Pomona College Economics Senior Activity

An Extension to the Profits Theory of Investment: Less Competition, More Growth?

By

DERRICK CHOE;
PAUL LE TRAN (TRẦN LÊ ANH PHÚ)

Department of Economics
POMONA COLLEGE

A senior exercise submitted to the Economics Department of Pomona College in accordance with the requirements of the degree of BACHELOR OF ARTS in the Faculty of Economics.

1ST MAY 2017

Abstract

This senior exercise will be investigating the empirical applicability of the Profits Theory of Investment, and further investigating its connection to market concentration in the United States. It was specifically found that whilst the relationship between market concentration and profitability across industries is both statistically significant and strong, the Profits Theory of Investment was statistically significant but weak in terms of its effects.

Table of Contents

Page

List of Tables

Table **Page**

List of Figures

Figure **Page**

CHAPTER 1

INTRODUCTION

In the past decade, the U.S. economy has experienced dramatic declines in productivity, business dynamism (i.e. firm entry and turnover rates), and job growth [3, Baily and Montalbano, 2016]. For reasons not yet fully understood, American firms are becoming less innovative and competitive. Accompanying this increase in market concentration comes a concern about the state of investment within the U.S.; if large incumbent firms lack competition, they may enjoy inflated profit levels and lack incentives to innovate and invest in new technologies [1, Alesina et al., 2005]. We seek to test the Profit Theory of Investment (the PTI), which would contradict these concerns of decreased investment and technological growth [14, Merling, 2016]. This theory states that a firm's investment is a positive function of its profits: Using Compustat North America and the Economic Census data, we test whether this hold true for U.S. firms in recent years. Additionally, we explore whether industry concentration is positively correlated with profit levels, through means of decreased competition. Through these two relationships, we test whether increased market concentration implies higher investment in the United States.

1.1 Profits and Investment: The PTI

The PTI is elegant and simple; it states that investment I is a positive and direct function of profits, or

$$I = f(\text{Profits}). \tag{1.1}$$

The PTI "... implie[s] that all else equal, firms with higher profits invest more" [17, Romer, 2012]. The core of the PTI stems from how "theories of financial-market imperfections imply that internal finance is less costly than external finance" [17, Romer, 2012]. This discrepancy in costs can be attributed to three mechanisms: adverse selection, lack of flexibility, and monitoring costs.

The Profit Theory of Investment is backed both theoretically and empirically. Taking the former approach, Alesina et al. confirmed a positive relationship between profits and investment. Focusing on "... the effects… of the fiscal policy channel… of public spending and taxes on labor costs and therefore profits,... [they derived that] ceteris paribus, an increase… in the real wage decreases the shadow value of capital, and hence investment" [2, Alesina et al., 1999]. This theory was further addressed through a large empirical study which compared the investment behaviours of different types of firms [8, Fazzari et al., 1988]. Firms in their sample were divided according to their dividend payments as a fraction of income. "Firms that pay high dividends can finance additional investment by reducing their dividends. Firms that pay low dividends, in contract, must rely on external finance" [17, Romer, 2012]. In other words, Fazarri et al. found that financial-market imperfections (i.e., the cost differences in financing methods) have a large effect on investment in low-dividend firms, as firms paying low dividends often must rely on external financing [8, Fazzari et al., 1988].

However, there exist several potential issues with this study. For one, firms such as Google and Facebook are examples of firms that pay little to no dividends, but are likely to not rely on external financing. Another issue with this study is one of reverse causality; firms that use internal financing for investment might not have enough cash left to pay high dividends. Furthermore, it's argued that even in firms facing barriers to external finance, there is little reason to expect a stronger relationship between investment and profitability [11, Kaplan and Zingales, 1997]. Specifically, they argued that the theory that financial-market imperfections are important to investment does not make strong predictions about the differences in the sensitivity of investment to profits across different kinds of firms [11, Kaplan and Zingales, 1997]. Furthermore, additional critiques of the PTI are that it's possible for many firms to not be liquidity-constrained, and that firms with high profit levels may not actually invest their excess reserves (e.g., Apple).

Research investigating this theory in the 21st century is limited in the sense of few modern publications. Given the recent declines in productivity in the U.S. economy, we find it prudent to use current data to test the PTI.

1.2 Industry Concentration and Profitability

Although microeconomic theory suggests that increases in market power allow for higher profitability, empirical evidence is mixed. It was found that the differences in profit rates, amongst industries with varying concentration ratios, are minimal [10, Gort and Singamsetti, 1976]. In contrast, a positive correlation between market share and profitability, via the proxy measurement of return on investment, was found [4, Buzzell et al., 1975]. In their Harvard Business Review article, they believe that increasing economies of scale, market power, and quality of management could explain the observation that increasing market share increases a firm's chances of high profit margins, declining purchase-to-sales ratio, declining market costs as a percentage of sales, higher quality of goods, and higher prices [4, Buzzell et al., 1975].

Similar to the study done by Bailey and Montalbano, the Economist (2016) also found evidence supporting a less competitive, but higher profit U.S. economy overall [6, The Economist, 2016]. We take inspiration from previous studies and create our own model investigating the relationship between industry concentration and profitability in recent years.

1.3 Industry Concentration and Investment

Definition 1.1. A market is considered to be *perfectly competitive* if it possesses the following characteristics: [17, Romer, 2012]

- Large numbers of firms and consumers;

- Perfect information amongst all firms and consumers;
- No barriers to entry or exit;
- Consumers are considered rational;
- No externalities;
- All firms are price takers;
- All firms are profit maximising.

A market is thus considered imperfectly competitive if any of these conditions are violated. Furthermore, the degree in which a market is imperfectly competitive depends on the degree of violation of the above conditions. With this in mind, recall that in perfectly competitive markets, all firms obtain zero profits in the long run. Therefore, it is possible that as a market becomes less competitive, firms will experience higher profit levels, and therefore increase their levels of investment. This theory is controversial because it goes against the common notion that market competition is ideal for both consumers and economic growth. Empirical studies have found conflicting conclusions about the effects of competition on investment levels. It was found that policies encouraging competition resulted in increased investment levels in non-manufacturing industries like energy and communications [1, Alesina et al., 2005]. However, they also found that the promotion of market entry have possibly resulted in negative effects on network investment for the hard-lined telecommunications industry. Additional unrelated research found no evidence for a relationship between consolidation, via higher concentration, and an increase in investment in mobile markets [7, Elixmann et al., 2015]. We wish to contribute to this ongoing debate by not only using current data to test the linkage between industry concentration and investment, but also through investigating this relationship across multiple industries.

1.4 Going Forward

The next section will detail the dataset used for all analyses, created by merging both the Compustat North America and Economic Census datasets. We then move onward to discuss the series of multi-linear regression models that will be used to investigate the validity of the PTI. This is done in two stages. We first examine the connection between industry concentration and profitability. Afterwards, we look at the connection between profitability and investment (i.e., the PTI). If both stages show statistically significant relationships, we are therefore able to establish a connection between industry concentration and investment levels.

Chapter 2

Data & Descriptions

2.1 Rationale

This paper's analyses and regression models draw upon data from Compustat North America and the Economic Census. The former provides detailed firm level information from the years 1950-2016; we use this dataset to derive measures of profitability and investment across firms and time. Relevant variables from this dataset include net income, gross profits, total assets, and total employees (detailed explanation of all variables will follow in the next section). Economic Census industry concentration data is reported every five years; our sample ranges from the years 2002-2012. Reporting the percent of revenues (for non-manufacturing industries) and the percent of value added (for manufacturing industries) held by the top 4, 8, 20 and 50 firms in each respective industry, the Economic Census covers NAICS codes up to the 6 digit level. We aggregate profit levels by industry with the purposes of linking industry concentration to profitability. By merging with Economic Census data, we compare the revenues held by the top 50 firms in an industry to the relative profit levels in that industry.

2.2 Variable Description & Explanation

Understanding the theory behind the PTI and the potential connection between industry concentration and investment levels, we now turn to understanding the specific variables that are used to test the validity of these two relationships empirically.

2.2.1 Regressands

Gross profits: gp

Compustat codes this variable in millions of US dollars and defines this variable as the difference between total revenue and cost of goods sold. This variable is the main regressand in the multi-linear regression model that investigates the relationship between market concentration and profit levels.

Capital Expenditures: $capx$

Compustat codes this variable in millions of US dollars and defines this variable as the funds used for additions to property, plant, and equipment, excluding amounts arising from acquisitions (for example, fixed assets of purchased companies), and finally includes property & equipment expenditures. Therefore, we use this variable to represent industry investment levels when investigating the PTI.

Research and Development (R&D) Expense: xrd

Compustat codes this variable in millions of US dollars and defines this variable as all costs a company incurred during the year that relate to the development of new products or services. By also including software expenses and the amortisation of software costs, we believed that this variable is useful in capturing R&D levels in both technology-related and non-technology-related industries. We thus use this variable as a regressand when performing a robustness check in our investigation of the PTI.

2.2.2 Regressors

Gross Profits: gp

With the definition already established above, we use gross profits as a regressor when investigating the PTI, as this variable represents industry profit levels in the regression.

Percent of Revenue Held Held By Industry's Top 50 Firms: $revperc50$

The Economic Census codes this variable in percentage points and defines this variable as the percentage of an industry's revenue held by said industry's top 50 firms. This variable serves as the main regressor measuring an industry's level of competition and concentration, and is used to investigate the relationship between market competition and profits.

Total Assets: at

Compustat codes this variable in millions of US dollars and defines this variable as the total assets/liabilities of a company at a point in time. The main purpose of using this variable as a regressor in our models is to ensure we control for company size when working with gross levels of profit and investment.

Fiscal Year (Time Fixed Effects): γ

Time fixed effects are included in all of the regression models in order to prevent omitted variable bias from affecting the integrity of our parameters.

North American Industrial Classification System Codes (Industry Fixed Effects): α

Similar to time fixed effects, industry fixed effects are included in all of the regression models in order to prevent omitted variable bias from affecting the integrity of our parameters. Specifically, NAICS code specific up to three digits are used.

2.3 Summary Statistics

Before testing the relationship amongst industry concentration, profits, and investment via our given variables, it's necessary to have an understanding of some basic information and trends about each variable. Consider the Table A.1. of summary statistics in the Appendix. We immediately notice negative values for capital expenditures, which, at first, seem difficult to interpret. There is certainly the possibility for coding error, as well as the possibility of alternative accounting methods used by these firms. For example, firms might indicate an inflow of cash due to the sale of capital with negative capital expenditures. In any case, we found through trials of regression analysis that omitting these potential errors does not greatly affect our regression and statistical analyses due to the sheer amount of observations available when compared to how there are only 193 firms that have recorded negative capital expenditures.

From quick overview, we see that all firms in all industries cover a wide range of values when it comes to profits, assets, and types of investment. It's notable that the range of gross profits is massive. Coded in millions of US dollars, the fact that there exists one firm in the dataset that has a recorded gross profit of $128.130 billion, whilst the average gross profit is about $410.6 million gives some sense of market power some firms hold across industries. Additionally, observe how the maximum amount of capital expenditures recorded by a firm is a little over half of what the maximum amount of gross profits is. Superficially, this seems to suggest that incurring large amounts of profit might not result in large increases in investment.

Consider the time series plots of Figure Matrix A.1, located in the Appendix, for the median of logged gross profits, capital expenditures, R&D expenses, and total assets. We immediately see that all four measures experienced a sharp decrease during the late 1970s. However, all four variables have increased more or less linearly until near the present time, where the growth has stopped and seems to not be decreasing.

2.4 Estimated Models

We now turn towards understanding the multi-linear regression models that will be used to investigate the relationship between industry concentration and profits, and the validity of the PTI. Specifically, we have the following model to regress profit levels on industry concentration:

$$gp_{ijt} = \beta_o + \beta_1 revperc50_{it} + \beta_2 at_{it} + \beta_3 gp_{it-1} + \alpha_j + \gamma_t + \epsilon_{it}, \tag{2.1}$$

for $\alpha_j =$ industry fixed effects , and $\gamma_t =$ time fixed effects.

Additionally, the two following regression models are used to investigate the PTI across all firms:

$$\Delta[ln(capx_{ijt})] = \beta_o + \beta_1 \Delta[ln(gp_{it})] + \beta_2 \Delta[ln(at_{it})] + \beta_3 \Delta[ln(capx_{it-1})] + \alpha_j + \gamma_t + \epsilon_{it} + \mu_{it} \tag{2.2}$$

and

$$\Delta[ln(xrd_{ijt})] = \beta_o + \beta_1 \Delta[ln(gp_{it})] + \beta_2 \Delta[ln(at_{it})] + \beta_3 \Delta[ln(xrd_{it-1})] + \omega_j + \gamma_t + \epsilon_{it} + \mu_{it}, \tag{2.3}$$

for $\alpha_j =$ industry fixed effects , $\gamma_t =$ time fixed effects, and μ_{it} = normally distributed firm-specific random effects. A detailed explanation of why we estimate Equations (2.2) and (2.3) as random effects models will be provided in Section 3.2.2.

CHAPTER 3

REGRESSIONS DIAGNOSTICS & RESULTS

3.1 Industry Concentration & Profitability

To establish the relationship between market conditions and profit levels, we perform a panel data analysis across U.S. industries. We aggregate Compustat firm-level data up to the most specific industry available by NAICS code (the 6-digit level), and compute median gross profit, net income, and total assets for each of these industries. We use medians as our measure of "average" industry characteristics to mitigate the effects of extreme outliers pulling the mean. Our measure for industry competitiveness is the percent of revenue held by the top 50 firms in an industry; whilst concentration ratios are available for the top 4, 8, and 20 firms, we select the top 50 measure in order to capture broader information about individual markets. We follow this same reasoning when selecting median industry and profit levels; we are less concerned with the macroeconomic effects of a smaller population of large concentrated firms, but instead are concerned with a persistent and widespread trend of uncompetitive yet profitable incumbent firms across industries.

3.1.1 Diagnostics

Consider the following OLS estimation of Model (2) in Tables A.2. of the appendix. Before attempting to perform statistical inference, we first check whether our regression estimate suffers from heteroscedasticity, autocorrelation, and the spurious regression problem.

3.1.1.1 Diagnostics: Heteroscedasticity

For heteroscedasticity, we first examine Model (2)'s residuals plot in Figure A.2. of the appendix. With such close clustering, it's not obvious from the plot if our model estimate is heteroscedastic; we use the Breusch-Pagan test to formally detect this issue (displayed in Table A.3. of the appendix). At the 5% significance level, we see that the test model's overall F score is relatively high, and the p-value is essentially zero. This leads us to reject the null hypothesis that there exists no heteroscedasticity at the 5% significance level.

3.1.1.2 Diagnostics: Serial Correlation

Any analysis involving a time-wise component must not only take into account potential issues of heteroscedasticity (as demonstrated above), but also problems of serial correlation in the residuals. As such, it should be noted that even though we are working with panel data, we are not worried about the presence of autocorrelation affecting our analysis. It should be noted we only have three time periods in our data, and each period is spaced five years apart: as such, serial correlation should not be a problem with regards to Model (2).

3.1.1.3 Diagnostics: Unit Roots and Orders of Integration

Establishing the existence of heteroscedasticity and the non-issue of serial correlation in the residuals, we investigate for the presence of unit roots in our variables of interest. Because our dataset is limited to only three time periods of 2002, 2007, and 2012, we are unable to run the Augmented Dickey-Fuller (ADF) test for unit roots. It is for this reason that we are only able to inspect graphically.

Consider the following time series graphs of gross profits, total assets, and percent of revenue held by the top 50 firms in Figure Matrix A.3. of the appendix. We immediately see that all three variables follow a somewhat linear trend, implying that our variables are neither stationary nor integrated of order 1 (i.e., they are not I(0) processes). To determine what specific order of integration these variables are, we take first differences of gross profits and total assets. Due to lack of time periods for percent of revenue held by an industry's top 50 firms, and its graphical similarity with our two other variables, we assume that our conclusions for gross profit and total assets apply.

Consider the time series graphs of our first-differenced variables in Figure matrix A.4. of the appendix. We see that the graphs of first-differenced gross profits and total assets seem to be both mean-reverting and have somewhat constant variance. The lack of an obvious trend is additional evidence that our first-differenced variables are I(0) and potentially weakly stationary processes. Since percent of revenue held by the top 50 firms had a similar linear trend, we believe that our three variables are I(1) processes.

3.1.2 Establishing Cointegration

Our variables being I(1) processes imply that our Model (2) regression could be spurious, and therefore invalid. With only three time periods, we cannot resort to establishing the presence of cointegration amongst our variables through statistical tests. Instead, we argue for the presence of cointegration through economic theory and previous empirical work. Specifically, we will attempt to establish that gross profits, total assets, and market concentration are all affected by the same stochastic shock: the business cycle.

In terms of economic theory, observe that financing markets often become tighter and raise lending standards during recessions. Such examples can be seen through how "loan growth at commercial banks decreased substantially and remained negative... after the 2007-08 financial crisis", and how "lending growth slowed to zero during the 1990-91 and 2001 recessions..." [5, Dvorkin and Shell, 2016]. This results in entrepreneurs and people to get external finances needed to start a new business. This tightening in lending credit therefore results in a decrease in new businesses entering a market. We therefore would see an increase in market concentration in an industry. The link between investment and the business cycle is well researched. Boldrin et al. find that residential investment played a crucial role in the severity and duration of the Great Recession. In an NBER working paper, Rognlie et al. argue the combination of falling residential investment, as well as the burst in non-residential investment (the result of low interest rates in a liquidity trap), explain the asymmetric recovery in residential investment during the Great Recession. Understanding the theoretical and empirical evidence that stochastic business cycles affect market concentration, gross profits, and total assets (i.e., investment levels), we have reason to believe that our three variables are cointegrated [18, Vassolo et al., 2015][9, Gallet and Euzent, 2011][12, Machin and Van Reenen, 1993] [13, Rognlie et al., 2014] [15, Boldrin et al., 2013].

Establishing our variables to be cointegrated, there are several caveats and changes in interpretation to consider for Model (2). Firstly, OLS regressions performed on cointegrating variables will produce estimators that are super-consistent. This means that because OLS is super-consistent on β, we have $T(\hat{\beta}-\beta) \xrightarrow{d} \mathcal{N}(0,\Sigma)$ by the Central Limit Theorem [16, De Pace, 2016]. This faster rate of convergence to the true β implies that the relevant asymptotic theory to be applied on β for statistical inference is non-standard for OLS regression [16, De Pace, 2016]. Though this is a caveat for OLS regression performed on small samples, OLS can still be safely used to consistently estimate β because estimators $\hat{\beta}$ converge to β at a faster rate than normal. Given that our sample size is close to 700, the property of super-consistency should be applicable to Model (2)'s estimators.

The property of super-consistency also changes Model (2)'s interpretation to be that of long-run equilibrium between gross profits, total assets, and percent of revenue held by an industry's top 50 firms. By converging to the true parameter values much faster than normal, we are able to assume that Model (2)'s estimators are very close to the true parameter values, given a large enough sample size. This also implies that hypothesis tests and confidence interval construction are not required for long-run interpretation, because the estimators are already rapidly approaching their true values.

The final thing to consider is that cointegration results in the OLS estimators of Model (2) to be possibly biased. This seems to not be an issue for Model (2), as its R^2 is extremely close to one. This high coefficient of determination implies Model (2)'s estimators have little to no bias at all.

3.1.3 Market Concentration and Profitability: Non-Manufacturing Industries

Finding our OLS estimation to have an interpretation of long-run equilibrium because of cointegration, we disregard heteroscedasticity as a problem for said interpretation. Reexamining Model (2)'s results in Table A.4. of the appendix, we find, in the long run, that increases in the revenues held by the top 50 firms in an industry correspond to increases predicted gross profit levels. A one percentage point increase in industry concentration corresponds with a 8.327 million dollar increase in predicted median gross profits in that industry. In the long run and controlling for company size, we find that increases in total assets do not correspond with a strong change in gross profits, with predicted gross profits only increasing by around 4 cents for every dollar of total assets. Because these non-zero values represent the true values of Model (2)'s super-consistent estimators, we are able to state that there does exists strong relationship between market concentration and profitability amongst non-manufacturing industries.

3.1.4 Market Concentration and Profitability: Manufacturing Industries

We apply the same long run interpretation of Model (3), which is our OLS estimation for manufacturing industries. Model (3)'s results are displayed in Table A.5. of the appendix. Similar to Model (2), because the non-zero values represent the true values of Model (2)'s super-consistent estimators, we are able to state that there does exist a relationship between market concentration and profitability amongst manufacturing industries. However, the relationship is weaker, as we find, in the long run, that a one percentage point increase in percent of value added by the top 50 firms in an industry is associated with about an increase in gross profits by 60 cents.

3.2 Profitability & Investment

Now, working with Compustat firm-level data, we test the profit theory of investment. We first test for a linear relationship between gross profits and two measures of investment: Capital expenditures and research and development. We select these two regressands in order to understand how profit levels interact with different types of investment: excess funds might affect capital expenditures, which boost a firm's fixed assets, differently from how they affect research and development expenditures, which go towards the development of new technology as well as the improvement of existing ones. The results of Model (4) (capital expenditures as the regressand) and Model (5) (R&D expense as the regressand) are respectively displayed in Tables A.6. and A.7. of the appendix.

3.2.1 Diagnostics

Looking at the residual plots for both Models (4) and (5) in Figure Matrix A.5., we immediately see that both OLS regression models violate the Gauss-Markov Assumptions due to how the residuals seem to have non-constant variance. Therefore, we can see from the residuals plot themselves that both models (4) and (5) suffer from heteroscedasticity. Observing Figure Matrix A.5 in the Appendix once again, we quickly see that Models (4) and (5) are not valid due to how all of our variables seem to be neither stationary or possess first order of integration (i.e., they are not I(0) processes). This is because our graphs suggest the existence of unit roots in our variables, which causes any hypothesis tests used for conduct statistical inference in our OLS regressions to be incorrect.

3.2.2 Solutions & Results

Recall the set of models in Section 2.4. In order to properly model the relationship between firm-level profitability and investment using panel data, we utilise a model with firm-specific random effects, industry fixed effects, and time fixed effects. We find a firm-specific random effects model to be appropriate as we want to generalise our results to a larger population of firms within the United States, and we have reason to believe that individual firm characteristics influence our regressand of investment.

Suffering from heteroscedasticity and the existence of unit roots, we first transform our variables into growth rates by taking the natural logarithm and first-difference. We see in Figure Matrix A.6. that our variables now seem to be I(0) processes and potentially weakly stationary. We address the issues of heteroscedasticity and autocorrelation by using robust estimation of the Heteroscedasticity and Autocorrelation Consistent (HAC) matrix. We estimate our Generalised Least Squares (GLS) models in Tables A.8. and A.9. of the appendix: we still find our relevant variables to be statistically significant at the 1% significance level. Controlling for firm size, firm random effects, and year fixed effects, we find that on average, shifts in gross profits correspond to non-negligible changes in investment. In particular, a 100% increase in gross profits boosts predicted capital expenditures by about 14%, and boosts predicted R&D expense by about 8.71%. These findings indicate that firms only invest a small portion of excess funds; the PTI holds weakly empirically.

Chapter 4

Discussion

4.1 Industry Concentration & Profitability

Our results point towards a strong long-run relationship between industry concentration and profitability amongst non-manufacturing industries. With 1 % increases in a non-manufacturing industry's top 50 firm revenue share corresponding to about a $8 million increases in median gross profits, there is definite possibility of a casual long-run equilibrium between these two variables. Whilst general microeconomic theory indicates that deviations from the perfectly competitive market structure detailed in Section 1.3 lead to firms with market power and subsequently profits, we acknowledge the possibility of reverse causality within our model. If profitable firms are able to influence market characteristics and negatively impact competition, we cannot interpret Model (2)'s coefficients as an accurate measure of the profit effect of a change in industry concentration.

It should be noted that in manufacturing industries, the long-run relationship between concentration and profitability is obscured and weaker. This is because a 1 % increase in the value added by a manufacturing industry's top 50 firms is associated with only a 60 cent increase in median gross profits. This discrepancy in our results may exist for several reasons. First, it is possible that different methods of measuring market concentration relate to firm profitability differently. In our analysis, we find that market revenue concentration is strongly correlated with profitability, while the percentage of value added by the top 50 firms in an industry is not. These results are somewhat surprising– value added measures the amount of additional money a firm can earn selling a product after deducting labour, service, raw input costs. We expect that industries where a select few firms hold the majority of value added would be highly profitable. Still, our analysis contradicts this notion.

We additionally explore the possibility that manufacturing industries, by means of their operations, may be less able to actualize profits through market power. Manufacturing deals exclusively in the process of utilizing raw materials to create a product; input price transparency may diminish a firm's ability to charge a mark-up. As such, we surmise that manufacturing firms may be less able to exert market power and influence prices to improve profitability.

Naturally, we shift our focus towards economic theory and the implementation of instrumental variables in order to isolate the effect of changing market conditions on firm profitability. We will review existing literature on the subject, looking for economic and empirical arguments for the relationship between industry concentration and profit. In addition, we will investigate potential exogenous variables in order to implement two-stage least squares regression, with the goal of establishing a causal relationship between market competition and profitability. Finally, we will address how our results fit into a broader macroeconomic context, in which increasing market power and profitability may be negatively impacting consumer welfare, labour's share of income, and economic growth.

4.2 The Profit Theory of Investment

While our results in Section 4.1 are compelling and indicate a clear direction for further investigation, our test of the Profit Theory of Investment fails to confirm a strong relationship between firm profits and investment. Measuring investment as both capital expenditures and research and development expenditures, we find that increases in growth in gross profits only correspond to small changes in investment's growth (with changes ranging from 9-14% for every 100% increase in profitability). Our analysis indicates that, taking into account industry characteristics, firm size, and other controls, a company's investment is not strongly related to its profitability.

We conclude that from the time period of 1950-2016, investment levels in the United States are not primarily the result of firm profitability.

Although our results do not confirm our initial suspicions that market concentration, profits, and investment are strongly intertwined through the Profit Theory of Investment, we are still eager to investigate how investment in the United States has evolved over the past few decades. Although investment may not be strongly influenced by a firm's available internal funds, it is important to seek other mechanisms through which firms might be encouraged to invest.

It is clear that companies are becoming larger, more profitable, and more powerful; through our analysis, we find that this increase in profits does not result in a substantial increase in investment. As such, we cannot ignore the potential issue that increasing competition leads to stagnation in investment and innovation, as suggested by [1, Alesina et al., 2005]. We believe that it is prudent to further investigate the macroeconomic implications of increasing market concentration. For now, the state of investment in the U.S. in unclear: We hope to better understand the future of technological progress, innovation, and productivity growth under current market conditions.

APPENDIX A

APPENDIX A

Variable	Num. of Obs.	Mean	Std. Dev.	Minimum	Maximum
Gross Profits	384,141	410.56	2,545.95	-76,735	128,130
Total Assets	402,877	4,128.37	50,536	0	3,771,200
Capital Expenditures	361,750	110.67	801.49	-994	65,028
R&D Expense	164,746	54.77	382.86	-0.546	14,035.29

TABLE A.1. Summary Statistics of Gross Profits, Capital Expenditures, R&D Expenses, and Total Assets, in Millions of US Dollars.

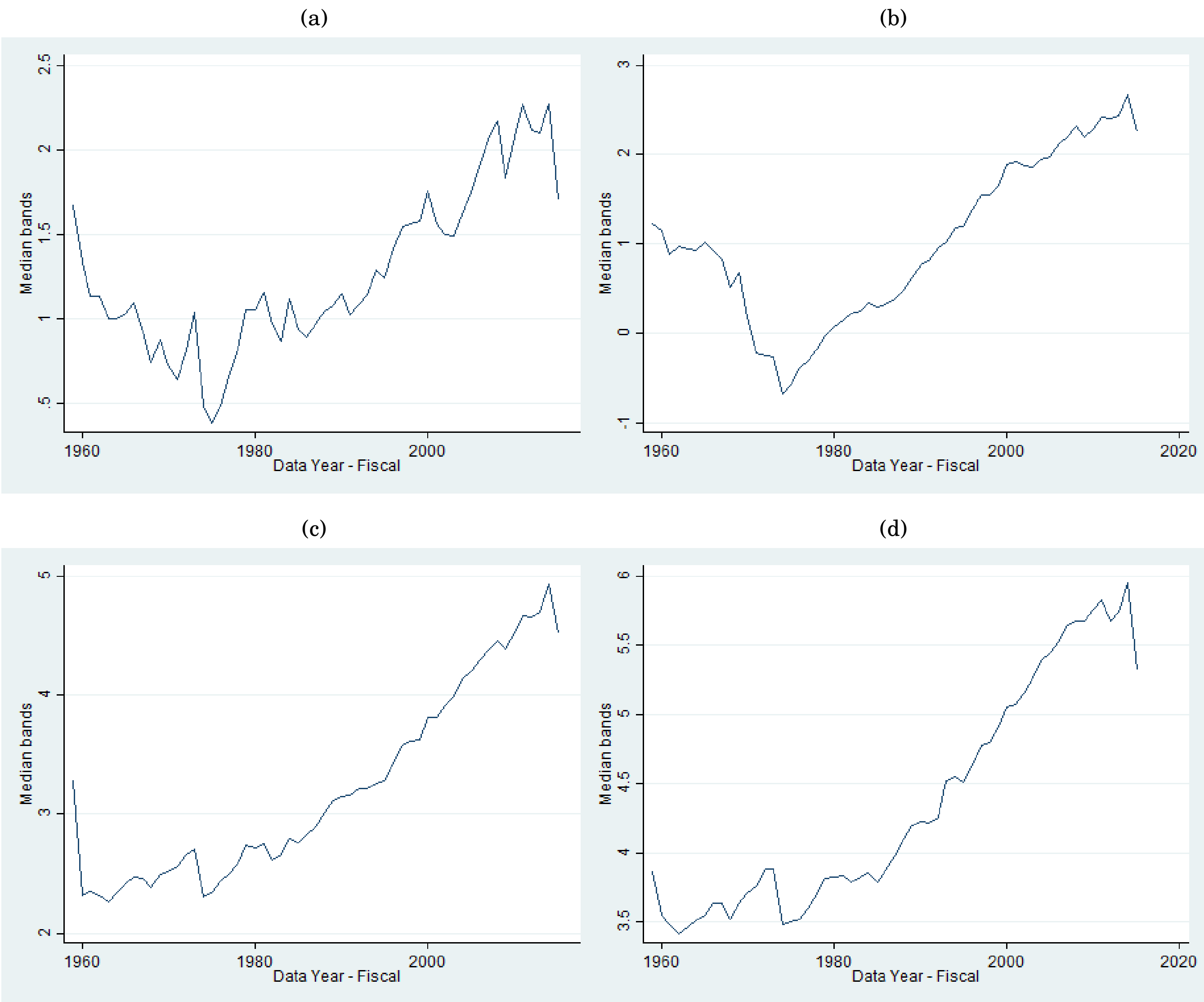

FIGURE A.1. (a) Time series plot of median logged capital expenditures. (b) Time series plot of median logged R and D expenses. (c) Time series plot of median logged gross profits. (d) Time series plot of median logged total assets.

Model 2 **Non-Manufacturing Industries** **Regressand: Gross Profits**	
Number of Observations	698
R^2	0.981
Adjusted R^2	0.980
$F(45,652)$	745.84
$Prob > F$	0.0000

Regressors	**Estimators** $\hat{\beta}$	**Std. Errors** $\hat{\sigma}$	t	$P > \|t\|$	95% CI
Total Assets	0.0401	0.000225	177.85	0.000	(0.0396, 0.0405)
Per Cent of Revenue Held By Industry's Top 50 Firms	8.327	1.533	5.43	0.000	(5.317, 11.338)

TABLE A.2. OLS Estimation of Model (2): Coefficients for Main Regressors, Controlling for Year and Industry Fixed Effects (Not Shown)

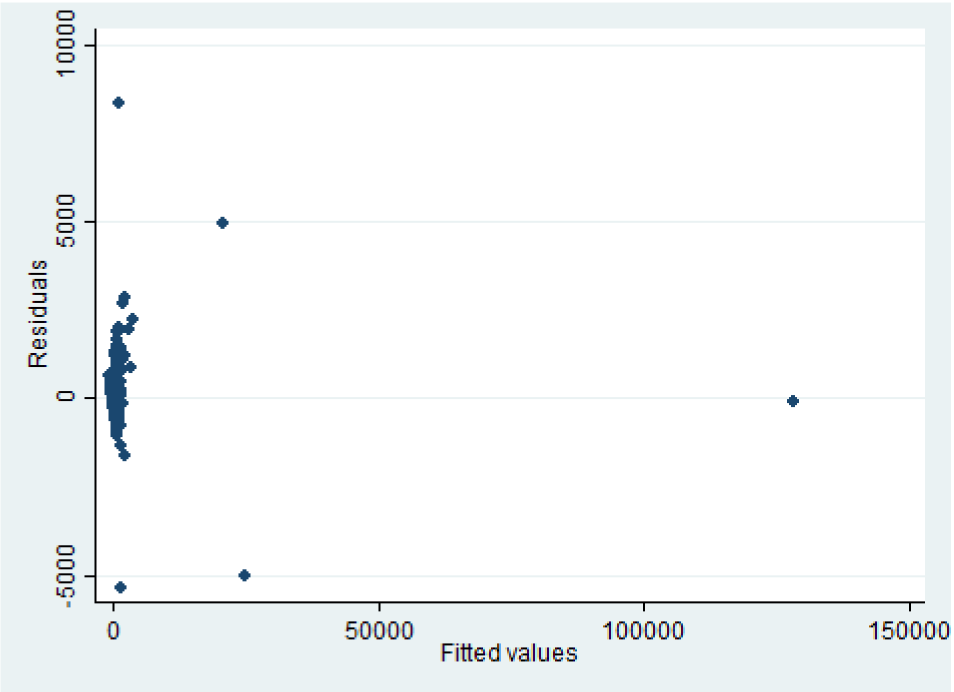

FIGURE A.2. Residuals Plot of OLS Estimation of Model (2).

Breusch-Pagan Test for Model 2 Regressand: Squared Residuals	
Number of Observations	698
R^2	0.974
Adjusted R^2	0.972
$F(45,652)$	532.02
$Prob > F$	0.0000

TABLE A.3. Bresuch-Pagan Test for Model (2)

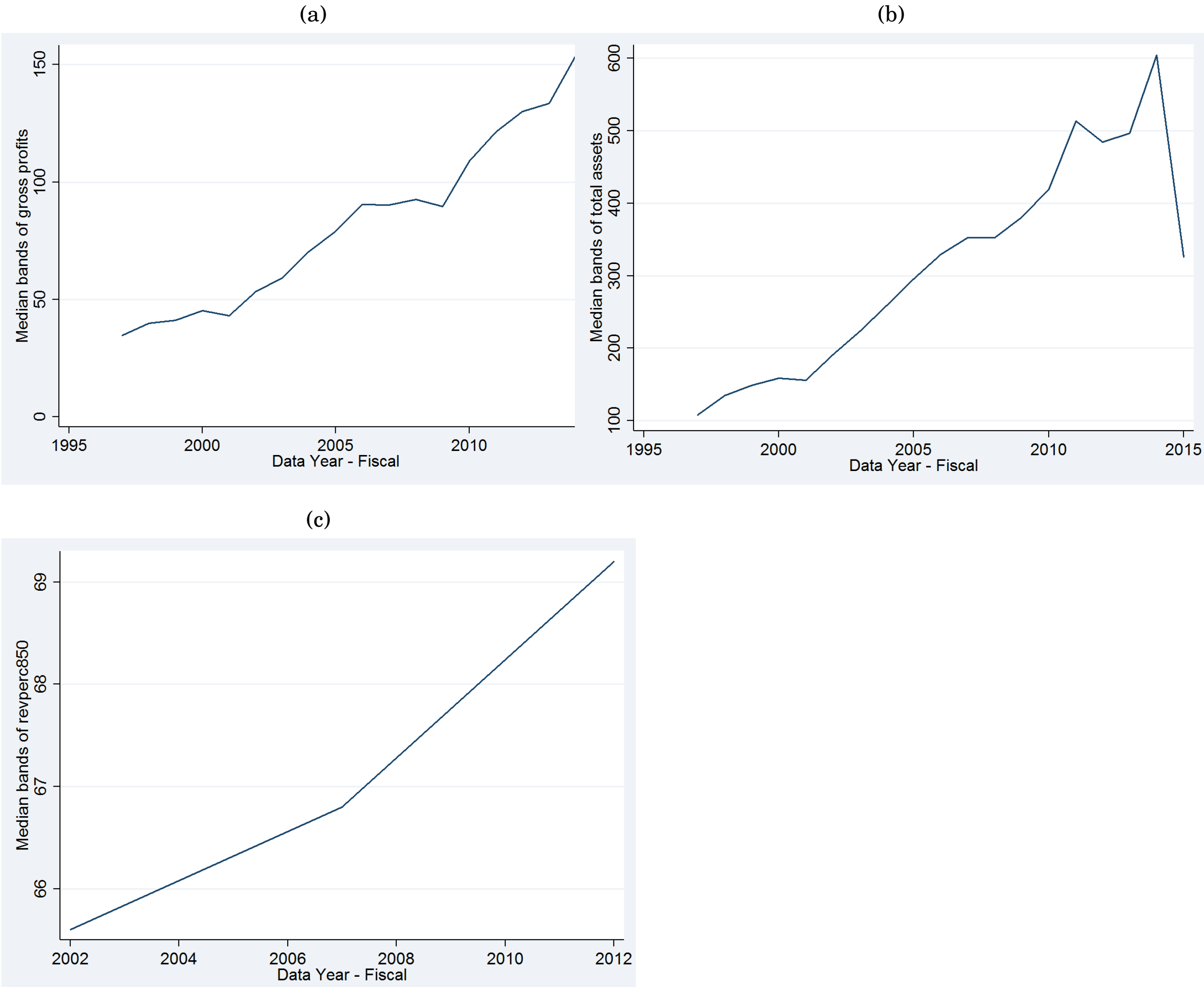

FIGURE A.3. (a) Time series plot of median gross profits. (b) Time series plot of median total assets. (c) Time series plot of median logged gross profits.

(a) (b)

FIGURE A.4. (a) Time series plot of median first-differenced gross profits. (b) Time series plot of median first-differenced total assets.

Model 2 (Long Run Interpretation By Cointegration) **Non-Manufacturing Industries** **Regressand: Gross Profits**	
Number of Observations	698
R^2	0.981
Adjusted R^2	0.980
$F(45,652)$	745.84
$Prob > F$	0.0000

Regressors	**Estimators** $\hat{\beta}$
Total Assets	0.0401
Per Cent of Revenue Held By Industry's Top 50 Firms	8.327

TABLE A.4. Long Run Interpretation of OLS Estimation of Model (2): Coefficients for Main Regressors, Controlling for Year and Industry Fixed Effects (Not Shown)

Model 3 (Long Run Interpretation By Cointegration) **Manufacturing Industries** **Regressand: Gross Profits**	
Number of Observations	901
R^2	0.926
Adjusted R^2	0.924
$F(24,876)$	45.54
$Prob > F$	0.0000

Regressors	**Estimators** $\hat{\beta}$
Total Assets	0.255
Per Cent of Value Added By Industry's Top 50 Firms	0.600

TABLE A.5. Long Run Interpretation of OLS Estimation of Model (3): Coefficients for Main Regressors, Controlling for Year and Industry Fixed Effects (Not Shown)

Model 4 **Regressand: Capital Expenditures**	
Number of Observations	296,000
R^2	0.915
Adjusted R^2	0.915
$F(167,295,832)$	19,066.78
$Prob > F$	0.0000

Regressors	**Estimators** $\hat{\beta}$	**Std. Errors** $\hat{\sigma}$	t	$P > \|t\|$	95% CI
Gross Profits	0.0317	0.000285	111.48	0.000	(0.0312, 0.0323)
Total Assets	-0.000421	0.0000184	-22.86	0.000	(-0.000457, -0.000385)
Capital Expenditures (Lagged By 1 Year)	0.926	0.000827	1119.24	0.000	(0.924, 0.927)

TABLE A.6. Initial OLS Estimation of Model (4)

Model 5 **Regressand: R&D Expense**	
Number of Observations	136,487
R^2	0.958
Adjusted R^2	0.958
$F(167,295,832)$	19,680.48
$Prob > F$	0.0000

Regressors	**Estimators** $\hat{\beta}$	**Std. Errors** $\hat{\sigma}$	t	$P > \|t\|$	95% CI
Gross Profits	0.00627	0.000144	43.45	0.000	(0.00599, 0.00656)
Total Assets	-0.000376	0.0000297	-12.65	0.000	(-0.000434, -0.000317)
R&D Expense (Lagged By 1 Year)	0.992	0.000807	1230.07	0.000	(0.991, 0.994)

TABLE A.7. Initial OLS Estimation of Model (5)

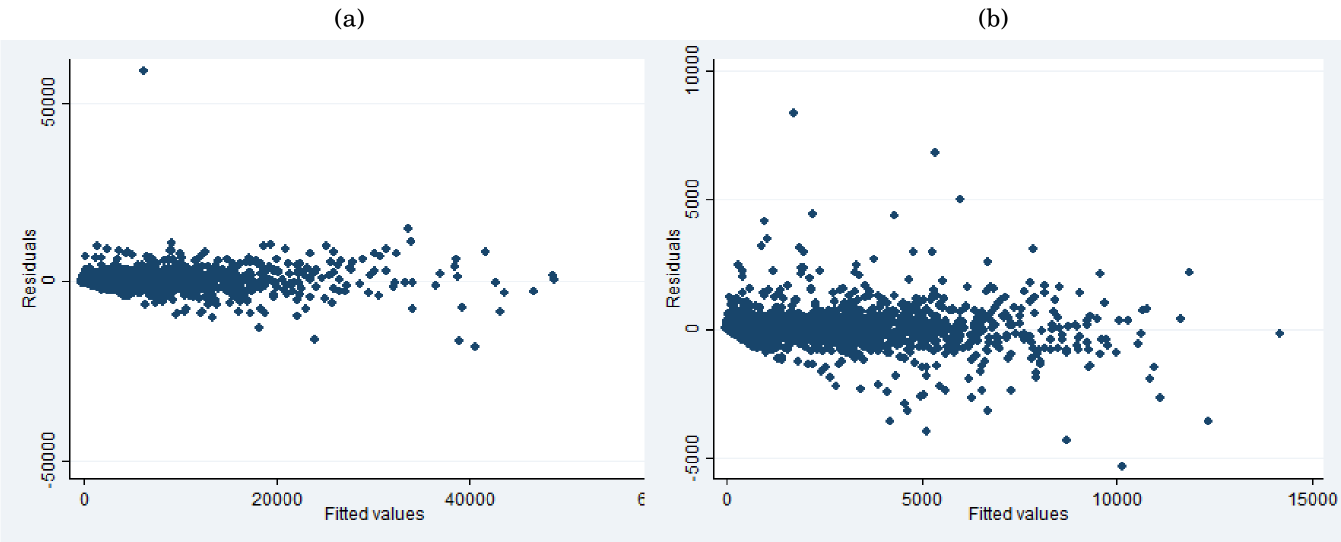

FIGURE A.5. (a) Residual Plots for OLS Models (4). (b) Residual Plots for OLS Models (5).

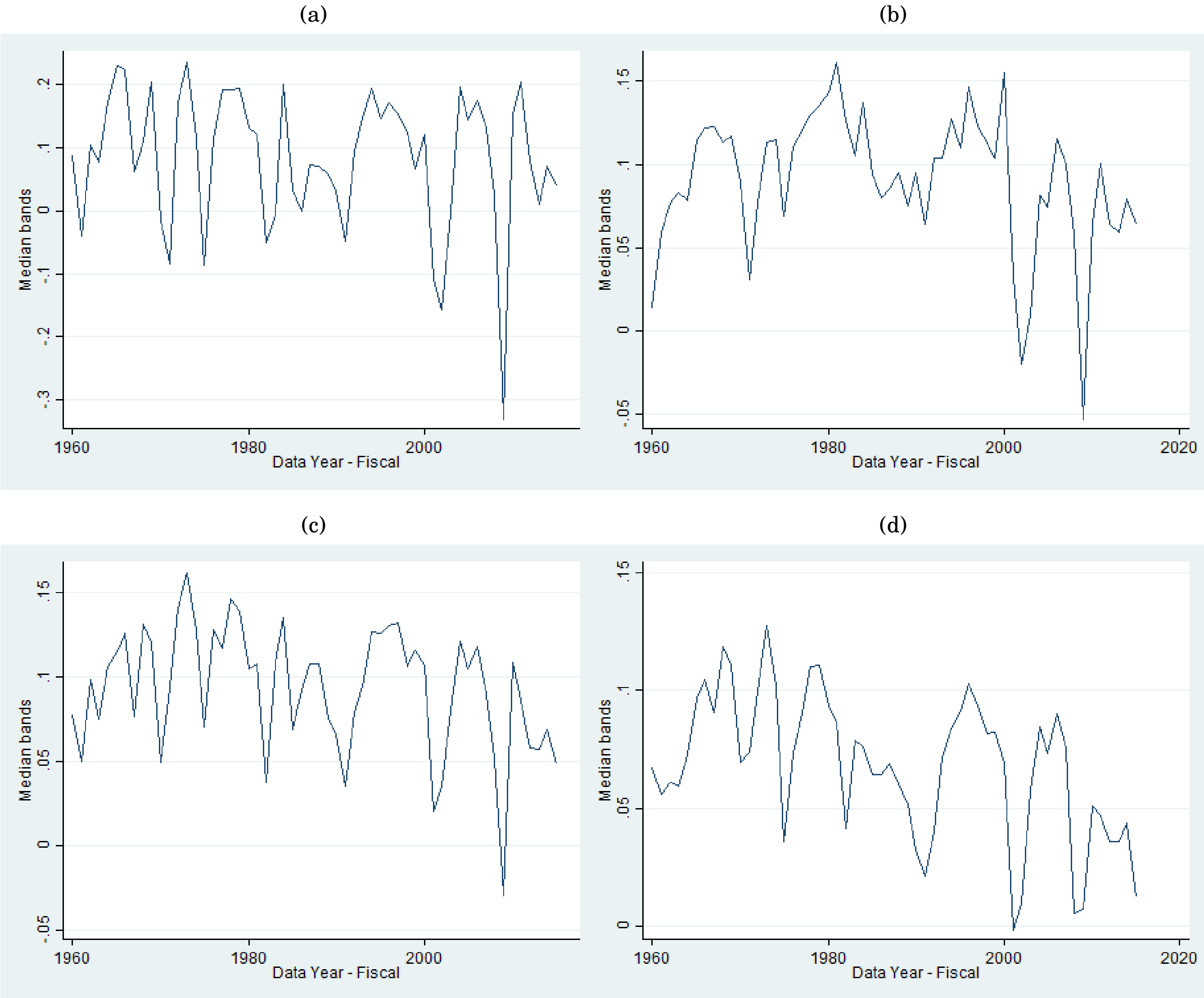

FIGURE A.6. (a) Time series plot of median first-differenced growth in capital expenditures. (b) Time series plot of median first-differenced growth in R and D expenses. (c) Time series plot of median first-differenced growth in gross profits. (d) Time series plot of median first-differenced growth in total assets.

Corrected Model 4 with Robust Standard Errors **Regressand: Capital Expenditures**					
Number of Observations	222,995				
R^2	0.2051				
Regressors (All in Growth Rates)	**Estimators** $\hat{\beta}$	**Std. Errors** $\hat{\sigma}$	z	$P > \|z\|$	95% CI
Gross Profits	0.140	0.00688	20.32	0.000	(0.126, 0.153)
Total Assets	0.900	0.0111	81.32	0.000	(0.879, 0.922)
Capital Expenditures (Lagged By 1 Year)	-0.259	0.00304	-85.12	0.000	(-0.265, -0.253)

TABLE A.8. GLS Estimations of Corrected Model (4) with Robust Standard Errors

Corrected Model 5 with Robust Standard Errors **Regressand: R&D Expense**					
Number of Observations	82,864				
R^2	0.2051				
Regressors (All in Growth Rates)	**Estimators** $\hat{\beta}$	**Std. Errors** $\hat{\sigma}$	z	$P > \|z\|$	95% CI
Gross Profits	0.0871	0.00803	10.85	0.000	(0.0714, 0.103)
Total Assets	0.306	0.00917	33.40	0.000	(0.288, 0.324)
Capital Expenditures (Lagged By 1 Year)	-0.114	0.000851	-13.36	0.000	(-0.130, -0.0971)

TABLE A.9. GLS Estimations of Corrected Model (5) with Robust Standard Errors

Bibliography

[1] A. Alesina, S. Ardagna, G. Nicoletti, and F. Schiantarelli, *Regulation and investment*, Journal of the European Economic Association, 3 (2005), pp. 791–825.
https://dash.harvard.edu/bitstream/handle/1/2579825/Ardagna_RegulationInvestment.pdf?sequence=2.

[2] A. Alesina, S. Ardagna, R. Perotti, and F. Schiantarelli, *Fiscal policy, profits, and investment.*, National Bureau of Economics Research Working Paper Series, (1999).
https://www.nber.org/papers/w7207.pdf.

[3] M. N. Baily and N. Montalbano, *Why is u.s. productivity growth so slow? possible explanations and policy responses*, Hutchins Center Working Paper, (2016), pp. 1–29.
https://www.brookings.edu/wp-content/uploads/2016/09/wp22_baily-montalbano_final4.pdf.

[4] R. D. Buzzell, B. T. Gale, and R. G. Sultan, *Market share — a key to profitability*, Harvard Business Review, (1975).
https://hbr.org/1975/01/market-share-a-key-to-profitability.

[5] M. Dvorkin and H. Shell, *Bank lending during recessions*, Economic Synopses, (2016).
https://files.stlouisfed.org/files/htdocs/publications/economic-synopses/2016-02-05/bank-lending-during-recessions.pdf.

[6] T. Economist, *Too much of a good thing*, Business in America, (2016).
http://www.economist.com/news/briefing/21695385-profits-are-too-high-america-n

[7] D. ELIXMANN, I. GODLOVITCH, I. HENSELER-UNGER, R. SCHWAB, AND U. STUMPF, *Competition & investment: An analysis of the drivers of investment and consumer welfare in mobile telecommunications*, WIK-Consult, (2015).
http://www.wik.org/fileadmin/Studien/2015/Competition_and_investment_mobile_telecommunications.pdf.

[8] S. M. FAZZARI, R. G. HUBBARD, AND B. C. PETERSEN, *Financing constraints and corporate investment*, Brookings Papers on Economic Activity, 1988 (1988), pp. 141–195.
http://people.stern.nyu.edu/eofek/PhD/papers/FHP_Financing_BPEA.pdf.

[9] C. A. GALLET AND P. J. EUZENT, *The business cycle and competition in the u.s. brewing industry*, The Journal of Applied Bussiness Research, 18 (2011), pp. 89–96.
https://www.researchgate.net/publication/238754336_The_Business_Cycle_And_Competition_In_The_US_Brewing_Industry.

[10] M. GORT AND R. SINGAMSETTI, *Concentration and profit rates: New evidence on an old issue*, Explorations in Economic Research, 3 (1976), pp. 1–20.
https://www.nber.org/chapters/c9077.pdf.

[11] S. N. KAPLAN AND L. ZINGALES, *Do investment-cash flow sensitivities provide userful measures of financing constraints?*, Quarterly Journal of Economics, 112 (1997), pp. 169–215.
https://www.researchgate.net/publication/284106144_Do_investment-cash_flow_sensitivities_provide_useful_measures_of_financial_constraints.

[12] S. MACHIN AND J. V. REENEN, *Profit margins and the business cycle: Evidence from uk manufacturing firms*, The Journal of Industrial Economics, 41 (1993), pp. 29–50.
http://www.jstor.org/stable/2950616.

[13] A. S. MATTHEW ROGNLIE AND A. SIMSEK, *Investment hangover and the great recession*, NBER Working Paper Series, (2014).
http://www.nber.org/papers/w20569.pdf.

[14] L. MERLING, *Higher profits for companies does not translate into higher investment*, Center for Economic and Policy Research Blog, (2016).

Blog.

[15] A. P.-A. MICHELE BOLDRIN, CARLOS GARRIGA AND J. M. SÁNCHEZ, *Reconstructing the great recession*, Federal Reserve Bank of St. Louis, (2013). https://research.stlouisfed.org/wp/2013/2013-006.pdf.

[16] P. D. PACE, *Econ 169, advanced econometrics, class notes*. August 2016.

[17] D. ROMER, *Advanced Macroeconomics*, McGraw-Hill Education Ltd, 4th edition ed., 2012.

[18] R. VASSOLO, M. J. MURCIA, AND J. GARCIA-SANCHEZ, *The evolution of competition through the business cycle.*, Academy of Management Proceedings, 2015 (2015). http://proceedings.aom.org/content/2015/1/11882.abstract.