2005).

TABLE 6

OLS Regression of Macro-forecast Errors on Lagged Aggregate Earnings Growth

Panel A: Quarterly Forecast Errors

	Dependent Variable					
	$EPNFI\_SPF_q$		$EINV\_SPF_q$		$EPCE\_SPF_q$	
Intercept	−0.197	0.325	−7.715	−5.610	0.726	0.681
	(−0.29)	(0.51)	(−3.22)	(−2.49)	(4.02)	(3.96)
$VCOMP_{q-1}$	6.637		24.834		−0.496	
	(4.23)		(4.75)		(−1.34)	
$ECOMP_{q-1}$		6.437		22.275		−0.420
		(4.49)		(4.65)		(−1.23)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Percent Adj. R^2	14.30	15.70	20.82	20.31	4.04	3.83

Panel B: Monthly Forecast Errors

	Dependent Variable											
	$EPPI_t$	$EPPI_{t+1}$	$EPPI_{t+2}$	$EPPI_t$	$EPPI_{t+1}$	$EPPI_{t+2}$	$ECPI_t$	$ECPI_{t+1}$	$ECPI_{t+2}$	$ECPI_t$	$ECPI_{t+1}$	$ECPI_{t+2}$
Intercept	−0.066	−0.065	−0.056	−0.054	−0.056	−0.049	−0.012	−0.014	−0.016	−0.013	−0.015	−0.016
	(−2.91)	(−2.91)	(−2.44)	(−2.53)	(−2.61)	(−2.26)	(−1.42)	(−1.69)	(−1.87)	(−1.65)	(−1.89)	(−2.01)
$VCOMP_{t-1,t-3}$	0.106	0.102	0.061				−0.008	−0.003	0.001			
	(2.25)	(2.18)	(1.30)				(−0.47)	(−0.14)	(0.04)			
$ECOMP_{t-1,t-3}$				0.073	0.078	0.040				−0.003	0.003	0.004
				(1.69)	(1.81)	(0.94)				(−0.18)	(0.18)	(0.24)
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Percent Adj. R^2	1.41	1.19	0.16	0.86	0.82	−0.04	1.54	0.63	−0.02	1.50	0.63	−0.01

This table presents the results from the regressions of macro-forecast errors on lagged aggregate earnings growth and lagged control variables. The macro-forecast errors are computed as the actuals minus the corresponding forecast for each macro-variable analyzed. The forecasts are obtained from either the Survey of Professional Forecasters (for quarterly analysis) or Money Market Services (for monthly analysis). Panel A reports the results for the private non-residential fixed investment growth rate ($EPNFI\_SPF_q$), changes in private inventories ($EINV\_SPF$), and personal consumption expenditure growth rate ($EPCE\_SPF$) forecast errors in quarter q. Panel B reports the results for the producer price index ($EPPI$) and consumer price index ($ECPI$) forecast errors in months t to t+2. The control variables are $\Delta DEFAULT_{q-1}$, $\Delta YIELD_{q-1}$, $\Delta TERM_{q-1}$, and $\Delta SP500_{q-1}$ ($\Delta DEFAULT_{t-1,t-3}$, $\Delta YIELD_{t-1,t-3}$, $\Delta TERM_{t-1,t-3}$, and $\Delta SP500_{t-1,t-3}$) in quarterly (monthly) regressions. The control variables also include one lag of the dependent variable in quarterly regressions and three lags of dependent variable in monthly regressions. The coefficients on control variables are not reported. Quarterly forecasts start from 1981:Q3. The number of observations is 127 (399) in quarterly (monthly) regressions. The t-statistics are reported in parentheses.

$\Delta YIELD_{t-1,t-3}$, $\Delta TERM_{t-1,t-3}$, and $\Delta SP500_{t-1,t-3}$) in quarterly (monthly) regressions. Additionally, to control for potential serial correlation, we include three lags of the dependent variable in monthly regressions and one lag of the dependent variable in quarterly regressions. To conserve space, we do not tabulate the control variables.

The regression results are reported in Table 6. Panel A presents the results of the quarterly investment and consumption forecast errors. In regressions of $EPNFI\_SPF_q$, the coefficients on both value- and equal-weighted aggregate earnings growth measures are significantly positive, suggesting that lagged earnings growth has the ability to predict private non-residential fixed investment forecast errors. Similarly, we find that aggregate earnings growth predicts changes in inventory forecast errors. However, we do not find any statistically significant relation between aggregate earnings growth and personal consumption expenditure growth forecast errors. The insignificant coefficient on the short-term forecasts of personal consumption expenditures is consistent with previous analyses indicating the weak link between aggregate earnings growth and short-term innovations in future consumption.

Panel B of Table 6 documents the statistically significant coefficients on both aggregate earnings growth measures in the regressions of one- and two-month-ahead PPI forecast errors. The coefficients on $VCOMP_{t-1,t-3}$ and $ECOMP_{t-1,t-3}$ are 0.106 and 0.073, respectively, for the one-month-ahead PPI forecast error. These coefficients imply that a one-standard-deviation

increase in $VCOMP_{t-1,t-3}$ ($ECOMP_{t-1,t-3}$) increases the PPI forecast errors by 0.05 percent (0.03 percent), which is economically large (around 20 percent of the average monthly change in a PPI of 0.22 percent).[37]

In all of the regressions of the CPI forecast errors, the coefficients on the aggregate earnings growth proxies are insignificant. This result holds across both aggregate earnings growth measures. These results are consistent with our earlier findings that aggregate earnings growth has greater incremental information about future investments and PPI innovations than about future personal consumption expenditures and CPI innovations.

Overall, the results from Table 6 suggest that macroeconomic forecasters do not fully incorporate the macro information contained in aggregate earnings growth in their forecasts for investment growth and PPI forecasts. Moreover, consistent with aggregate earnings growth containing only limited incremental information about future consumption or CPI innovations, we do not find inefficiency in either the personal consumption expenditure growth or CPI forecasts with respect to aggregate earnings growth. This dichotomy in the results between investment and consumption runs consistently through all of our analyses.

Inefficiency in GDP Growth Forecasts

As investment and consumption are two substantial components of GDP, we next examine whether inefficiencies in these forecasts can potentially explain the inefficiencies in GDP growth forecasts documented by Konchitchki and Patatoukas (2014a). To test this, we initially replicate the Konchitchki and Patatoukas (2014a) analysis by regressing GDP growth forecast errors on the lagged measure of aggregate earnings growth, and then extend the regressions to include contemporaneously measured forecast errors of GDP components (*viz.,* investment and consumption), with inflation forecast errors as additional controls. By including these additional controls, the regressions essentially test whether aggregate earnings growth predicts the component of GDP forecast errors that is orthogonal to PPI and investments forecast errors. It is important to note that because GDP component forecast errors are contemporaneously measured to the dependent variable, this regression cannot and is not intended to question the validity of the Konchitchki and Patatoukas (2014a) results. In fact, macro-forecasters will not have these additional controls at the time of forecasting GDP growth and, thus, cannot rely on them to improve their GDP growth forecasts. Rather, the objective of this analysis is merely to examine which component of GDP causes the GDP growth forecast inefficiency documented in Konchitchki and Patatoukas (2014a).

We implement this analysis by closely following the approach of Konchitchki and Patatoukas (2014a). First, we measure aggregate earnings growth (hereafter, $VPREL_{q-1}$) as the value-weighted average of firms' earnings growth during quarter $q-1$ (constituting months $t-1$ to $t-3$), where firm-level earnings growth is defined as the year-over-year change in quarterly net income, scaled by sales. Although we tabulate the results for the $VPREL_{q-1}$ measure to be consistent with Konchitchki and Patatoukas (2014a), we obtain similar conclusions when we replace $VPREL_{q-1}$ with either $VCOMP_{q-1}$ or $ECOMP_{q-1}$. Second, we rely on data obtained from the Compustat Quarterly Preliminary History dataset, delete the top and bottom percentiles of earnings growth each quarter before computing cross-sectional averages, and include only firms with December fiscal year-ends and those that released their earnings within the first month after fiscal quarter end. Third, we restrict the sample for this analysis to the period between 1988:Q1 and 2011:Q4. The sample covers 93 quarters, excluding 1995:Q4, for which the relevant GDP data are unavailable due to a government shutdown. Fourth, the t-statistics are based on Newey and West's (1987) standard errors with three lags. Finally, the GDP growth forecast errors ($EGDP_q$) for quarter q are based on the third revised estimate of the GDP and the mean consensus forecasts of GDP growth provided by the SPF during the quarter. Given that Konchitchki and Patatoukas (2014a) primarily focus on quarter-ahead GDP growth forecast errors, we also tabulate results primarily for this forecast error.

The results reported in Table 7 show that the proxy for aggregate earnings growth is significantly positive.[38] After adjusting the coefficients to express the GDP forecast errors from percentage to decimal, we obtain a coefficient on $VPREL_{q-1}$ of 0.093 with a t-statistic of 2.46, which is comparable to the coefficient of 0.138 (t-statistic = 3.64) reported in Konchitchki and Patatoukas (2014a). When we include the personal consumption expenditure forecast errors for the contemporaneous quarter and the CPI forecast errors for the months constituting this quarter, we find that the coefficient on aggregate earnings growth increases by nearly 40 percent and continues to be significant at the 1 percent level. Moreover, the consumption and CPI forecast errors tend to be significantly related to the GDP growth forecast errors, which is not surprising, as consumption and inflation variables are directly related to nominal GDP growth. However, the significant coefficient on $VPREL_{q-1}$ points

[37] The significantly negative intercepts in regressions of PPI forecast errors are driven by optimistic forecasts in the first half of the subsample (i.e., pre-1997 period). This finding is consistent with that of Aggarwal et al. (1995), who report that during their sample period between November 1977 and November 1993, survey forecasts of "PPI tend to over-predict the realized (actual) value."

[38] Our conclusions are unaffected by including lagged GDP growth as an additional control variable.

TABLE 7

OLS Regression of Nominal GDP Growth Forecast Errors on Lagged Aggregate Earnings Growth

	Dependent Variable				
	$EGDP_q$	$EGDP_q$	$EGDP_q$	$EGDP_q$	$EGDP_q$
Intercept	0.165	−0.104	0.077	0.178	−0.090
	(1.03)	(−0.81)	(0.53)	(1.17)	(−0.82)
$VPREL_{q-1}$	9.340	12.943	3.653	5.758	1.013
	(2.46)	(3.40)	(1.00)	(1.21)	(0.25)
$ECPI_t$		2.472			1.951
		(2.56)			(2.66)
$ECPI_{t+1}$		1.814			2.381
		(1.80)			(2.63)
$ECPI_{t+2}$		2.211			2.209
		(2.92)			(2.06)
$EPCE\_SPF_q$		0.616			0.639
		(8.76)			(8.90)
$EPPI_t$			0.079	−0.016	0.388
			(0.23)	(−0.04)	(1.61)
$EPPI_{t+1}$			−0.351	−0.215	−0.169
			(−1.18)	(−0.60)	(−0.77)
$EPPI_{t+2}$			0.634	0.731	0.524
			(1.60)	(2.10)	(1.70)
$EPNFI\_SPF_q$			0.070		0.056
			(2.93)		(2.85)
$EINV\_SPF_q$				0.006	0.016
				(1.02)	(3.11)
Percent Adj. R^2	1.67	41.33	8.67	1.45	52.16

This table presents the results from the regressions of nominal GDP growth forecast errors ($EGDP_q$) on lagged aggregate earnings growth $VPREL_{q-1}$ and control variables. Aggregate earnings growth is computed as the value-weighted average of firms' earnings growth during quarter $q-1$. Firm-level earnings growth is defined as year-over-year change in quarterly net income scaled by sales. The top and bottom percentiles of earnings growth are deleted each quarter before computing the cross-sectional averages. Only firms with December fiscal-year ends and those that released their earnings within the first month after the fiscal quarter-end are included for the computation of $VPREL_{q-1}$. The GDP growth forecast errors ($EGDP_q$) for quarter q are based on the third revised estimate of the GDP and forecasts of the GDP provided by the Survey of Professional Forecasters during quarter q. $EPCE\_SPF_q$ is the forecast error in the personal consumption expenditure growth rate. $EPNFI\_SPF_q$ is the forecast error in the private non-residential fixed investment growth rate. $EINV\_SPF_q$ is the forecast error in the change in private inventories. These forecast errors are defined similarly to the GDP forecast error, and obtained from the Survey of Professional Forecasters. $ECPI_{t+j}$ ($j=0$ to 2) and $EPPI_{t+j}$ ($j=0$ to 2) are the forecast errors of the CPI and PPI, respectively, based on monthly Money Market Services forecasts in the months constituting quarter q. In this table, all of the subscripts reflect the period to which the variables pertain rather than their announcement month. The sample, which covers the period between 1988:Q1 and 2011:Q4, but excludes 1995:Q4 due to a government shutdown, has 93 quarters. The t-statistics, based on Newey and West (1987) standard errors with three lags, are reported in parentheses.

out that the consumption and CPI forecast errors are insufficient to explain the ability of aggregate earnings to predict future GDP growth forecast errors.

When we replace consumption and CPI forecast errors with private non-residential fixed investment ($EPNFI\_SPF_q$) and PPI forecast errors, the coefficient on $VPREL_{q-1}$ declines by over 70 percent and becomes insignificant. Although the coefficient on *EPPI* is insignificant in the first two months, with signs flipping across the variables, the coefficient is statistically significant for the third month. The coefficient on $EPNFI\_SPF_q$ is consistently significantly positive in the regressions. Also, aggregate earnings growth continues to be insignificant when we use changes in inventory forecast errors ($EINV\_SPF_q$) instead of private non-residential fixed investment forecast errors. When we include all forecast errors in the regression, the coefficient on $VPREL_{q-1}$ reduces further in magnitude and continues to be highly insignificant. These results suggest that the predictive ability of aggregate earnings growth for future GDP growth forecast errors pertains primarily to macro-forecasters making errors in investment or PPI forecasts, and that inefficient GDP growth forecasts and investment or PPI forecasts are not independent. We would like to emphasize that our focus here is only on the ability of aggregate earnings growth to predict nominal GDP forecast errors. Other studies find aggregate profit margins and aggregate asset turnovers to predict real GDP and real GDP forecast errors (Konchitchki and Patatoukas 2014b), indicating that there is likely to be other information in earnings numbers, not examined here, that is relevant to future GDP.

VII. CONCLUSION

A growing literature on the macro-content of accounting numbers has generally found a link between accounting numbers and information about future macroeconomic activities, such as inflation and GDP growth. However, prior studies do not investigate the mechanisms underlying these links, or otherwise explain the reasons for the relationships. This study evaluates two possible mechanisms through which aggregate earnings growth could causally affect future inflation. The findings are then used to better understand the GDP forecast inefficiencies documented in Konchitchki and Patatoukas (2014a).

Our first hypothesis is that growth in firm-level earnings causes managers to revise investment plans, leading them to increase investments following positive earnings growth and to decrease or delay investments following negative earnings changes. These changes, at the aggregate level, cause the demand curve for production goods and services to shift. This shift in aggregate demand then influences the inflation of production goods and services in the near term due to supply's inability to fully adjust to demand changes in the short run.

Our second hypothesis is that aggregate earnings growth affects future inflation by causing individuals' consumption to change. This possibility arises because aggregate earnings growth could change individuals' wealth in the near term by either affecting stock market returns or by changing labor income. To the extent that wealth changes are consumed by individuals in the short run, it would shift the demand curve for consumption goods at the aggregate level, affecting the inflation of consumption goods in the short run when their supply is relatively inelastic.

Our empirical tests reveal that aggregate earnings growth affects investments and the prices of production goods (the PPI) in subsequent periods. In contrast, there is, at best, a weak effect of aggregate earnings growth on either consumption or the prices of consumption goods (the CPI). These conclusions are consistently obtained across a variety of analyses and across alternative research methodologies. Additional analyses reveal that GDP growth forecast inefficiencies documented by Konchitchki and Patatoukas (2014a) relate to, among other potential reasons, inefficiencies in near-term investments and PPI forecasts, presumably because macro-forecasters do not efficiently incorporate the investment demand effects of aggregate earnings growth. Based on these findings, we conclude that aggregate earnings growth affects future inflation through its short-term effects on firms' investment strategies.

Apart from contributing to the macro-accounting literature, this study's findings will help monetary authorities, macro-forecasters, and capital market participants to better understand the effects of aggregate earnings growth on future inflation and GDP growth. The study's findings also extend prior evidence on firm-level real effects of financial reporting by showing that firm-level effects translate into macroeconomic effects at the aggregate level. Our results also have methodological implications for researchers, as they show that even if various inflation measures are highly correlated, results and inferences can be affected by choices of inflation measures in the analyses.

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APPENDIX A
Construction of CPI and PPI Indices

The CPI is the most widely used measure of inflation and is often viewed as the benchmark inflation guide for the U.S. economy.[39] The CPI focuses on tracking price changes that affect consumers, and primarily measures the adjustments that need to be made to consumer payments when the intention is to maintain consumers' purchasing power. The CPI is derived from the prices on a base-year market basket that is selected by weighting 200 categories of goods and services grouped under eight categories: food and beverages, housing, apparel, transportation, medical care, recreation, education, and communication, among other goods and services. The weight for each category in the CPI basket is based on expenditure information gathered through surveys of thousands of families across the country.[40] For each of the categories in the basket, the Bureau chooses samples of several hundred specific items within select business establishments and doctors' offices. The prices considered for the index include taxes and government fees directly associated with the purchase of goods and services, such as sales and excise taxes.

Unlike the consumer-oriented focus of the CPI, the PPI measures the average change over time in the selling prices received by domestic U.S. producers for their output.[41] The prices included in the PPI are from the first commercial transaction for products and services, and reflect the net revenues received by producers. These prices, thus, exclude revenues collected on behalf of governments, such as sales taxes, and the effects of customer rebates or subsidized interest financing if the costs of these promotions are not borne by the manufacturers.[42]

The PPI is broader in its coverage of goods and services than the CPI, and primarily covers the goods and services purchased by other businesses, which justifies our decision to use it in measuring the price changes for production goods. In addition, unlike the CPI, the PPI includes price changes for goods produced in the U.S. specifically for military or export, but does not track changes in the prices of imported goods and services.

[39] The discussions in this subsection are largely based on information provided on the Bureau of Labor Statistics' website (see: https://www.bls.gov/).

[40] The expenditure weights are currently updated every two years. Before 2002, the weights were updated roughly once every ten years.

[41] The aggregate earnings of U.S.-listed firms include earnings from products sold outside of the U.S. The effect of such foreign earnings on the PPI depends on whether the product is manufactured in the U.S. Our discussions with officials at the BLS reveal that if a product is manufactured in the U.S., then its price is considered for the PPI, but not otherwise. In our analysis, we consider excluding foreign earnings from the definition of aggregate earnings. Given that some of the foreign earnings are relevant for the PPI, *a priori* it is not obvious that foreign earnings should be excluded from aggregate earnings. In any case, we could not conduct our analysis on domestic earnings, as the segment data on earnings are only available on an annual basis in Compustat, whereas our analysis requires data at a monthly or, at most, quarterly frequency.

[42] The PPI views wholesalers and retailers as service providers (such as marketing and distributing goods to customers) rather than suppliers of goods. Hence, the PPI computes output prices for wholesale or retail trade establishment as the difference between the selling price of a good and its acquisition price.