NBER WORKING PAPER SERIES

INVESTMENT-LESS GROWTH:
AN EMPIRICAL INVESTIGATION

Germán Gutiérrez
Thomas Philippon

Working Paper 22897
http://www.nber.org/papers/w22897

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2016

We are grateful to Janice Eberly, Olivier Blanchard, Toni Whited, René Stulz, Martin Schmalz, Boyan Jovanovic, Tano Santos, Charles Calomiris, Glenn Hubbard, Holger Mueller, Alexis Savov, Philipp Schnabl, Ralph Koijen, Ricardo Caballero, Emmanuel Farhi, Viral Acharya, and seminar participants at Columbia University and New York University for stimulating discussions. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Investment-less Growth: An Empirical Investigation
Germán Gutiérrez and Thomas Philippon
NBER Working Paper No. 22897
December 2016, Revised January 2016
JEL No. E22,G3

ABSTRACT

We analyze private fixed investment in the U.S. over the past 30 years. We show that investment is weak relative to measures of profitability and valuation – particularly Tobin's Q, and that this weakness starts in the early 2000's. There are two broad categories of explanations: theories that predict low investment because of low Q, and theories that predict low investment despite high Q. We argue that the data does not support the first category, and we focus on the second one. We use industry-level and firm-level data to test whether under-investment relative to Q is driven by (i) financial frictions,(ii) measurement error (due to the rise of intangibles, globalization, etc), (iii) decreased competition (due to technology, regulation or common ownership), or (iv) tightened governance and/or increased short-termism. We do not find support for theories based on risk premia, financial constraints, or safe asset scarcity, and only weak support for regulatory constraints. Globalization and intangibles explain some of the trends at the industry level, but their explanatory power is quantitatively limited. On the other hand, we find fairly strong support for the competition and short-termism/governance hypotheses. Industries with more concentration and more common ownership invest less, even after controlling for current market conditions. Within each industry-year, the investment gap is driven by firms that are owned by quasi-indexers and located in industries with more concentration and more common ownership. These firms spend a disproportionate amount of free cash flows buying back their shares.

Germán Gutiérrez
NYU Stern School of Business
44 West 4th Street
KMC 9-190
New York, NY 10012
ggutierr@stern.nyu.edu

Thomas Philippon
New York University
Stern School of Business
44 West 4th Street, Suite 9-190
New York, NY 10012-1126
and NBER
tphilipp@stern.nyu.edu

In his March 2016 letter to the executives of S&P 500 firms, BlackRock's CEO Laurence Fink argues that, "*in the wake of the financial crisis, many companies have shied away from investing in the future growth of their companies. Too many companies have cut capital expenditure and even increased debt to boost dividends and increase share buybacks.*" The decline in investment has been discussed in policy papers [Furman, 2015], especially in the context of a perceived decrease in competition in the goods market [CEA, 2016]. There is little systematic evidence, however, on the extent of the investment puzzle and on the potential explanations.

This paper tries to (at least partially) fill that gap. We clarify some of the theory and the empirical evidence; and test whether alternate theories of under-investment are supported by the data. The main contributions of the paper are to show that: (i) the lack of investment represents a reluctance to invest despite high Tobin's Q; and (ii) this investment wedge appears to be linked to decreased competition and changes in governance that encourage shares buyback instead of investment. We address the issues of causality of competition and governance in a companion paper Gutiérrez and Philippon [2017].

It is useful, as a starting point, to distinguish two broad categories of explanations for low investment rates: theories that predict low investment *because* they predict low Tobin's Q and theories that predict low investment *despite* high Tobin's Q. The first category includes explanations based on increasing risk aversion or decreasing expected growth. The standard Q-equation holds in these theories, so the only way they can explain low investment is by predicting low values of Q. The second category ranges from credit constraints to oligopolistic competition, and predicts *a gap* between Q and investment due to differences between average and marginal Q (e.g., market power, growth options) and/or differences between firm value and the manager's objective function (e.g., governance, short-termism).

We find that private fixed investment is weak relative to measures of profitability and valuation – particularly Tobin's Q. Time effects from industry- and firm-level panel regressions on Q suggest that this weakness starts around 2000. This is true controlling for firm age, size, and profitability; focusing on subsets of industries; and even considering tangible and intangible investment separately. Given these results, we discard theories that predict low investment *because* they predict low Q; and focus on theories that predict *a gap* between Q and investment. This still leaves us with a large set of potential explanations.

We consider the following eight potential explanations, grouped into four broad categories. See Section 2 for a detailed discussion of these hypotheses.

- Financial frictions
  1. External finance
  2. Bank dependence
  3. Safe asset scarcity
- Measurement Error

4. Intangibles
5. Globalization

- Lack of Competition

6. Regulation
7. Concentration due to other factors

- Tighter Governance

8. Ownership and Shareholder Activism

We emphasize that these hypotheses are not mutually exclusive. For instance, there is a large and growing literature that focuses precisely on the interaction between governance and competition (see, for example, Giroud and Mueller [2010, 2011]). Thus, our tests do not map one-to-one into hypotheses (1) to (8); some tests overlap two or more hypotheses (e.g., measures of firm ownership affect both governance and competition). We report the results of our tests and discuss their implications for the above hypotheses in Section 4.

Testing these hypotheses requires a lot of data, at different levels of aggregation. Some are industry-level theories (e.g., competition), some firm-level theories (e.g., ownership), and some theories that can be tested at the industry level and/or at the firm level. Unfortunately, firm- and industry-data are not readily comparable, because they differ in their definitions of investment and capital, and in their coverage. As a result, we must spend a fair amount of time simply reconciling the various data sources. Much of the work is explained in Section 3 and in the Appendix.

We gather industry investment data from the BEA and firm investment data from Compustat; as well as additional data needed to test each of the eight hypotheses. For instance, for Concentration, we obtain measures of firm entry, firm exit, price-cost margins, and concentration (including 'traditional' and common ownership-adjusted Herfindahls[1], as well as concentration ratios defined as the share of sales and market value of the Top 4, 8, 20 and 50 firms in each industry). For governance and short-termism, we use measures of institutional ownership, including different ownership types following Brian Bushee's institutional investor classification.[2]

Competition and Governance We then analyze investment patterns at the industry- and firm-level. At the industry level, we find that industries with more quasi-indexer institutional ownership and less competition (as measured by higher 'traditional' and common ownership-adjusted Herfindahls, as well as higher price-cost margins) invest less. These results are robust to controlling for firm demographics (age and size) as well as Q.

[1] We follow Salop and O'Brien [2000] and Azar et al. [2016b] to compute the common ownership-adjusted Herfindahl, which accounts for anti-competitive incentives due to common ownership. See Section 2 for additional details

[2] The classification – described in Bushee [2001] – identifies Quasi-indexer, Transient and Dedicated institutional investors based on the turnover and diversification of their holdings. Dedicated institutions have large, long-term holdings in a small number of firms. Quasi-indexers have diversified holdings and low portfolio turnover – consistent with a passive, buy-and-hold strategy of investing portfolio funds in a broad set of firms. Transient owners have high diversification and high portfolio turnover. See Section 3 for additional details.

The decrease in competition is supported by a growing literature[3], though the empirical implications for investment have not been recently studied (to our knowledge). Similarly, the mechanisms through which quasi-indexer institutional ownership impacts investment remain to be fully understood: while such ownership may improve governance (e.g., Appel et al. [2016a]), it may also increase short-termism (e.g., Asker et al. [2014], Bushee [1998]) – both of which could lead to higher buybacks and less investment. Firm-level results are consistent with industry-level results. They suggest that within each industry-year and controlling for Q, firms with higher quasi-indexer institutional ownership invest less; and firms in industries with less competition also invest less. To better understand the implications of safe asset scarcity and the rise of intangibles, we discuss these hypotheses in greater detail.

Safe Assets According to the safe asset scarcity hypothesis, the value of being able to issue safe assets increases after the Great Recession. This should increase the value of very sage (AAA) firms, but, to the extent that safety cannot be readily scaled up, it would not increase their physical investment to the same extent that it increases their value. This might then account for relatively low investment despite high Q Note that, a some broad abstract level, this is a example of (potentially sharp) decreasing returns to (physical) scale. The problem with this theory is that it predicts that the valuation (and investment, to a lesser extent) of highly rated firms should increase relative to that of other firms. We regress the 2014 firm value on the 2006 value and an indicator for being initially AA to AAA rated firms and find no support for the hypothesis. We also fail to observe higher investment for these firms in the cross-section. The safety premium seems present in the data, but only in 2009 and 2010, not in later years. Therefore it cannot account for the persistence of weak investment.

Intangibles The rise of intangibles can affect investment in several ways. Intangible investment is difficult to measure. Under-estimation of I would lead to under-estimation of K, and therefore over-estimation of Q. This could translate to an 'observed' under-investment at industries with a higher share of intangibles. Alternatively, intangible assets might be more difficult to accumulate. A rise in the relative importance of intangibles could then lead to a higher equilibrium value of Q even if intangibles are correctly measured. Fortunately, the relationship between Q and intangible investment has been thoroughly studied by Peters and Taylor [2016]. Building on their work, and using the Erickson et al. [2014] cumulant estimator, we find some support for these hypotheses (industries with a higher share of intangibles exhibit lower investment) but we show that the aggregate impact does not seem to be quantitatively very large. It is also important to emphasize, as Peters and Taylor [2016] do, that Q explains intangible investment relatively well, and works even better when both tangible and intangible investments are combined, exactly as the theory would predict. Moreover, intangible investment exhibits roughly the same weakness as tangible invest-

[3] For instance, the Council of Economic Advisers issued a 2016 issue brief that "*reviews three sets of trends that are broadly suggestive of a decline in competition: increasing industry concentration, increasing rents accruing to a few firms, and lower levels of firm entry and labor market mobility.*" (see also Decker et al. [2015]).

ment. Properly accounting for intangible investment is clearly a first order empirical issue, but, as far as we can tell, it does not lessen the puzzle that we document.

Other theories We find some evidence that firms in industries with more regulation invest less, but the impact does not appear to affect industry-level investment. Industries with higher foreign profits invest less in the US, as expected, but firm level investment does not depend on the share of foreign profits. None of the other theories appear to be supported by the data. They often exhibit the 'wrong' and/or inconsistent signs; or are not statistically significant.

Other Papers Overall, our results are aligned with Lee et al. [2016] who find that industries that receive more funds have a higher industry Q until the mid-1990s, but not since then. The change in the allocation of capital is explained by a decrease in capital expenditures and an increase in stock repurchases by firms in high Q industries since the mid-1990s. Our results are also related to Alexander and Eberly [2016] who study the implications of the rise of intangibles on investment. Last, our results somewhat contrast with Bena et al. [2016], who study the relationship between foreign institutional ownership (proxied by additions to the MSCI World Index), investment and innovation across 30 countries. They find that foreign institutional ownership can increase long-term investment in fixed capital, innovation, and human capital. It will therefore be interesting, in future work, to understand if our results are specific to the United States. Finally, the above conclusions are based on simple regressions and therefore cannot establish causality between competition, governance and investment. In follow-up work Gutiérrez and Philippon [2017] we use a combination of instrumental variables and natural experiments to test the causality of our two main explanations, lack of competition and tight or short-termist governance.

From a macro-perspective, our paper is related to Jones and Philippon [2016] who explore the macro-economic consequences of decreased competition in a DSGE model with time-varying parameters and an occasionally binding zero lower bound. They show that the trend decrease in competition can explain the joint evolution of investment, Q, and the nominal interest rate. Absent the decrease in competition, they find that the U.S. economy would have escaped the ZLB by the end of 2010 and that the nominal rate today would be close to 2%.

The remainder of this paper is organized as follows. Section 1 presents five important facts about aggregate private fixed investment in recent years. Section 2 discusses the theories that may explain under-investment relative to Q and reviews the related literature. Section 3 describes the data used to test our eight hypotheses. Section 4 discusses the methodology and results of our analyses; and section 5 concludes.

1 Five Facts about US Non Financial Sector Investment

We present five important facts related to investment by the US non financial sector in recent years. We focus on the non financial sector for three main reasons. First, this sector is the main source of nonresidential investment. Second, we can roughly reconcile aggregate data from the Flow of Funds

Table 1: Current Account of Non financial Sector

Name	Notation	Value in 2014 ($ billions) Corporate[1]	Non corporate[2]	Business[1+2]
Gross Value Added	P_tY_t	$8,641	$3,147	$11,788
Net Fixed Capital at Rep. Cost	$P_t^kK_t$	$14,857	$6,126	$20,983
Consumption of Fixed Capital	$\delta_tP_t^kK_t$	$1,286	$297	$1,583
Net Operating Surplus	$P_tY_t - W_tN_t - T_t^y - \delta_tP_t^kK_t$	$1,614	$1,697	$3,311
Gross Fixed Capital Formation	$P_t^kI_t$	$1,610	$354	$1,964
Net Fixed Capital Formation	$P_t^k(I_t - \delta_tK_t)$	$325	$56	$381

with industry-level investment data from the BEA (which includes residential and non residential investment, as well as investment in intellectual property). Last, we can use data on the market value of bonds and stocks for the non financial corporate sector to disentangle various theories of secular stagnation.

1.1 Fact 1: The Non financial Business Sector is Profitable but does not Invest

Table 1 summarizes some key facts about the balance sheet and current account of the non financial corporate, non financial non corporate and non financial business sectors.

One reason investment might be low is that profits might be low. This, however, is not the case. Figure 1 shows the operating return on capital of the non financial corporate, non financial non corporate and non financial business sector, defined as net operating surplus over the replacement cost of capital:

$$\text{Net Operating Return} = \frac{P_tY_t - \delta_tP_t^kK_t - W_tN_t - T_t^y}{P_t^kK_t}$$

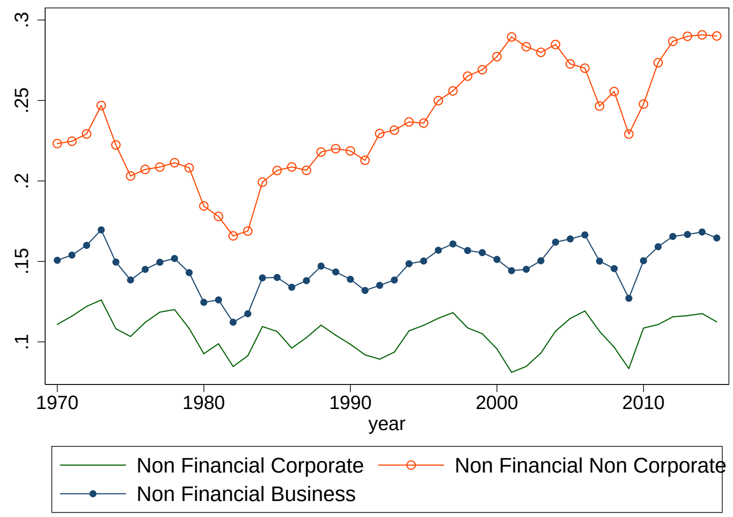
As shown, the operating return for corporates has been quite stable over time while the operating return of non corporates has increased substantially since 1990. For corporates, the yearly average from 1971 to 2015 is 10.5%, with a standard deviation of only one percentage point. The minimum is 8.1% and the maximum 12.6%. In 2015, the operating return was 11.2%, very close to the historical maximum. For non corporates, the yearly average from 1971 to 2015 is 24%, while the average since 2002 has been 27%. The maximum is 29%, equal to the operating return observed every year since 2012. A striking feature is that the net operating margin was not severely affected by the Great Recession, and has been consistently near its highest value since 2011 for both Corporates and Non corporates.

But firms do not invest the same fraction of their operating returns as they used to. Figure 2 shows the ratio of net investment to net operating surplus for the non financial business sector:

$$^{NI}/_{OS} = \frac{P_t^k(I_t - \delta_tK_t)}{P_tY_t - \delta_tP_t^kK_t - W_tN_t - T_t^y}$$

The average of the ratio between 1962 and 2001 is 20%. The average of the ratio from 2002 to

Figure 1: Net Operating Return, by Sector



Note: Annual data, by Non financial Business sector.

2015 is only 10%.[4] Current investment is low relative to operating margins. Similar patterns are observed when separating corporates and non corporates.

1.2 Fact 2: Investment is low relative to Q

Of course, economic theory does not say that ${}^{NI}/_{OS}$ should be constant over time. Investment should depend on expected future operating surplus, on the capital stock, and the cost of funding new investment; it should rely on a comparison of expected returns on capital and funding costs. The Q-theory of investment captures this trade-off.

Consider a firm that chooses a sequence of investment to maximize its value. Let K_t be capital available for production at the beginning of period t and let μ_t be the profit margin of the firm. The basic theory assumes perfect competition so the firm takes μ as given. In equilibrium, μ depends on productivity and production costs (wages, etc.). The firm's program is then

$$V_t\left(K_t\right) = \max_{I_t} \mu_t P_t K_t - P_t^k I_t - \frac{\gamma}{2} P_t^k K_t \left(\frac{I_t}{K_t} - \delta_t\right)^2 + \mathbb{E}_t\left[\Lambda_{t+1} V_{t+1}\left(K_{t+1}\right)\right],$$

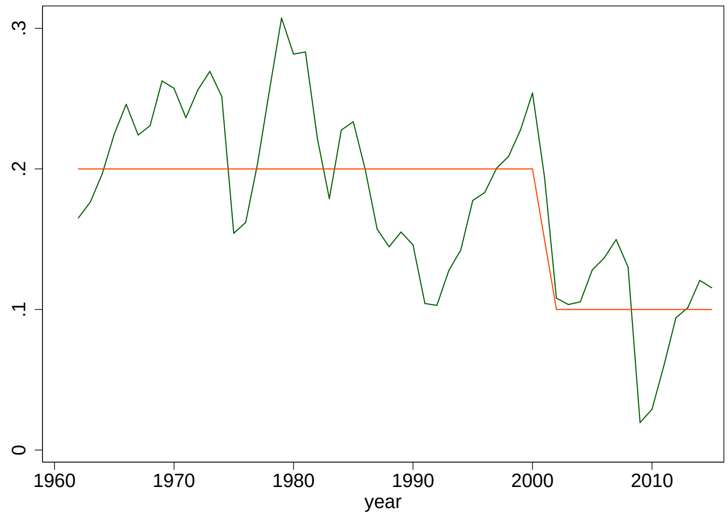
where P_t^k is the price of investment goods. Given our homogeneity assumptions, it is easy to see that the value function is homogeneous in K. We can then define $\mathcal{V}_t \equiv \frac{V_t}{K_t}$ which solves

$$\mathcal{V}_t = \max_{x} \mu_t P_t - P_t^k\left(x_t + \delta_t\right) - \frac{\gamma}{2} P_t^k x^2 + (1+x)\,\mathbb{E}_t\left[\Lambda_{t+1}\mathcal{V}_{t+1}\right],$$

where $x_t \equiv \frac{I_t}{K_t} - \delta_t$ is the net investment rate. The first order condition for the net investment rate

[4] Note that 2002 is used for illustration purposes only; the cut-off is not based on a formal statistical analysis.

Figure 2: Net Investment Relative to Net Operating Surplus



Note: Annual data for Non financial Businesses (Corporate and Non corporate).

is

$$x_t = \frac{1}{\gamma}(Q_t - 1), \tag{1}$$

where

$$Q_t \equiv \frac{\mathbb{E}_t[\Lambda_{t+1}\mathcal{V}_{t+1}]}{P_t^k} = \frac{\mathbb{E}_t[\Lambda_{t+1}V_{t+1}]}{P_t^k K_{t+1}}. \tag{2}$$

Q is the ex-dividend market value of the firm divided by the replacement cost of its capital stock; and γ controls adjustment costs. To build our empirical measures, we define

$$Q = \frac{V^e + (L - FA) - Inventories}{P_k K}$$

where V^e is the market value of equity, L are the liabilities (mostly measured at book values, but this is a rather small adjustment, see Hall [2001]), and FA are financial assets. Notice that the BEA measure of K now includes intangible assets (including software, R&D, and some intellectual property). As a result, our measure of Q is lower than in the previous literature. Because financial assets and liabilities contain large residuals, we also compute another measure of Q:

$$Q^{misc} = Q + \frac{A^{misc} - L^{misc}}{P_k K}$$

where A^{misc} and L^{misc} are the miscellaneous assets and liabilities recorded in the financial accounts. Since $A^{misc} > L^{misc}$, it follows that $Q^{misc} > Q$. It is unclear which measure is more appropriate. Figure 3 shows the evolution of Q for the non financial corporate sector. As shown, Q is high according to both measures, by historical standards.

This leads us to our main conclusion: investment is low relative to Q. The top chart in Figure 4

Figure 3: Two Measures of Q

Note: Annual data. Q for Non Financial Corporate sector (data for Non Corporate sector not available)

shows the aggregate net investment rate for the non financial business sector along with the fitted value for a regression on (lagged) Q from 1990 to 2001. The bottom chart shows the regression residuals (for each period and cumulative) from 1990 to 2015. Both charts clearly show that investment has been low relative to Q since sometime in the early 2000's.[5] By 2015, the cumulative under-investment is more than 10% of capital.[6]

The above regression focuses on aggregate investment. To study under-investment at a more granular level, we estimate panel regressions of industry- and firm-level investment on Q; and study the time effects. To correct for the well-known measurement errors in Q, we use the Erickson et al. [2014] cumulant estimator in all regressions reported throughout the paper (see Section 4 for additional details).

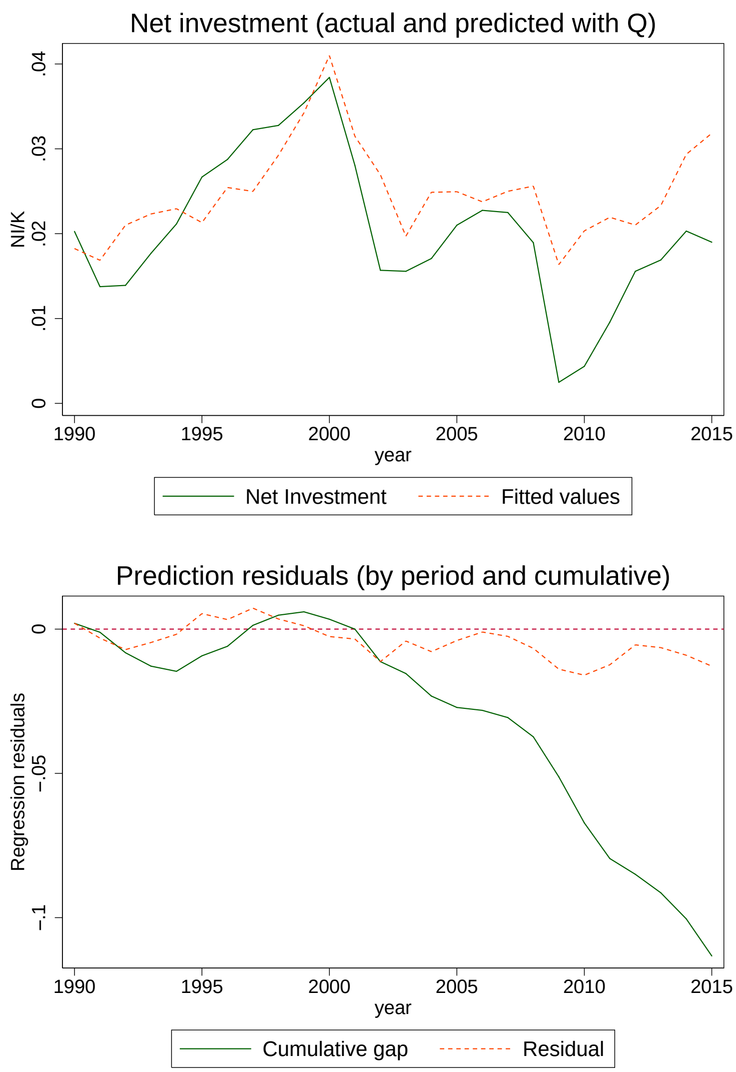
Figure 5 shows the results: time effects for the industry regression are shown on the left and for the firm regression on the right. The vertical line highlights the average time effect across all years for each regression.[7] As shown, the time-effects are substantially lower for both Industry- and Firm-level regressions since approximately 2000. In the industry regression, time effects were above average the 1980s; on average in the 1990s and below-average since 2002. Time effects in the firm regression were fairly high in the 1980s, but have been trending down since. They are near the average in the early 1990s and well below-average in the early 2000s. They increase at the height

[5] By definition of OLS, the cumulative residual for 2001 is zero, but the under-investment from then on is striking

[6] We focus on the past 25 years because measures of Q based on equity are not always stable and therefore do not fit long time series. This is a well known fact that might be due to long run changes in technology and/or participation in equity markets that make it difficult to compare the 2000's with the 1960's. Even in shorter windows, van Binsbergen and Opp [2016] argue convincingly that asset pricing anomalies that affect Q can have material consequences for real investment – particularly for high Q firms. Q is therefore not a perfect benchmark, but it enables us to control for a wide range of factors and provides theoretical support for testing the remaining hypotheses.

[7] Note that the time effects need not be zero, on average, given the impact of adjustment costs in Q theory and the inclusion of a constant in the regression.

Figure 4: Net Investment vs. Q

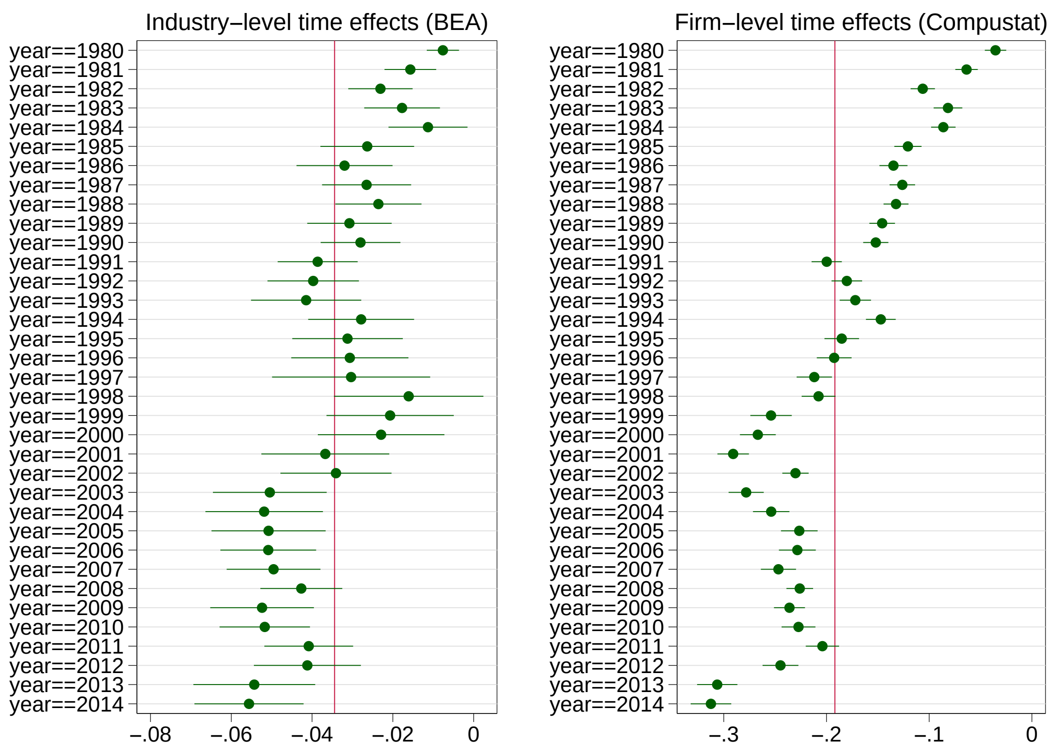


Note: Annual data. Net investment for Non Financial Business sector.

of the great recession (when Q decreased drastically) but reach their lowest level in 2013 and 2014.

These results are robust to including additional measures of fundamentals such as cash flow; considering only a subset of industries; and even splitting tangible and intangible assets (see Figure 17). They are also consistent with results in Alexander and Eberly [2016], who consider firm-level gross investment, defined as the ratio of capital expenditures to assets. We conclude that investment has been low relative to Q since the early 2000's.

Figure 5: Time effects from Industry and Firm-level regressions

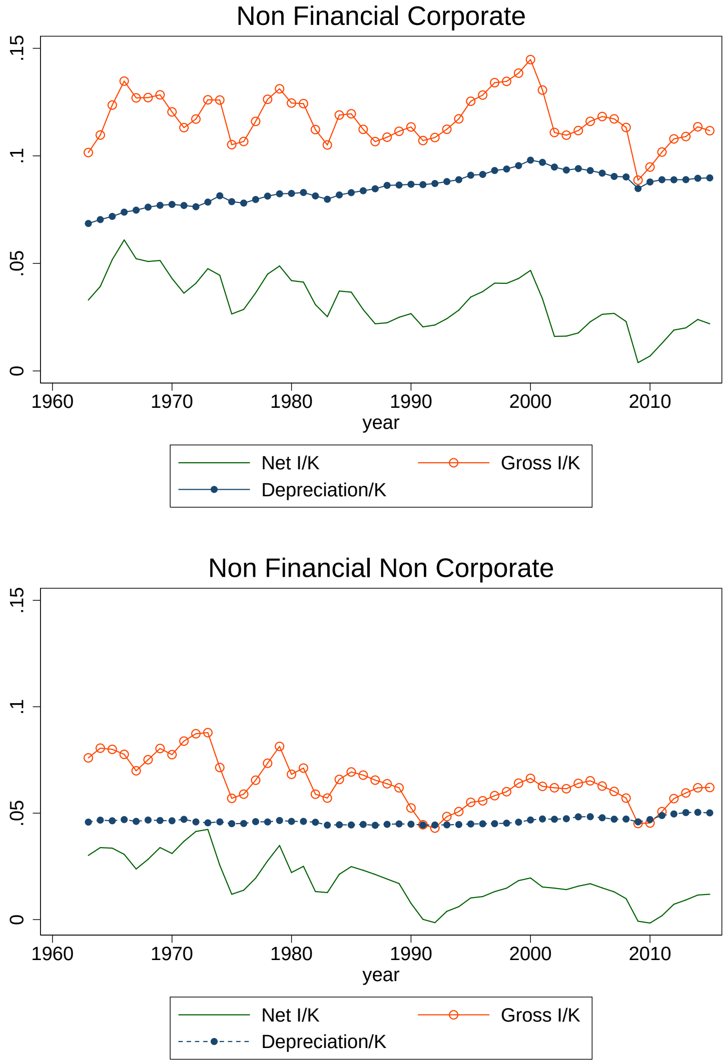


Note: Time fixed effects from errors-in-variables panel regressions (Erickson et al. [2014]) of de-meaned net investment on median/firm-level Q. Industry investment data from BEA; Q and firm investment (defined as CAPX/PPENT minus depreciation) from Compustat. See Section 4.2.1 for additional details on the regression approach.

1.3 Fact 3: Following a Secular Increase, Depreciation Has Remained Stable Since 2000

The decrease in net investment could be the result of changes in the depreciation rate. To test this, Figure 6 shows the gross investment rate, the net investment rate and the depreciation rate for the non financial corporate sector on the top, and the non financial non corporate sector on the bottom. Note that these series include residential structures, but their contribution is relatively small for non financial businesses. The gross investment rate is defined as the ratio of 'Gross fixed capital formation with equity REITs' to lagged capital. Depreciation rates are defined as the ratio of 'consumption of fixed capital, equipment, software, and structures, including equity REIT' to

Figure 6: Investment and Depreciation Rate for Non financial Business Sector



Note: Annual data. Non financial corporate sector on the top, non financial non corporate sector on the bottom.

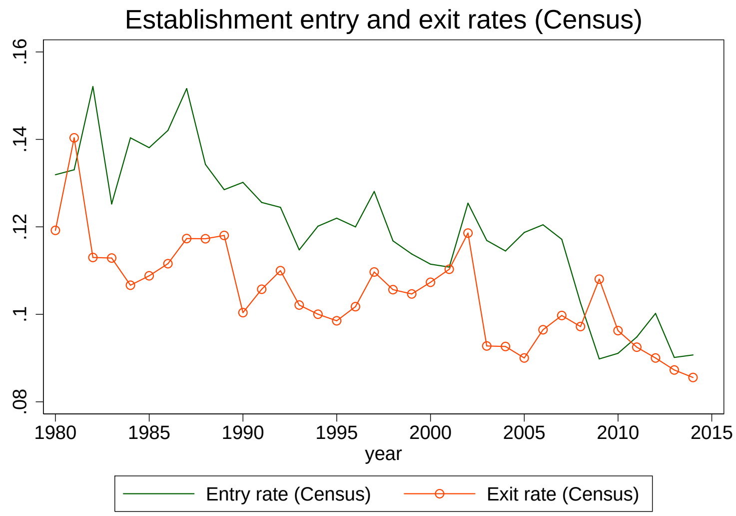
lagged capital; and net investment rates as the gross investment rate minus the depreciation rate.

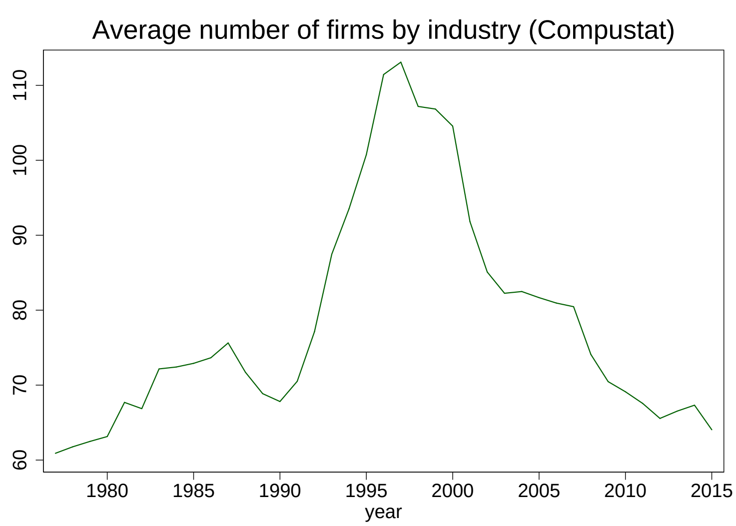
In the non corporate sector, depreciation is stable and net investment follows gross investment. The evolution is more complex in the corporate sector. There was a secular increase in depreciation from 1960 until 2000, driven primarily by a shift in the composition of corporate investment (from structures and equipment to intangibles). As a result, the trend in net investment is significantly lower than the trend in gross investment from 1960 to 2000. Since 2000, however, the share of intangible assets has remained flat such that depreciation has been more stable, and, if anything, it has decreased. The drop in net investment over the past 15 years is therefore due to a drop in gross investment, not a rise in depreciation. Because the corporate sector contributes the lion share of investment, the aggregate figure for the combined non-financial sector resembles the top panel (see Table 1).

1.4 Fact 4: Firm Entry has Decreased

Figure 7 shows two measures of firm entry: the establishment entry and exit rates as reported by the U.S. Census Bureau's Business Dynamics Statistics (BDS); and the average number of firms by industry in Compustat. In the early 1990s, we see a large increase in firms in Compustat, driven primarily by firms going public. Since then, both charts provide strong evidence of a decline in the number of firms. This downward trend in business dynamism has been highlighted by numerous papers (e.g., Decker et al. [2014]) but the trend has been particularly severe in recent years. In fact, Decker et al. [2015] argue that, whereas in the 1980s and 1990s declining dynamism was observed in selected sectors (notably retail), the decline was observed across all sectors in the 2000s, including the traditionally high-growth information technology sector.

Figure 7: Firm entry, exit and number of firms

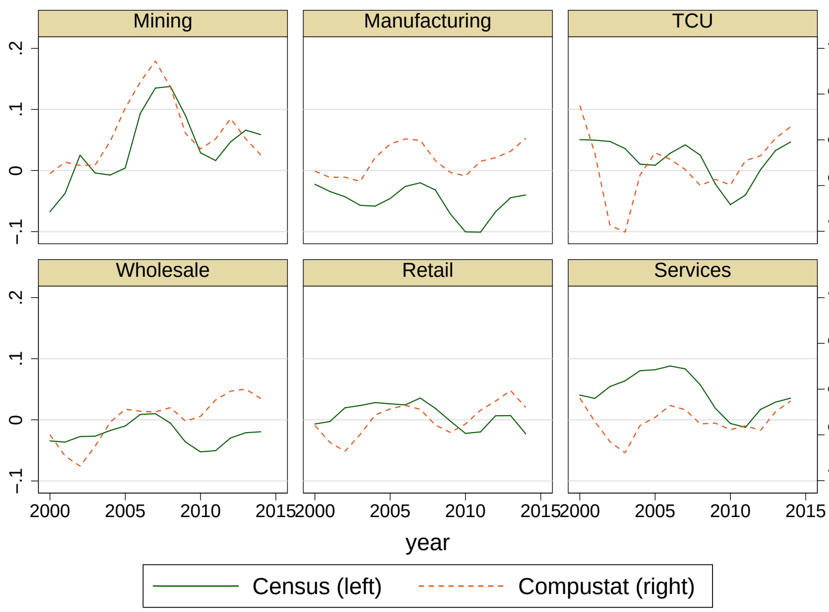




Note: Annual data.

The Compustat and Census patterns above appear quite different. However, focusing on the post-2000 period (the main period of interest) and the sectors for which Compustat provides good coverage, we find significant similarities. Figure 8 shows the 3-year log change in the number of firms based on Compustat and the number of establishments based on Census BDS data (excluding agriculture and construction for which Compustat provides limited coverage). As shown, changes in the number of firms are roughly similar across all sectors, including manufacturing, mining and retail which are the main contributors of investment.

Figure 8: Comparison of 3-Year log change in # of establishments (Census) and firms (Compustat), by SIC sector



Note: Annual data. Agriculture and construction omitted due to limited coverage in Compustat

1.5 Fact 5: Institutional Ownership and Payouts Have Increased

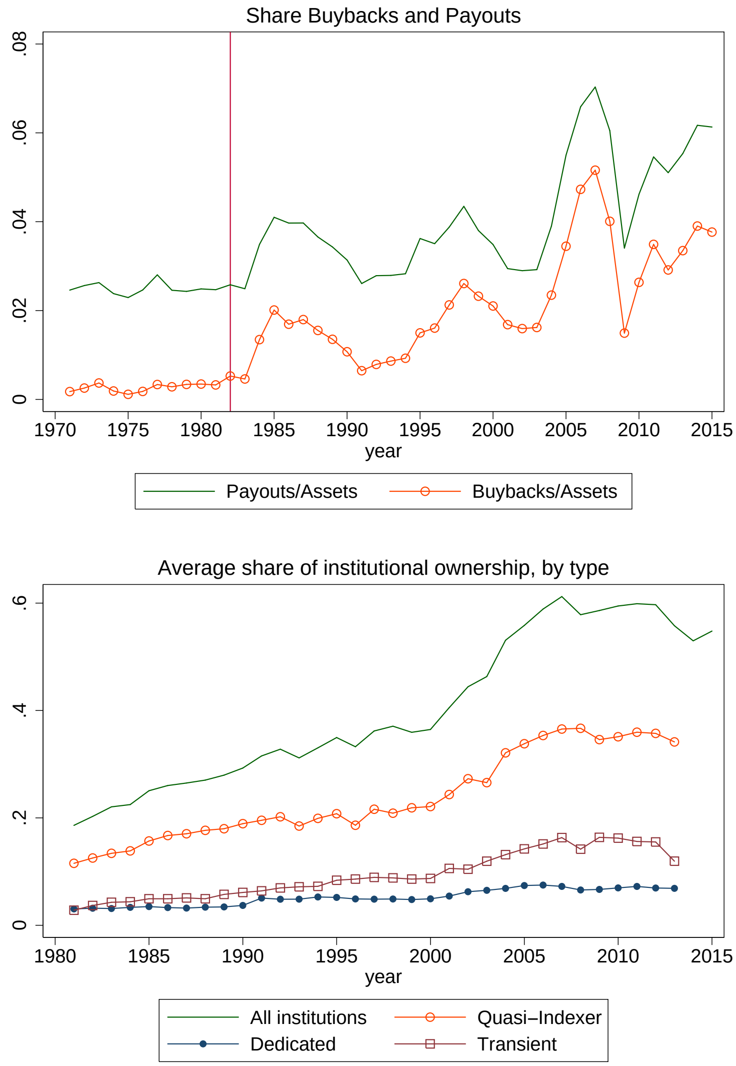
The top graph of Figure 9 shows the total buybacks and payouts for all US-incorporated firms in Compustat. As shown, there has been a substantial increase in total payouts, primarily driven by an increase in share buybacks. The increase starts soon after 1982, when SEC Rule 10b-18 was instituted (noted by the vertical line). Rule 10b-18 allows companies to repurchase their shares on the open market without regulatory limits.

The bottom graph shows the average share of institutional ownership, by type. Again, we see a substantial increase in institutional ownership – particularly since 2000. The increase is primarily driven by growth in transient and quasi-indexer institutions. This is not shown in the figure, but the increase is particularly pronounced for smaller firms: since 2000, the dollar-weighted share of quasi-indexer institutional ownership increased from ~30% to ~45%, while the median share increased from ~15% to ~50%. That is, while the dollar-weighted quasi-indexer ownership increased by about

50%, it more than doubled for the median firm.

These two effects are remarkable, and closely match the timing of decreasing investments at the aggregate level.

Figure 9: Payouts and Institutional ownership



Notes: Annual data for all US incorporated firms in Compustat. Results are similar when including foreign-incorporated firms. The vertical line in the first graph highlights the passing of SEC rule 10b-18, which allows companies to repurchase their shares on the open market without regulatory limits.

2 What might explain the under-investment?

The basic Q-equation (1) says that Q should be a sufficient statistic for investment, while equation (2) equates Q with the average market to book value. This theory is based on the following assumptions [Hayashi, 1982]:

- no financial constraints;

- shareholder value maximization;
- constant returns to scale and perfect competition;

Low investment despite high levels of Q might be explained by a variety of theories – we consider the following eight (grouped into four broad categories)[8]:

- **Financial frictions**

  1. **External finance constraints**: A large literature has argued that frictions in financial markets can constrain investment decisions and force firms to rely on internal funds. See Fazzari et al. [1987], Gomes [2001], Moyen [2004], and Hennessy and Whited [2007].[9] Similarly, Rajan and Zingales [1998] show that industrial sectors that are relatively more in need of external financing develop disproportionately faster in countries with more developed financial markets. Thus, if certain sectors depend on external finance to invest and are unable to obtain the required funds, they may under-invest relative to Q. Relatedly, Acharya and Plantin [2016] study optimal monetary policy in the presence of financial stability concerns. They show that monetary easing subsidizes inefficient maturity transformation by financial intermediaries, which crowds out real investment (by re-allocating savings away from real investment into carry trades).
  2. **Bank dependence**: Financial constraints may differ between bank-dependent firms and firms with access to the capital markets. As a result, we also test whether bank dependent firms are responsible for the under-investment (see, for instance, Alfaro et al. [2015]). This hypothesis is supported by recent papers such as Chen et al. [2016], which shows that reductions in small business lending has affected investment by smaller firms.[10]
  3. **Safe asset scarcity:** Safe asset scarcity and/or changes in the composition of assets may affect corporations' capital costs (see Caballero and Farhi [2014], for example). In their simple form, such variations would impact Q. They would not cause a gap between Q and investment. However, a gap may appear if safe firms are unable or unwilling to take full advantage of low funding cost (due to, for example, product market rents). See section 4.2.5 for additional discussion and results relevant to this hypothesis.

- **Measurement Error**

[8] We also considered changes in R&D expenses as a proxy for lack of ideas (i.e., differences between *average* and *marginal* Q). Firms increasing R&D expenses are likely to have better ideas and therefore a higher marginal Q. So we test whether under-investing industries (and firms) exhibit a parallel decrease in R&D expense. We do not find support for this hypothesis, but this is inconclusive: under some theories, a rise in R&D may actually imply lower marginal Q (e.g., if ideas are harder to identify). We were unable to find a better measure for (lack of) ideas, so we cannot rule out this hypothesis.

[9] There is considerable controversy about the implications of financial frictions, of course, but this does not matter for our analysis because we are not interested in estimating elasticities. While financial frictions make internal funds relevant, it is not at all clear that they increase the sensitivity of investment to cash flows. Kaplan and Zingales [1997] and Gomes [2001] show that financial frictions might not decrease the fit of the Q equation much.

[10] We should say from the outset that our ability to test this hypothesis is rather limited. Our industry data includes all firms, but investment is skewed and tends to be dominated by relatively large firms. Our firm-level data does not cover small firms.

4. **Intangibles:** The rise of intangibles may affect investment in several ways: first, intangible investment is difficult to measure and is therefore prone to measurement error. Under-estimation of I would lead to under-estimation of K, and therefore over-estimation of Q; and would translate to an 'observed' under-investment at industries with a higher share of intangibles. Alternatively, intangible assets might be more difficult to accumulate. A rise in the relative importance of intangibles could then lead to a higher equilibrium value of Q even if intangibles are correctly measured.
   Both of these effects are analyzed in Peters and Taylor [2016]. They propose a new proxy of Q that explicitly accounts for intangible capital, thereby correcting for measurement error. This new proxy (referred to as 'total Q') is shown to be a better proxy of both tangible and intangible investment.[11] They also show that intangible capital adjusts more slowly to changes in investment opportunities than tangible capital; which reflects higher adjustment costs. [12]

5. **Globalization**: official GDP statistics on private investment aim to capture investment that occurs physically in the US, regardless of where the firm making the investment is incorporated. For example, the investment series would include a manufacturing plant in Michigan built by a German company and exclude investment in China by a US Retail company. Thus, we may observe lower US private investment if US firms with foreign activities are investing more abroad, or foreign firms are investing less in the US. This would be pure measurement error: consolidated investment at the firm-level would still follow Q, but would not be included in US Financial Accounts.

- **Competition**

6. **Regulations & uncertainty:** Regulation and regulatory uncertainty may affect investment in two ways. First, increased regulation may stifle competition by raising barriers to entry. Second, per the theory of investment under uncertainty, irreversible investment in an industry may decline if economic agents are uncertain about future payoffs (see, for example, Bernanke [1983]). Thus, increased regulation and the associated regulatory uncertainty may restrain investment.[13]

7. **Concentration:** A large literature has studied the link between competition, investment, and innovation (see Aghion et al. [2014] for a discussion). From a theoretical

[11] Our results are robust to using 'total Q' instead of the traditional measure of Q described in the data section, although the significance of QIX ownership decreases slightly at the industry-level.

[12] Intangibles can also interact with information technology and competition. For instance, Amazon does not need to open new stores to serve new customers; it simply needs to expand its distribution network. This may lead to a lower equilibrium level of tangible capital (e.g., structures and equipment), thus a lower investment level on tangible assets. But this would still be consistent with Q theory since the Q of the incumbent would fall. On the other hand, Amazon should increase its investments in intangible assets. Whether the Q of Amazon remains large then depends mostly on competition. Finally, intangible assets can be used as a barrier to entry. For all these reasons, we think that it is important to consider intangible investment together with competition.

[13] Increases in firm-specific uncertainty may also lead to lower investment levels due to manager risk-aversion Panousi and Papanikolauo [2012] and/or irreversible investment [Pindyck, 1988, Dixit and Pindyck, 1994]. We test this hypothesis using stock market return and sales volatility; and find some, albeit limited support.

perspective, we know that the relationship is non-monotonic because of a trade-off between average and marginal profits. For a large set of parameters, however, we can expect competition to increase innovation and investment. Firms in concentrated industries, aging industries and/or incumbents that do not face the threat of entry might have weak incentives to invest.[14]

This hypothesis is supported by a growing literature that argues that competition may be decreasing in several economic sectors (see for example CEA [2016], Decker et al. [2015]) and is prevalent even at the product market level (e.g., Mongey [2016]). Similarly, Jovanovic and Rousseau [2014] highlight differences in the sensitivity of investment to Q between incumbents and new entrants. Blonigen and Pierce [2016] studies the impact of mergers and acquisitions (M&As) on productivity and market power, and finds that M&As are associated with increases in average markups. Given the rise in M&A over the past decades, this suggests a potential rise in market power.

In addition, the rapid increase in institutional ownership (see Figure 9), and the increased concentration in the asset management industry may have introduced substantial anti-competitive effects of common ownership.[15] Such anti-competitive effects are the subject of a long theoretical literature in industrial organization, which argues that common ownership of natural competitors may reduce incentives to compete (see, for example, Salop and O'Brien [2000]). Azar et al. [2016a] and Azar et al. [2016b] show that this effect is empirically important using the U.S. Airline and the U.S. Banking industries as test cases.[16]

- **Governance**

8. **Ownership and Shareholder Activism:** beyond the anti-competitive effects of common ownership discussed above, ownership can affect management incentives through short-termism (i.e., investment horizon) and governance. Regarding short-termism, some have argued that equity markets can put excessive emphasis on quarterly earnings, and that higher stock-based compensation incentivizes managers to focus on short term share prices rather than long term profits (see Martin [2015], Lazonick [2014], for example). In particular, Almeida et al. [2016] show that the probability of share repurchases is sharply higher for firms that would have just missed the EPS forecast in the absence of a repurchase; and Jolls [1998] shows that firms which rely heavily on stock-option-based

[14] We do not take a stand on the drivers of increased concentration; simply that it appears in the data.

[15] For instance, Fichtner et al. [2016] show that the "Big Three" asset managers (BlackRock, Vanguard and State Street) together constitute the largest shareholder in 88 percent of the S&P500 firms, which account for 82% of market capitalization.

[16] It is worth noting that the exact mechanisms through which common ownership reduces competition remain to be identified; but they need not be explicit directions from shareholders. They may result from lower incentives for owners to push firms to compete aggressively if they hold diversified positions in natural competitors; or from the ability of board members elected by and representing the largest shareholders to minimize breakdowns of cooperative arrangements and undesirable price wars between their commonly owned firms. See Salop and O'Brien [2000] and Azar et al. [2016b] for additional details.

compensation are significantly more likely to repurchase their stock than firms which rely less heavily on stock options to compensate their top executives. Given the rise of institutional ownership, an increase in market-induced short-termism may lead firms to increase buybacks and cut long term investment.

On the other hand, ownership may improve governance. A large literature following Jensen [1986] argues that conflicts of interest between managers and shareholders can lead firms to invest in ways that do not maximize shareholder value. [17] Harford et al. [2008] and Richardson [2006] find evidence that poor governance associates with greater industry-adjusted investment. Thus, improvements in governance driven by changes in ownership may lead to lower investment levels.

The implications of shareholder activism and institutional ownership on governance and payouts are studied in several papers. Appel et al. [2016a] find that passive owners influence firms' governance choices (they lead to more independent directors, lower takeover defenses, and more equal voting rights; as well as more votes against management). Appel et al. [2016b] find that larger ownership stakes of passive institutional investors make firms more susceptible to activist investors (increasing the ambitiousness of activist objectives as well as the rate of success); and Crane et al. [2016] show that higher (total and quasi-indexer) institutional ownership causes firms to increase their payouts. But the evidence is not clear-cut: Schmidt and Fahlenbrach [2016] find opposite effects for some governance measures (including the likelihood of CEO becoming chairman and appointment of new independent directors), and an increase in value-destructing M&A linked to higher institutional ownership.

In the end, it is unclear whether the higher payouts and the increased susceptibility to activist investors are evidence of tighter governance or increased short-termism. Some papers provide qualitative support for governance (e.g., Crane et al. [2016] refer to Chang et al. [2014] which argues that increasing passive institutional ownership leads to share price increases), but it is inconclusive. And other studies such as Asker et al. [2014] show that public firms invest substantially less and are less responsive to changes in investment opportunities than private firms. In the end, we are unable to differentiate between these two hypotheses empirically.[18] Improvements in governance reduce managerial entrenchment and require managers to continuously demonstrate strong performance, just as increased short-termism would. We simply test whether increases in (passive) institutional ownership lead to higher payouts and lower investment.

[17] This does not necessarily imply that managers invest too much; they might invest in the wrong projects instead. The general view, however, is that managers are reluctant to return cash to shareholders, and that they might over-invest.

[18] This is true despite the very different mechanisms through which they impact investment: improved governance aligns the (manager's) maximization problem with that of the shareholder's, thereby increasing the focus on long term value. Increased short-termism shifts the objective function of the maximization towards short-term value.

Table 2: Data sources

	Data fields	Source	Granularity
Primary datasets	Aggregate investment and Q	Flow of Funds	US
	Industry-level investment and operating surplus	BEA	~NAICS L3
	Firm-level financials	Compustat	Firm
Additional datasets	Sales and Market Value Concentration	Census	NAICS L3
	Entry/Exit; firm demographics	Census	SIC L2
	Occupational Licensing	PDII Survey	NAICS L3
	Regulation index	Mercatus	NAICS L3
	Industry-level spreads	Egon Zakrajsek	NAICS L3
	Institutional ownership	Thomson Reuters 13F	Firm
	Bushee's institutional investor classification	Brian Bushee's website	Institutional Investor

3 Data

Testing the above theories requires the use of micro data. We gather and analyze a wide range of aggregate-, industry- and firm-level data. The data fields and data sources are summarized in Table 2. Sections 3.1 and 3.2 discuss the aggregate and industry datasets, respectively. Section 3.3 discusses the firm-level investment and Q datasets; and 3.4 discusses all other data sources, including the explanatory variables used to test each theory. We discuss data reconciliation and data validation results where appropriate.

3.1 Aggregate data

Aggregate data on funding costs, profitability, investment and market value for the US Economy and the non financial sector is gathered from the US Flow of Funds accounts through FRED. These data are used in the aggregate analyses discussed in Section 1; in the construction of aggregate Q; and to reconcile and ensure the accuracy of more granular data. In addition, data on aggregate firm entry and exit is gathered from the Census BDS; and used in aggregate regressions similar to those reported in Section 4.

3.2 Industry investment data

3.2.1 Dataset

Industry-level investment and profitability data – including measures of private fixed assets (current-cost and chained values for the net stock of capital, depreciation and investment) and value added (gross operating surplus, compensation and taxes) – are gathered from the Bureau of Economic Analysis (BEA).

Fixed assets data is available in three categories: structures, equipment and intellectual property (which includes includes software, R&D and expenditures for entertainment, literary, and artistic originals, among others). This breakdown allows us to (i) study investment patterns for intellectual property separate from the more 'traditional' definitions of K (structures and equipment); and (ii) better capture total investment in aggregate regressions, as opposed to only capital expenditures.

Investment and profitability data are available at the sector (19 groups) and detailed industry (63 groups) level, in a similar categorization as the 2007 NAICS Level 3. We start with the 63 detailed industries and group them into 47 industry groupings to ensure investment, entry and concentration measures are stable over time. In particular, we group detailed industries to ensure each group has at least ~10 firms, on average, from 1990 - 2015 and it contributes a material share of investment (see Appendix I: Industry Investment Data for details on the investment dataset). We exclude Financials and Real Estate; and also exclude Utilities given the influence of government actions in their investment and their unique experience after the crisis (e.g., they exhibit decreasing operating surplus since 2000). Last, we exclude Management because there are no companies in Compustat that map to this category. This leaves 43 industry groupings for our analyses, whose total net investment since 2000 is summarized in Table 14 in the appendix. All other datasets are mapped into these 43 industry groupings using the NAICS Level 3 mapping provided by the BEA.

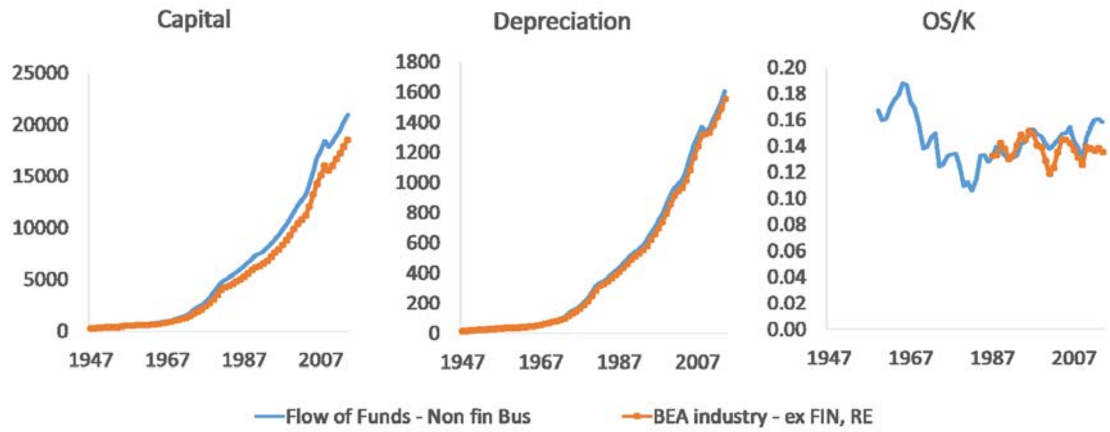
We define industry-level gross investment rates as the ratio of 'Investment in Private Fixed Assets' to lagged 'Current-Cost Net Stock of Private Fixed Assets'; depreciation rates as the ratio of 'Current-Cost Depreciation of Private Fixed Assets' to lagged 'Current-Cost Net Stock of Private Fixed Assets'; and net investment rates as the gross investment rate minus the depreciation rate. Investment rates are computed across all asset types, as well as separating intellectual property from structures and equipment.

The Gross Operating Surplus is provided by the BEA, while the Net Operating Surplus is computed as the 'Gross Operating Surplus' minus 'Current-Cost Depreciation of Private Fixed Assets'. OS/K is defined as the 'Net Operating Surplus' over the lagged 'Current-Cost Net Stock of Private Fixed Assets'.

3.2.2 Data validation

In order to ensure industry-level figures are consistent with aggregate data, we reconcile the two datasets. We first note that industry-level figures include all forms of organization (financials and non financials, as well as corporates, non corporates and non businesses). A breakdown between financials and non financials or corporates and non corporates by industry is not available. Thus, a full reconciliation can only be achieved at the aggregate level or considering pre-aggregated BEA series (such as non financial corporates). But these do not provide an industry breakdown. Instead, we note that aggregating capital, depreciation and operating surplus across all industries except Financials and Real Estate yields very similar series as the aggregated non financial business series from the Flow of Funds (see Figure 10). The remaining differences appear to be explained by non-businesses (households and non profit organizations) but cannot be reconciled due to data availability. Regardless, the trends are sufficiently similar to suggest that conclusions based on industry data will be consistent with the aggregate-level under-investment discussed in Section 1.

Figure 10: Reconciliation of Flow of Funds and BEA industry datasets



Notes: Flow of Funds data for non financial business sector; BEA data for all industries except Finance and Real Estate. Remaining differences – particularly for OS/K – appear to be driven by non-businesses (households and non profit), which are included in the BEA series but not in the Flow of Funds series.

3.3 Firm-level investment and Q data

3.3.1 Dataset

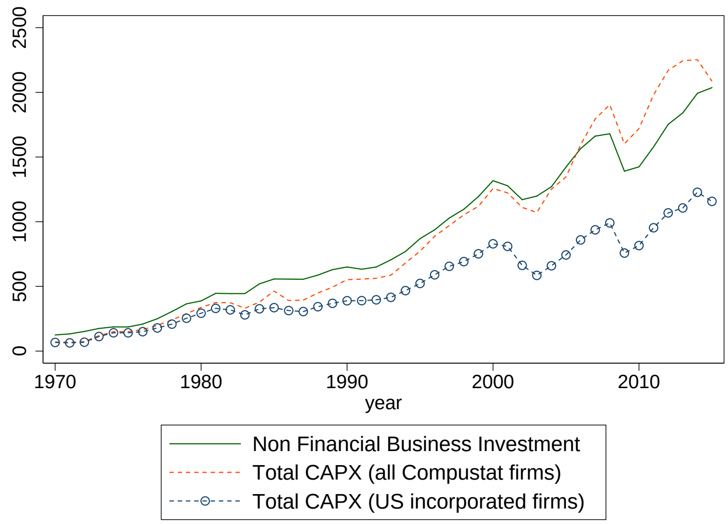
Firm-level data is primarily sourced from Compustat, which includes all public firms in the US. Data is available from 1950 through 2016, but coverage is fairly thin until the 1970s. We exclude firm-year observations with assets under $1 million; with negative book or market value; or with missing year, assets, Q, or book liabilities.[19] In order to more closely mirror the aggregate and industry figures, we exclude utilities (SIC codes 4900 through 4999), real estate (SIC codes 5300 through 5399) and financial firms (SIC codes 6000 through 6999); and focus on US incorporated firms (see Section 3.3.2 for additional discussion).

Firms are mapped to BEA industry segments using 'Level 3' NAICS codes, as defined by the BEA. When NAICS codes are not available, firms are mapped to the most common NAICS category among those firms that share the same SIC code and have NAICS codes available. Firms with an 'other' SIC code (SIC codes 9000 to 9999) are excluded from industry-level analyses because they cannot be mapped to an industry.

Firm-level data is used for two purposes: first, we aggregate firm-level data into industry-level metrics and use the aggregated quantities to explain industry-level investment behavior (e.g., by computing industry-level Q). We consider the aggregate (i.e., weighted average), the mean and the median for all quantities, and use the specification that exhibits the highest statistical significance.

[19] These exclusion rules are applied for all measures except firm age, which starts on the first year in which the firm appears in Compustat irrespective of data coverage

Figure 11: Comparison of Flow of Funds and Compustat CAPX ($B)



Note: Annual data. Note that all Compustat figures are before the application of our exclusion criteria (e.g., excluding Financials). The qualitative conclusions remain the same after applying our exclusion criteria.

Second, we use firm-level data to analyze the determinants of firm-level investment through panel regressions (see Section 4 for additional details).

3.3.2 Data validation

The sample of Compustat firms that we study represents a wide cross-section of firms in the US. Still, this set of firms may not be representative of aggregate and industry-level investment figures.

For instance, Compustat captures investment by US public firms, while official GDP statistics capture all investment that occurs physically in the US irrespective of the listing status or country of the firm making the investment. To address this issue, Figure 11 plots the gross fixed capital formation for non financial businesses (from the Flow of Funds) versus total capital expenditures (CAPX) for two sets of Compustat firms: all firms in Compustat, irrespective of country of incorporation, and all domestically incorporated firms. Simply summing up CAPX for all firms results in a series that roughly tracks, and sometimes exceeds, the official Flow of Funds estimates. However, this Compustat series exhibits a much stronger recovery after the Dotcom bubble and the Great Recession than the official estimates: total CAPX accounts for 85% of investment from 1980 to 2000, on average; but 117% from 2008 to 2015. Focusing on US incorporated firms largely resolves the differences: the new series accounts for 63% of investment from 1980 to 2000 and 59% from 2008 to 2015, on average. These results suggest that foreign-incorporated firms are investing more than US-incorporated firms, but this investment is occurring outside the US.

In order to more closely mirror US aggregate figures, we restrict our sample to US incorporated firms for the remainder of our analyses. None of the qualitative conclusions in this paper are sensitive to the inclusion of all firms irrespective of country of incorporation.

We are interested in using Compustat firm-level data to reach conclusions about industry-level investment. Thus, we need to understand whether Compustat firms in a given industry provide a good representation of the industry as a whole. We define the following two measures of 'coverage': the ratio of Compustat total CAPX to BEA Investment by industry, and the ratio of Compustat total PP&E to BEA Capital. Table 14 in the Appendix shows the coverage for the 43 industries under consideration. As shown, our Compustat sample provides good coverage for the majority of material industries. In particular, Compustat provides at least 10% coverage across both metrics for 19 industries, which account for 55% of total net investment from 2000 to 2015. The most material sectors for which Compustat does not provide good coverage are Health Care, Professional Services and Wholesale Trade.

Low coverage levels increase the noise in Compustat estimates, but are not expected to bias the results. We therefore include all industries in our analyses, and confirm that qualitative results remain stable when including only industries with >10% coverage across both metrics.

3.3.3 Investment definition

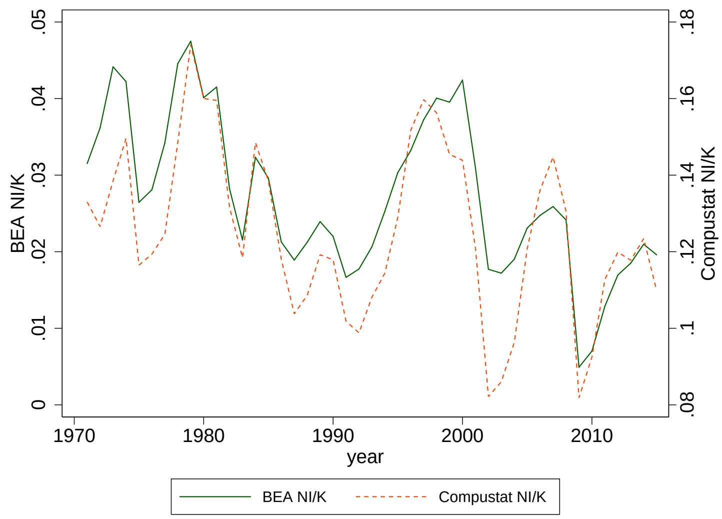
We consider two investment definitions. First, the 'traditional' gross investment rate is defined as in Rajan and Zingales [1998] (among others): capital expenditures (Compustat item CAPX) at time t scaled by net Property, Plant and Equipment (item PPENT) at time $t-1$. Net investment rate is calculated by imputing the industry-level depreciation rate from BEA figures. In particular, note that the depreciation figures available in Compustat include only the portion of depreciation that affects the income statement, and therefore exclude depreciation included as part of Cost of Goods Sold. For consistency, and because we are interested in aggregate quantities, we assume all firms in a given industry have the same depreciation rate, and compute the net investment rate as the gross investment rate minus the BEA-implied depreciation rate for structures and equipment in each industry. Second, we estimate investment in intangibles as the ratio of R&D expenses to assets (Compustat XRD / AT)[20]. We consider only the gross investment rate (i.e., do not subtract depreciation) because a good proxy for R&D depreciation is not available.[21]

The resulting firm-level net investment figures closely mirror the BEA official estimates. Figure 11 shows the BEA official net investment rate along with the aggregate net investment rate for our Compustat sample (adjusted to mirror the BEA industry mix). The Compustat series is higher because of the differences in definitions (e.g., PP&E covers only a portion of capital; the BEA includes all firms while Compustat includes only public firms), but the trends are very similar from

[20] XRD set to zero if missing

[21] In order to ensure robustness, we also test three alternate definitions: (i) capital expenditures plus R&D expense over total assets (Compustat (CAPX + XRD) / AT); (ii) a broader definition of investment constructed from the statement of cash flows (capital expenditures plus increase in investments minus sale of investments over the sum of PP&E, Investment and Advances (equity) and Investment and Advances (other) (Compustat (CAPX + IVCH - SIV)/(PPE+IVAEQ+IVAO); and (iii) investment over market value, in which case Q is omitted from the regression equations. Definitions (i) and (ii) aim to capture a broader set of long term investment activities than just capital expenditures. We use the total BEA-implied depreciation rate to compute net investment under all three alternate definitions. All qualitative conclusions are robust to using either of these broader definitions of investment.

Figure 12: Comparison of Compustat and BEA net investment rates



Note: Annual data. BEA and Compustat NI/K for selected sample.

each other.

3.3.4 Q definition

Firm-level stock Q is defined as the book value of total assets (AT) plus the market value of equity (ME) minus the book value of equity scaled by the book value of total assets (AT). The market value of equity (ME) is defined as the total number of common shares outstanding (item CSHO) times the closing stock price at the end of the fiscal year (item PRCC_F). Book value of equity is computed as AT - LT - PSTK.

Figure 13 shows the aggregate, mean and median Q across all firms in our Compustat sample, along with the measure of Q constructed for non financial corporates using Flow of Funds data. As shown, the aggregate and mean Q from Compustat closely mirror the Flow of Funds series. The median Q is substantially lower in the early 2000s, because the corresponding increase in average Q was driven by a few firms concentrated in particular industries. For some tests, we supplement this traditional measure of Q with the 'total Q' of Peters and Taylor [2016], which aims to control for intangible capital.

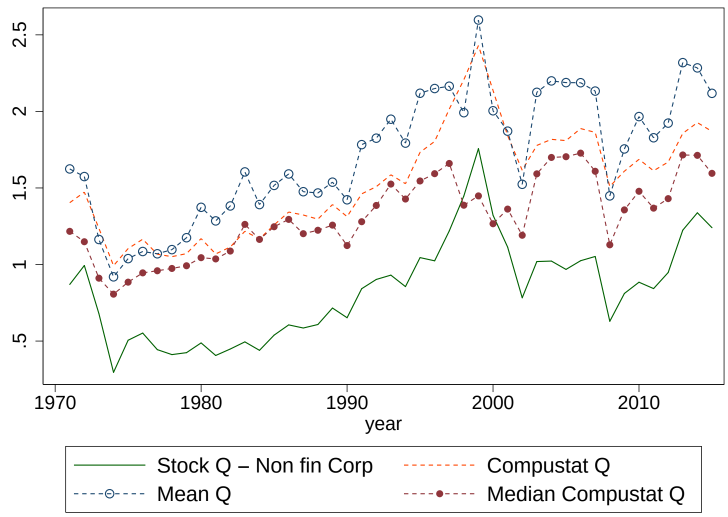
3.4 Explanatory Variables

Last, a wide range of additional variables are gathered and/or computed to test our eight theories of under-investment.

3.4.1 Financial Frictions

External finance constraints. For external finance constraints, we are interested in the amount of investment that cannot be financed through internal sources, i.e., the cash flow generated by the

Figure 13: Comparison of Compustat and Flow of Funds Q



Note: Annual data. Flow of Funds Q for Non Financial Corporate sector due to data availability. Compustat Q for selected sample.

business. We follow Rajan and Zingales [1998] and define a firm's dependence on external finance as the ratio of cumulative capital expenditures (item CAPX) minus cash flow from operations divided by capital expenditures over the 10-year prior period (to avoid over-weighting a particular year). Cash flow from operations is defined as the sum of Compustat cash flow from operations (item FOPT) plus decreases in inventories (item INVCH), decreases in receivables (item RECCH), and increases in payables (item APALCH).[22] The dependence on external equity finance is defined as the ratio of the net amount of equity issues (item SSTK minus item PRSTKC) to capital expenditures; and the dependence on external debt finance as the ratio of the net amount of debt issues (item DLTIS minus item DLTR) to capital expenditures.[23] We use these metrics to test whether firms or industries with high dependence on external finance are under-investing.

Bank dependence. Since financial constraints may differ between bank-dependent firms and firms with access to capital markets, we follow Kashyap et al. [1994] (and others) and define a borrower as bank-dependent if it does not have a long-term issuer rating from S&P. Again, we test whether bank-dependent firms or industries are under-investing. As explained earlier, however, note that in order to test the bank dependence hypothesis, we would need to over-sample small firms.

Safe asset scarcity. For safe asset scarcity, we gather firm-level S&P corporate bond ratings (available in the CRSP-Compustat Merged database) and industry-level corporate bond spreads. The former is used for firm-level analyses, and aggregated to the industry level based on the share of firms rated AA to AAA. The latter was kindly provided by Egon Zakrajsek, and measures the simple

[22]This definition is used for cash flow statements with format codes 1, 2, or 3. For format code 7 we use the sum of the following items: ibc, dpc, txdc, esubc, sppiv and fopo

[23]Note that debt finance dependence is not computed by Rajan and Zingales

average corporate bond spread across all bonds in a given NAICS Level 3 code. This dataset was used in Gilchrist and Zakrajsek [2011]. Not all industries are covered by the bond spread dataset.

3.4.2 Measurement Error

Intangibles. For Intangibles, we compute two types of metrics. First, we compute the investment rate for tangible and intangible assets separately (as described above) and use these to (i) test for under-investment in intangible assets and (ii) test whether the hypotheses supported for total investment also hold for intangible assets. Second, we compute the ratio of intangibles excluding goodwill to assets (Compustat (INTAN-GDWL)/AT); and use this ratio to test for measurement error in intangibles. See Section 4.2.6 for additional details. Goodwill is excluded because it primarily measures M&A activity, not formation of intangible capital.[24]

Globalization. For Globalization, we use Compustat item PRETAX INCOME - FOREIGN to identify industries and firms with substantial foreign activities. This field contains the income of a company's foreign operations before taxes. It is reported only by some firms[25], yet there are no other indicators of the extent of a firm's foreign operations available in Compustat (Foley et al. [2007]). For industry-level analyses, we compute the industry share of foreign income as the ratio of total PRETAX INCOME - FOREIGN to total PRETAX INCOME (i.e., across all firms in a given industry and year). For firm-level analyses, we consider three transformations of foreign activities given the potential for missing data: one omitting all firms with missing PRETAX INCOME - FOREIGN; one setting missing PRETAX INCOME - FOREIGN equal to zero; and one with an indicator for populated PRETAX INCOME - FOREIGN. We use these measures to test whether industries with substantial foreign activities are over-investing relative to Q.

3.4.3 Competition

Regulation and Uncertainty For regulation and uncertainty, we consider two measures.

As a measure of the amount and change in regulations affecting a particular industry, we gather the Regulation index published by the Mercatus Center at George Mason University. The index relies on text analysis to count the number of relevant restrictions for each NAICS Level 3 industry from 1970 to 2014. Note that most, but not all industries are covered by the index. See Al-Ubaydli and McLaughlin [2015] for additional details. Second, as a proxy for barriers to entry, we gather the share of workers requiring Occupational Licensing in each NAICS Level 3 industry from the 2008 PDII.[26]

[24] We also tested the ratio of intangibles to assets, but excluding goodwill is more appropriate and exhibits a stronger link to investment

[25] Security and Exchange Commission regulations stipulate that firms should report foreign activities separately in each year that foreign assets, revenues or income exceed 10% of total activities

[26] The 2008 PDII was conducted by Westat, and analyzed in Kleiner and Krueger [2013]. It is based on a survey of individual workers from across the nation.

Concentration and demographics. For concentration and firm demographics we use three different sources: Compustat, the US Census Bureau and Thomson-Reuters' Institutional Holdings (13F) Database.

From Compustat, we compute four measures of concentration (i) the log-change in the number of firms in a given industry as a measure of entry and exit; (ii) sales Herfindahls[27], (iii) the share of sales and market value held by the top 4, 8 and 20 firms in each industry, and (iv) the price-cost ratio (also known as the Lerner index). We use Compustat item SALE for measures of sales concentration and market value as defined in the computation of Q above for measures of market value concentration. To compute the Lerner index, we follow Datta et al. [2013] and calculate the ratio of operating profit (Compustat SALE - COGS - XSGA) to sales. We also compute (iv) age (from entrance into Compustat) and (v) size (log of total assets) as measures of firm demographics. The Lerner index differs from the Herfindahl and Concentration ratios because it does not rely on precise definitions of geographic and product markets; rather it aims to measure a firm's ability to extract rents from the market.

From the U.S. Census Bureau, we gather industry-level establishment entry/exit rates and demographics (age and size); and industry-level measures of sales and market value concentration The former are available in the Business Dynamics Statistics (BDS) for 9 broad sectors (SIC Level 2) since 1977. The latter are sourced from the Economic Census, and include the share of sales/market value held by the top 4, 8, 20 and 50 firms in each industry; and are available for a subset of NAICS Level 3 industries for 1997, 2002, 2007 and 2012. We aggregate concentration ratios to our 43 industry groupings by taking the average across industries.

The main benefit of the census data is that it covers all US firms (public and private). But the limited granularity/coverage poses significant limitations for its use in regression analyses. We mapped the 9 SIC sectors for which census entry/exit data are available to the BEA investment categories and analyzed industry-level investment patterns. However, limited conclusions could be reached given the very broad segmentation: Q exhibited significant measurement error, leading to unintuitive coefficients. So we use these data only to validate the representativeness of relevant Compustat series. For instance, Figure 8 above shows that from 2000 onward, changes in the number firms in Compustat closely resemble those of the US as a whole.

Similarly, the census concentration data is available at a more granular level, but only for a subset of years and industries. We use these metrics to test whether more concentrated industries exhibit lower investment; and to compare nationwide concentration measures with those computed from Compustat. Census and Compustat measures of concentration are found to be fairly correlated, and both are significant predictors of industry-wide (under-)investment. We use Compustat as the basis of our analyses because the corresponding measures are available for all industries and all years; but we also report some regression results using Census-based concentration measures.

Last, to account for anti-competitive effects of common ownership, we compute the modified Herfindahl. We use Compustat as well as Thomson-Reuters' Institutional Holdings (see the next sub-

[27] Market value Herfindahl also considered, but Sales Herfindahl performs better and is therefore reported.

section). The Modified Herfindahl – described in Salop and O'Brien [2000] and Azar et al. [2016b] – is defined as

$$MHHI = HHI + \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$$

$$= HHI + HHI_{adj}$$

where s_j and s_k denote the share of sales for firms j, k in a given industry. γ_{ij} and β_{ik} denote the control share and the ownership share of investor i in firm j, respectively. The first term is the traditional Herfindahl, while the second term is a measure of the anti-competitive incentives due to common ownership. Theoretical justification for this measure can be derived using the modified Herfindahl-Hirschman Index (MHHI) in a Cournot setting. See Salop and O'Brien [2000] and Azar et al. [2016b] for additional details. We consider the combined $MHHI$ in most of our tests; but also separate HHI and HHI_{adj} to assess their impact independently in some cases.

We make two assumptions to compute this measure empirically: first, because ownership data is only available for institutional investors, we compute γ_{ij} and β_{ik} as the control and ownership share of investor i in firm j relative to total institutional ownership reported in the 13F database, not total ownership. This is not expected to substantially influence the results because ownership by non-institutional investors is likely limited and restricted to a single firm, which does not induce common ownership links. Second, because data on the total number of voting shares per company is not readily available, we assume $\gamma_{ij} = \beta_{ik}$ (i.e., we consider total ownership rather than voting and non-voting shares separately).[28] Last, following Azar et al. [2016b], we restrict the data to holdings of at least 0.5% of shares outstanding.

3.4.4 Governance

For governance, we gather data on institutional ownership from Thomson-Reuters' Institutional Holdings (13F) Database. This data set includes investments in all US publicly traded stocks by institutional investors managing more than $100 million.

We define the share of institutional ownership as the ratio of shares owned by fund managers filing 13Fs on a given firm over total shares outstanding.[29] We also add Brian Bushee's permanent classification of institutional owners (transient, quasi-indexer, and dedicated), available on his website. This classification is based on the turnover and diversification of institutional investor's holdings. Dedicated institutions have large, long-term holdings in a small number of firms. Quasi-indexers have diversified holdings and low portfolio turnover – consistent with a passive, buy-and-hold strategy of investing portfolio funds in a broad set of firms. Transient owners have high diversification and high portfolio turnover. Quasi-indexers are the largest category, and account for ~60% of total

[28] We also measured γ_{ij} based on the (sole and shared) voting shares held by institutional investors only, but this exhibits lower statistical significance.

[29] We use CRSP's total shares outstanding instead of Thomson Reuter's since the latter are available only in millions for some periods.

institutional ownership. This includes 'pure' index investors as well as actively managed investors that hold diversified portfolios. Quasi-indexer ownership is therefore heavily influenced by index position and participation. This is obvious for index funds, but also affects actively managed funds that benchmark against these indices (see, for example, Wurgler [2011]).

Bushee [2001] shows that high levels of ownership by transient institutions are associated with significant over-weighting of the near-term earnings component of firm value. And Asker et al. [2014], shows that firms with more transient ownership exhibit lower investment sensitivity to Q. Appel et al. [2016a,b] and Crane et al. [2016] all use Bushee's classifications when studying the implications of institutional ownership on governance and payouts. The classification is available from 1981 to 2013.[30]

3.4.5 Other measures

In addition to the above metrics tied to specific theories, we compute the ratio of goodwill (item GDWL) to assets as a measure of past M&A activity; and the ratio of share repurchases (item PRSTKC) to assets as a measure of buybacks.[31] These two variables cut across several hypothesis. Acquisitions clearly has an impact on competition, but it can also be a sign of weak governance (a view supported by a large literature) or a sign of short-termism (since combining capital and labor into new units is much more time consuming than buying existing units of production). Similarly, high payout ratios can be a sign of strong governance, short-termism, or low competition.

Table 3 summarizes the data fields considered for each explanation. Investment rates as well as measures of external finance dependence; measures of intangibles; R&D expense; the ratio of operating surplus to capital; cash flow to assets; and foreign pretax income are all winsorized at the 2% and 97% level by year to control for outliers. Buybacks are capped at 10% of assets and Q is capped at 10.

4 Results

Armed with the requisite industry- and firm-level data, we can analyze the determinants of aggregate, industry and firm-level under-investment. We start by showing that the aggregate-level investment gap is explained by low competition and high quasi-indexer institutional ownership. We then discuss industry- and firm-level panel regression results, which confirm (i) that the observed aggregate-level under-investment appears consistently at the industry- and firm-level; and (ii) that industries with more quasi-indexer institutional ownership and less competition (as measured by the traditional and modified Herfindahl as well as the Lerner index) invest less. We report summary results in the body of the document, and detailed regression output in the Appendix.

[30] We also considered the GIM index of Gompers et al. [2003] as a proxy for managerial entrenchment; and the industry-level Earnings Response Coefficient, which measures the sensitivity of stock prices to earnings announcements. However,we did not find a strong relationship between these measures and investment.

[31] We also considered total payouts to assets and found very similar results

Table 3: Summary of data fields by potential explanation

Potential explanation		Relevant data field(s)
Financial Frictions	**1. External finance constraints**	Firm- and industry-level Rajan-Zingales (1998) external finance dependence (aggregate, equity and debt)
	2. Bank dependence	Firm-level bank-dependence indicator (firms missing S&P rating)
	3. Safe asset	Industry-average spread
		Firm-level Corporate Bond ratings
Measurement error	**4. Intangibles**	Separate CAPX vs. Intangible investment rates (firm- and industry-level)
		Intangibles ex. goodwill/assets
	5. Globalization	Share of foreign profits, as proxy for foreign activities
Competition	**6. Regulation & uncertainty**	Mercatus industry-level regulation index (restriction count)
		Share of workers with Occupational Licensing (PDII)
		Sales and stock market return volatility
	7. Concentration	Change in number of firms (Compustat and Census BDS)
		Share of total sales/market value of top X firms (Compustat and Economic Census)
		Lerner index; i.e., price-cost margin (Compustat)
		Traditional Herfindahl (Compustat)
		Modified Herfindahl, i.e., common-ownership adjusted (Compustat)
Governance	**8. Ownership**	Firm-level share of institutional ownership
		Firm-level share of Quasi-indexer, Dedicated and Transient ownership (Bushee (2001), updated through 2013)

It is well-known that OLS regressions of Q suffer from two problems: the slopes on Q are biased due to measurement error in Q; and the corresponding R^2 depends on the extent of measurement error. To correct for this, all industry- and firm-level panel regression results reported in the paper are based on the cumulant estimator of Erickson et al. [2014] (unless otherwise noted). Qualitative results are robust to using simple OLS, but coefficients on Q and other parameters are smaller as expected. In addition to the unbiased slopes produced by the estimator, we report the R^2 of the regression, labeled ρ^2. Note that this errors-in-variables estimator requires de-meaned data (and does not compute fixed effects internally). We therefore de-mean all industry-/firm-level dependent variables.

4.1 Aggregate-level results

We start by regressing the aggregate net investment rate (from the flow of funds) on mean Q (from Compustat), along with additional explanatory variables $\boldsymbol{X}$.[32]

$$\frac{NI_t}{K_{t-1}} = \beta_0 + \beta Q_{t-1} + \boldsymbol{\gamma} \boldsymbol{X} + \varepsilon_t$$

Table 4 shows the results of these regressions for our 'core' explanations: industry concentration and quasi-indexer ownership. We report results using the median sales Herfindahl across all industries as our measure of concentration, but alternate measures such as Census- and Compustat-based firm entry and exit rates, changes in the number of firms, and average concentration ratios (% of sales by top 4, 8, 20 firms) are also significant predictors with appropriate signs.

Columns 1 through 3 include regressions from 1980 onward while columns 4 to 6 include results from 1990 onward. As shown, Q exhibits a substantially better fit since 1990, hence we focus on this period for most of our analyses. Note, however, that measures of competition and quasi-indexer ownership are fairly stable and significant across both periods. Columns 2 and 5 show that an increase in the sales Herfindahl is correlated with lower investment. Columns 3 and 6 add quasi-indexer institutional ownership, and show that increases in such ownership are correlated with lower investment. Note that the R^2 in column 6 is 81%, suggesting a very high correlation between these measures and investment.

These results are based on time series regressions of fairly persistent series. To control for the over-estimation of T-values, Table 15 in the appendix reports moving average regression results with 1 and 2 year lags. The coefficients are very similar and often significant.

4.2 Industry and Firm-level results

4.2.1 Testing under-investment

In order to test our more granular hypotheses, we now move to industry- and firm-level data. We start by documenting that the observed under-investment at the aggregate-level persists at the

[32] The Flow of Funds measure of Q is also significant under most specifications. We focus on Compustat Q and Herfindahls for consistency with the rest of the paper.

Table 4: Aggregate Net Investment: OLS Regressions

	(1)	(2)	(3)	(4)	(5)	(6)
	Net I/K					
	≥1980	≥1980	≥1980	≥1990	≥1990	≥1990
Mean Stock Q (t-1)	0.002	0.001	0.012**	0.019**	0.010**	0.016**
	[0.48]	[0.24]	[3.58]	[3.78]	[2.86]	[4.10]
Median Sales Herfindahl(t-1)†		**-0.576****	**-0.270****		**-0.451****	**-0.260***
		[-6.93]	**[-2.79]**		**[-5.48]**	**[-2.61]**
Mean % QIX own (t-1)			**-0.059****			**-0.045****
			[-3.90]			**[-2.89]**
Observations	36	36	33	26	26	25
R^2	1%	60%	74%	37%	73%	81%

Notes: Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01. Investment from the US Flow of Funds; Q, Herfindahl and Ownership across all US incorporated firms in Compustat.
† Alternate measures of competition including changes in number of firms (Compustat), concentration (Compustat), and firm entry and exit (Census) are also significant.

industry- and firm-level. In particular, we perform the following errors-in-variables panel regression across industries or firms i:

$$\frac{NI_{it}}{K_{it-1}} - \mu_i = \beta_0 + \beta Q_{i,t-1} + \eta_t + \varepsilon_{it}$$

where β_0 represents a constant, μ_i denotes the mean industry-/firm-level investment over the regression period; and η_t represents year fixed effects. We omit the regression results for brevity (which exhibit the expected signs) and instead focus on the time fixed effects. The results are shown in Figure 5. The left (right) chart shows the time effects for the industry (firm) panel regression. The vertical line highlights the average time effect across all years for each regression. As shown, the time-effects are substantially lower for both industry- and firm-level regressions from approximately 2000. In the industry regression, time effects were above average in most years in the 1980s; on average in the 1990s and below-average since 2002. In the firm regression, time effects were fairly high in the 1980s, and have been trending down since. They are near the average in the early 1990s and well below-average in the early 2000s. They increase at the height of the great recession (when Q decreased drastically) but reach their lowest level in 2013 and 2014. Note that time effects need not be zero on average, given the impact of adjustment costs in Q theory and the inclusion of a constant in the regression.

These results confirm that the decline in investment is observed conditional on Q, and consistent across industries and firms (given the fixed effects). They are also robust to including additional financials such as operating surplus in the regression or including only a subset of industries.

4.2.2 Testing hypotheses

Having established the observed under-investment relative to fundamentals since 2000, we now test our eight theories of under-investment. We do so by expanding the above errors-in-variables panel regression to include additional measures for each theory:

$$\frac{NI_{it}}{K_{it-1}} - \mu_i = \beta_0 + \beta Q_{i,t-1} + \boldsymbol{\gamma X_{it-1}} + \boldsymbol{\alpha\, Y_{it-1}} + \eta_t + \varepsilon_{it}$$

where, again, β_0 and η_t represent a constant and year fixed effects, respectively. μ_i denotes the mean industry-/firm-level investment over the regression period. $\boldsymbol{X_{it-1}}$ denotes our 'core' explanations, which are included in all regressions. These include the modified Herfindahl and the share of quasi-indexer institutional ownership; as well as controls for age and size . We use the modified Herfindahl as our base measure of competition because it exhibits the highest statistical significance, and because it controls for anti-competitive effects of common ownership as well as traditional measures of concentration. $\boldsymbol{Y_{it-1}}$ denotes the additional measures for each hypotheses, including measures of financial constraints, globalization, etc. These measures are first included individually and then simultaneously (if significant) to assess their correlation with cross-sectional investment levels.

Note that including year fixed effects implies that we no longer see under-investment relative to Q. Instead, these regressions identify cross-sectional differences in investment, including which variables explain under-/over-investing relative to Q. For industry-level regressions, the dependent variable is the BEA net investment rate, and Q is the median Q across all Compustat firms in a given industry.[33] For firm-level regressions, the dependent variable is firm-level net investment (based on CAPX/PPENT) and Q is the corresponding a firm-level value. Results for intangible investment (using Intellectual Property investment at the industry level, and R&D expenses at the firm-level) are reported and discussed in Section 4.2.6.

Table 5 summarizes industry- and firm-level error-corrected regression results across all hypotheses. Tick-marks (✓) identify those variables that are significant and exhibit the 'right' coefficient. Crosses (✗) identify variables that are not significant or exhibit the 'wrong' coefficient. A minus sign after a tick-mark (✓-) highlights that the variable is significant but not robust across periods, against the inclusion of other predictor variables or against changes in the specification (e.g., census-based concentration ratios are significant, but Compustat-based ratios are not; coefficients on Dedicated and Transient ownership flip signs or are not significant under some robustness tests).

Detailed regression results underlying this summary table are included in Tables 16 to 19 in the appendix. Specifically, Table 16 includes industry-level results for all variables except measures of competition, which are included in Table 17. Table 18 shows firm-level errors-in-variables results for all explanations except governance and short-termism, which are shown in Table 19. Last, Tables 20 to 23 show the same results as Tables 16 to 19 but from 2000 onward, to demonstrate that results remain generally stable and robust over the more recent period (although coefficients are not always significant given the short fitting period).

Note that, for brevity, we include only the most significant variables/transformations for each type of measure in our reported regression results (e.g, we exclude the less significant transformations of foreign profits for Globalization, and the industry-average spread for safe asset scarcity). Qualitative results are robust to using the alternate definitions of firm-level investment; including

[33] We also considered the weighted average and mean Q but median Q exhibits higher T-stats

Table 5: Summary of Firm- and Industry-level results

Potential explanation		Relevant data field(s)	Significance Industry	Significance Firm
Financial constraints	1. External finance	RZ external finance dependence ('99)	✗	✗
	2. Bank dependence	Missing S&P rating ('99)	✗	✗
	3. Safe asset	Industry spread ('99)	✗	✗
		Firm-level ratings ('99)	✗	✗
Measurement error	4. Intangibles	Intangibles ex. goodwill/assets	✓	✗
	5. Globalization	% foreign profits	✓	✗
Competition	6. Regulation & uncertainty	Regulation index	✗	✓
		Occupational Licensing	✗	✗
	7. Concentration	ΔLog #of firms	✗	✗
		% sales/market value of top X firms	✓-	✗
		Lerner index (Compustat)	✓	✓
		Herfindahl (Compustat)	✓	✓
		Modified Herfindahl (Compustat)	✓	✓
Governance	8. Ownership	Share of Institutional ownership	✓	✓
		Share of QIX ownership	✓	✓
		Share of DED ownership	✓-	✓-
		Share of TRA ownership	✓-	✓-

Notes: Table summarizes industry- and firm-level errors-in-variables regression results across all potential explanations. Tick-marks (✓) identify those variables that are significant and exhibit the 'right' coefficient. Crosses (✗) identify variables that are not significant or exhibit the 'wrong' coefficient. A minus sign after a tick mark (✓-) highlights that the variable is significant but not robust to inclusion of additional variables, sensitive to treatment of measurement error or to alternate regression periods. See Appendix for detailed regression results and the text for caveats and discussions of the limitations of our results (e.g., in the case of bank dependence).

only industries with good Compustat coverage; and (almost always) allowing for measurement error in MHHI and Lerner index in addition to Q.

As shown, we find strong support for measures of competition and ownership; some support for intangibles and globalization (at the industry-level) and regulation (at the firm-level); and no support for the remaining hypotheses. Several measures of competition appear to be significant at the industry- and firm-level – particularly the modified Herfindahl (and both of its components) and the Lerner index.

Similarly, all four measures of ownership appear to be strongly correlated with industry- and firm-level under-investment (see Table 19). We emphasize quasi-indexer ownership throughout the paper because it exhibits high levels of significance across all specifications and robustness tests; and because of its rapid growth since 2000. But the significance of all ownership measures in our base specification suggests that the under-investment may in fact be linked to the financialization of the economies broadly, rather than the growth of a particular type of ownership.

Among the remaining hypotheses, we find some support for intangibles, globalization and regulation. Industries with a higher share of intangibles excluding goodwill tend to invest less, supporting the measurement error and adjustment cost hypotheses. Industries with higher foreign profits also exhibit lower US investment. This is expected, given their larger foreign operations. However, since this result is not significant at the firm-level (where we include all investment irrespective of the location), the under-investment in the US does not appear to be driven by US firms investing disproportionately more abroad, but rather by all firms investing less. Last, firms in industries with more regulations also appear to invest less; though this result is substantially less robust than measures of competition and quasi-indexer ownership; and does not appear at the industry-level.

We highlight that these results cannot discard the theories for all subsets of firms. For instance, other papers have documented that reductions in bank lending affect investment by smaller firms (e.g.,Chen et al. [2016]). We do not observe such an effect in our sample, using the lack of corporate bond ratings as a proxy for bank dependence. Still, our results are not inconsistent with the existing literature. Industry-level investment tends to be dominated by relatively large firms (which are rarely bank-dependent); and our firm-level data does not cover small firms. What our results suggest is that under-investment by small firms is unlikely to account quantitatively for the bulk of the aggregate investment gap. Finally, another caveat is that bank lending matters for business formation [Alfaro et al., 2015]. A decrease in bank lending can then, over time, lead to an increase in concentration.

The remainder of this section discusses the results in more detail. Section 4.2.3 and 4.2.4 discuss the primary industry and firm-level regression results. Section 4.2.5 provides additional analysis and support for discarding the safe asset scarcity hypothesis; while Section 4.2.6 discusses the implications of rising intangibles on investment. Detailed results are included in the Appendix.

4.2.3 Industry Results

Table 6 shows the results of error-corrected industry regressions for our 'core' explanations. We include the modified Herfindahl in columns 1 and 2, and separate the traditional and common ownership components in columns 3 and 4. As shown, all measures of concentration are significant from 1980 and 1990 onward. The differences in the magnitude of coefficients relative to the Aggregate results of Table 4 are driven by a larger coefficient on Q due to measurement error correction. It is worth noting that the coefficient on the common ownership adjustment is substantially larger than the coefficient on the traditional Herfindahl. Measures of quasi-indexer ownership are also significant.

4.2.4 Firm Results

Table 7 shows firm-level regression results including the modified Herfindahl and quasi-indexer ownership. Columns 1 to 3 regress net investment (defined as CAPX/PPE), and columns 4 to 6 regress the ratio of buybacks to assets.

Columns 1 and 2 include year fixed effects; and the investment rate is de-meaned within each industry and firm, respectively. As shown, quasi-indexer institutional ownership and concentration

Table 6: Industry regressions: 'Core' explanations

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. NI/K from BEA; remaining variables primarily from Compustat. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)
	Net I/K			
	≥1981	≥1990	≥1981	≥1990
Median Q (t-1)	0.101**	0.102**	0.101**	0.100**
	[4.942]	[6.180]	[4.776]	[5.784]
Mean % QIX own (t-1)	-0.108*	-0.118*	-0.109*	-0.114*
	[-2.272]	[-2.417]	[-2.430]	[-2.391]
Mod-Herfindahl (t-1)	**-0.056****	**-0.067***		
	[-2.880]	**[-2.491]**		
Herfindahl (t-1)			**-0.028+**	**-0.033+**
			[-1.701]	**[-1.697]**
CO Herf adjustment (t-1)			**-0.108****	**-0.116****
			[-2.951]	**[-3.015]**
Observations	1,398	1,063	1,398	1,063
Age and Size Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES
ρ^2	0.334	0.35	0.323	0.336

are significant predictors of investment. Firms with more quasi-indexer institutional ownership and firms in industries with higher modified Herfindahls, invest less. Note that the corresponding coefficients on quasi indexer ownership are similar to those recovered in industry-regressions, while the coefficient on the modified Herfindahl is larger.

Column 3 de-means the dependent variable for each industry-year, and excludes the measure of concentration because it would be absorbed into the means. As shown, quasi-indexer institutional ownership is significant, suggesting that, within each industry-year and controlling for Q, firms with more quasi-indexer institutional ownership invest less.

Where do the excess funds go? Share buybacks. As shown in columns 4 to 6, firms with more quasi-indexer ownership do more buybacks. This is true including year, as well industry (column 4), firm (column 5) and industry-firm (column 6) fixed effects, and controlling for a wide range of financials such as market value, cash flow, profitability, leverage, sales growth, etc.

Some recent literature highlights that weak governance affects primarily firms in noncompetitive industries. In unreported tests, we interact ownership and competition measures, and find that ownership leads to under-investment only in noncompetitive industries. This aligns with the results in Giroud and Mueller [2010, 2011].

Table 7: Firm regressions: 'Core' explanations

Table shows the results of firm-level errors-in-variables panel regressions of Net CAPX/PPE and Buybacks/assets over the periods specified. Data primarily sourced from Compustat. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
	Net CAPX/PPE			Buybacks/Assets		
	≥1990	≥1990	≥1990	≥1990	≥1990	≥1990
Stock Q (t-1)	0.174**	0.165**	0.168**	-0.006**	0.016**	-0.006**
	[32.835]	[24.868]	[31.137]	[-9.256]	[5.086]	[-7.700]
% QIX own MA2(t-1)	**-0.099****	**-0.126****	**-0.077****	**0.012****	**0.006****	**0.011****
	[-5.686]	**[-7.938]**	**[-4.540]**	**[7.448]**	**[5.314]**	**[7.332]**
Mod-Herfindahl (t-1)	**-0.157****	**-0.145****				
	[-6.840]	**[-7.160]**				
Other controls (market cap, OS/K, etc.)				...	...	...
Observations	59,310	59,310	59,310	55,486	55,486	55,486
Age and Size Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	NO	YES	YES	NO
Industry de-meaned	YES	NO	NO	YES	NO	NO
Firm de-meaned	NO	YES	NO	NO	YES	NO
Industry-Year de-meaned	NO	NO	YES	NO	NO	YES
ρ^2	0.274	0.188	0.236	0.161	0.0471	0.13

4.2.5 Drill-down: Debt issuance and investment by high-rated firms

There has been substantial discussion on the implications of safe asset scarcity on debt issuance; and to a lesser extent, on investment. To better understand whether this hypothesis is supported by the data, this section discusses valuation and investment patterns of AA to AAA rated firms and below AA-rated firms. To mitigate endogeneity problems, we assign firms to rating groups based on their 2006 rating, before the Great Recession. 2006 is chosen because safe asset scarcity is understood to be a post-Great Recession effect.

We start with valuations. According to the safe asset scarcity hypothesis, the value of being able to issue safe assets increased after the Great Recession. In that case, the valuation of highly rated firms should increase relative to other firms. We regress the 2014 value on the 2006 value and an indicator for AA to AAA rated firms:

$$logMV_{i,2016} = \beta_0 + \beta_1 log\, age_i + \beta_2 log\, assets_{i,2006} + log\ MV_{i,2006} + \mathbb{I}\{AA - AAA_{i,2006}\} + \varepsilon_i$$

We include industry fixed effects in some regressions; and run a similar regression for capital (PP&E) and assets to test for higher (cumulative) capital expenditures or balance sheet growth. Table 8 summarizes the results. As shown, the coefficient on the AA to AAA rated indicator is not significant and, if anything, it is negative. At least for corporates, we do not find support for the safe asset scarcity hypothesis.

Graphically, Figure 14 shows the average log-change in total assets and the average net invest-

Table 8: Safe Asset Scarcity: Valuation test

Table shows the results of firm-level OLS regressions of Market Value, PP&E and Assets as of 2014 on 2006 Market value and a AA-to-AAA rating indicator. Annual data, sourced from Compustat. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(1)	(2)	(1)	(2)
	Log MV (2014)		Log PPE (2014)		Log Assets (2014)	
AA to AAA rated (2006)	**-0.042**	**-0.21**	**-0.29**	**-0.139**	**-0.161**	**-0.236**
	[-0.20]	**[-0.96]**	**[-0.78]**	**[-0.43]**	**[-0.85]**	**[-1.23]**
Log MV (2006)	1.103**	1.078**	0.364**	0.513**	0.576**	0.593**
	[26.03]	[24.61]	[5.01]	[7.82]	[15.49]	[15.46]
Log Assets (2006)	-0.088*	-0.06	0.739**	0.533**	0.415**	0.390**
	[-2.06]	[-1.34]	[10.09]	[7.99]	[11.08]	[9.98]
Log(age)	-0.011	-0.032	0.158+	0.130+	-0.021	-0.022
	[-0.23]	[-0.63]	[1.90]	[1.74]	[-0.49]	[-0.51]
Industry FE	No	Yes	No	Yes	No	Yes
Observations	1680	1680	1675	1675	1680	1680
Overall R^2	0.848	0.857	0.693	0.78	0.871	0.879

ment rate (including R&D expenses) for both groups of firms.[34] At least until 2012, both groups of firms seem to be increasing assets at roughly the same rate. In contrast, the investment rate of highly rated firms has been well-below that of lower rated firms since 1990. This suggests that highly rated firms have grown their balance sheets at roughly the same rate as lower-rated firms but have invested less.

Have these firms reduced external financing given the lower investment? To answer this question, we follow Frank and Goyal [2003] and compute the uses and sources of funding based on Compustat data. Specifically, we define the total finance deficit as the sum of dividends, investment and changes in working capital minus internal cash flow:[35]

$$DEF = DIV + INV + \Delta WC - IntCF$$

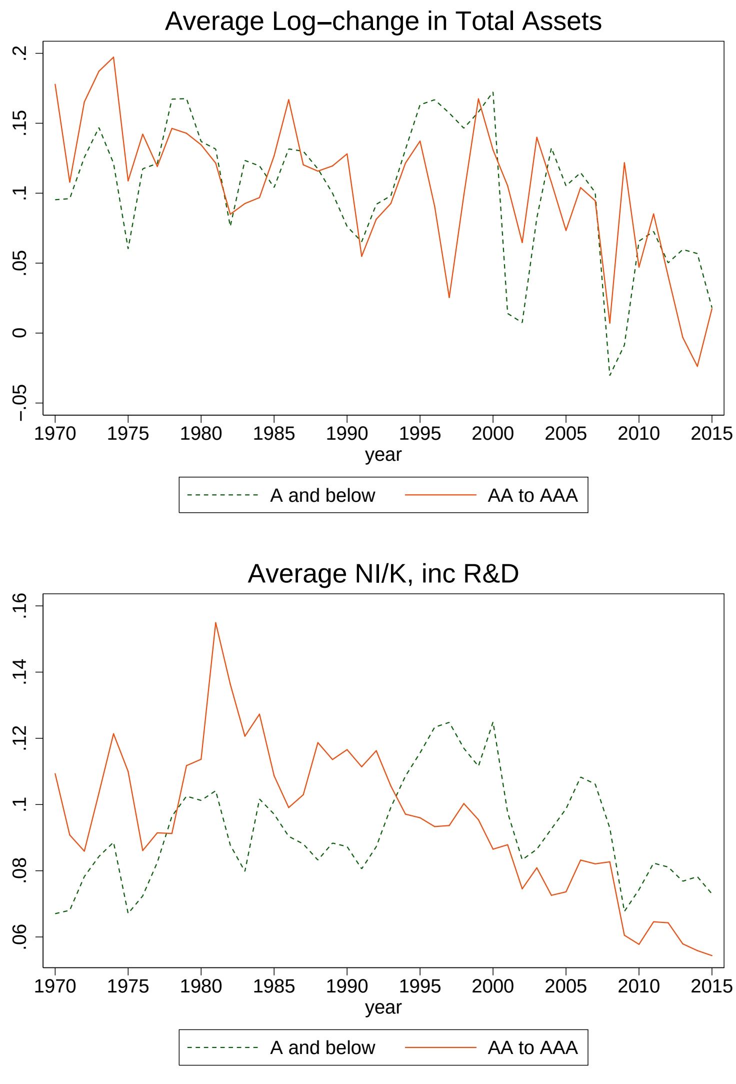
Note that this definition of investment is substantially broader than capital expenditures: it includes all short and long term investment as defined in the statement of cash flows. We also compute net debt and equity issuance, such that $DEF = NetDebtIss + NetEqIss$.

Figure 15 shows the 2-year cumulative financing deficit, debt and equity issuance by rating group, normalized by total assets. We highlight the year 1982, when SEC Rule 10b-18 was instituted, which allows companies to repurchase their shares on the open market without regulatory limits. Two interesting conclusions arise: first, both types of firms have either maintained or increased their debt issuance since the mid-1990s. Highly rated firms issued a substantial amount of debt in 2009, at the height of the Great Recession. Such debt issuance allowed them to maintain large buybacks

[34]Conclusions are qualitatively similar excluding R&D expenses from the NI/K calculation

[35]The following Compustat items are used: $Div = div$, $INV = capx + ivch + aqc - sppe - siv - ivstch - ivaco$, $\Delta WC = -recch - invch - apalch - txach - aoloch + chech - fiao - dlcch$ and $IntCF = ibc + xidoc + dpc + txdc + esubc + sppiv + fopo + exre$. Note that adjusted definitions are used for prior disclosure regimes – see Frank and Goyal [2003] for additional details.

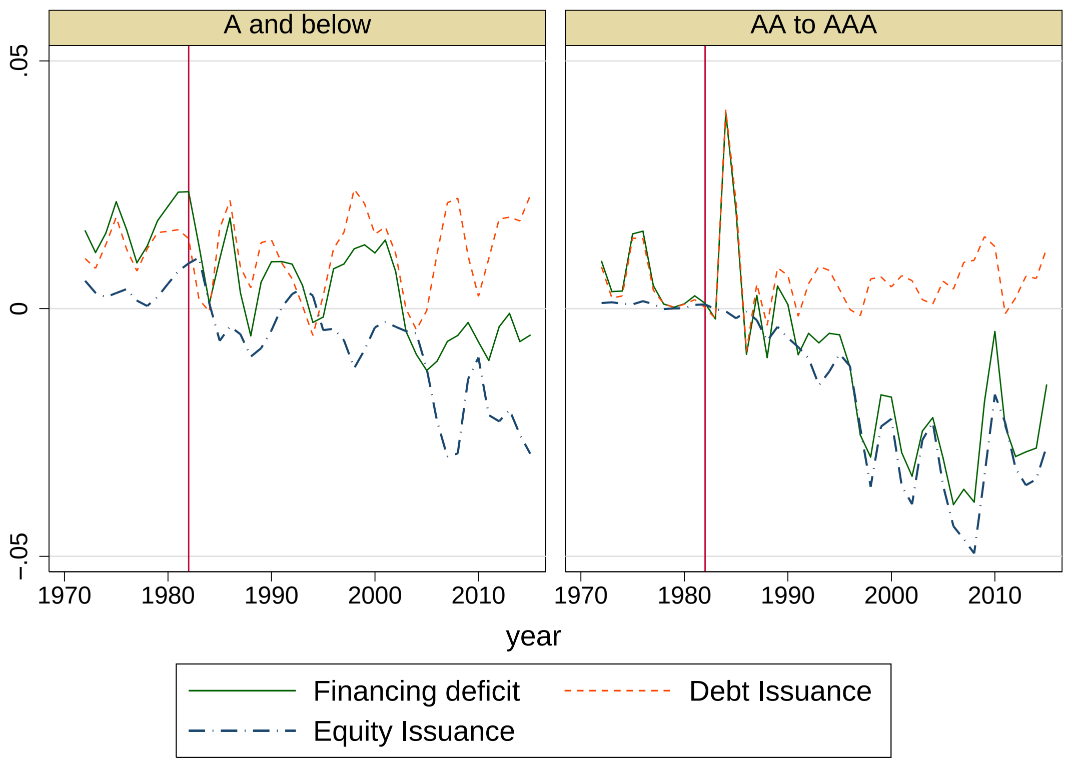
Figure 14: Assets and investment, by rating



Note: Annual data. Firms mapped to categories based on ratings as of 2006.

despite lower internal funds. They decreased issuance in the early 2010s but returned to the market in 2015 as internal funds decreased but buybacks remained high. Low rated firms issued almost no debt during the Great Recession, which led to a substantial decrease in buybacks. But they quickly returned to the market after the crisis, and used the funds raised primarily for buybacks. Second, buybacks at highly-rated firms increased soon after 1982, moving almost one-to-one with the internal finance deficit for the past 20 years. In contrast, the increase in buybacks is much less pronounced for lower rated firms until the mid-2000s. In fact, lower rated firms maintained a positive finance deficit until about 2000, which was financed primarily with debt.

Figure 15: Uses and sources of financing, by rating



Note: 2-year cumulative rates, normalized by total assets. Based on annual data. Firms mapped to categories based on ratings as of 2006. The vertical line on 1982 highlights the passing of SEC rule 10b-18, which allows companies to repurchase their shares on the open market without regulatory limits.

The improving finance deficit and associated buybacks may be driven by increasing profits, or by decreasing investments. Table 9 decomposes the sources and uses of financing for highly rated firms and lower-rated firms. As shown, the improving finance deficit for both types of firms is driven by decreasing investments and, to a lesser extent, working capital. Cash dividends have remained stable while cash flow decreased slightly. The decrease in investment is particularly pronounced for highly rated firms, from ~11% in the 1970s and 1980s to only 6% in the 2000s.

Table 9: Funds flow and financing as a fraction of total assets, by rating (%)

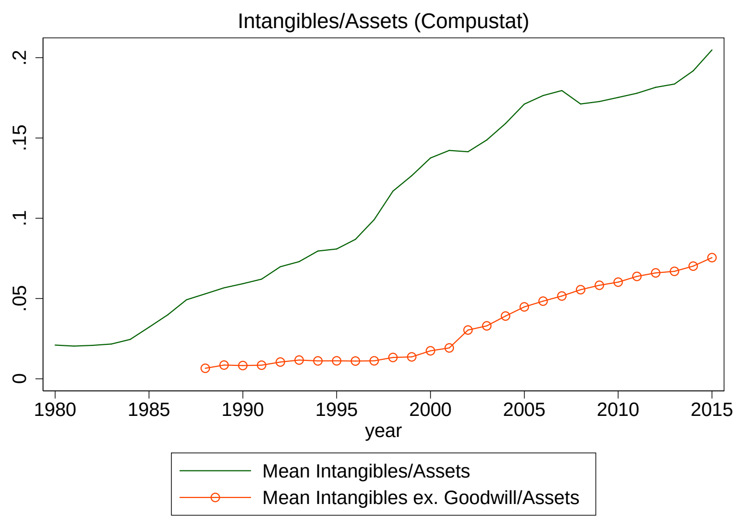
Rating	**Field / Year**	1970-1979	1980-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2015
AA to AAA rated firms	Cash dividends[a]	3.7	3.9	4.3	4.7	4.5	4.2	4
	Investments[b]	9.7	11.9	8.4	7.9	7.3	6.2	6.2
	ΔWorking capital[c]	1.6	-0.3	0.5	1.4	1.4	0.8	0.1
	Internal cash flow[d]	14.2	15.8	13.8	15.6	16.3	15.7	13
	Financing deficit[a+b+c-d]	**0.7**	**0.1**	**-0.7**	**-1.9**	**-2.7**	**-3**	**-2.3**
	Net debt issues[1]	0.6	0.2	0.4	0.3	0.4	1.1	0.6
	Net equity issues[2]	0.1	-0.1	-1.1	-2.2	-3.1	-4.1	-2.9
	Net external financing[1+2]	**0.7**	**0.1**	**-0.7**	**-1.9**	**-2.7**	**-3**	**-2.3**
Below AA rated firms	Cash dividends[a]	2.6	2.5	2.1	1.8	1.3	1.7	2
	Investments[b]	10.7	12.2	7.8	9.3	6.8	7.4	7.8
	ΔWorking capital[c]	1.8	0.9	0.8	2	1.9	1.6	1.5
	Internal cash flow[d]	13.4	14	10.1	11.7	9.8	11.3	11.7
	Financing deficit[a+b+c-d]	**1.5**	**1.1**	**0.4**	**1**	**0.2**	**-0.7**	**-0.6**
	Net debt issues[1]	1.2	1.1	0.2	1.6	0.6	1.3	1.7
	Net equity issues[2]	0.3	0	0.2	-0.7	-0.4	-2.1	-2.4
	Net external financing[1+2]	**1.5**	**1.1**	**0.4**	**0.9**	**0.2**	**-0.8**	**-0.7**

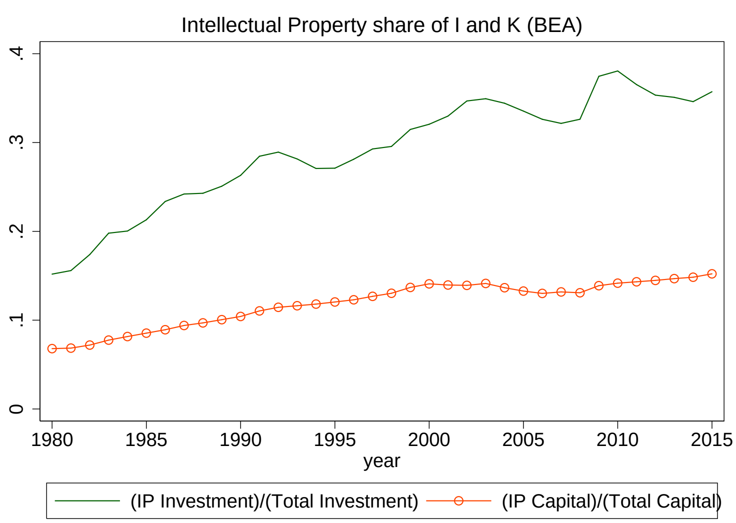
Notes: Annual data, in percentages. Based on the average of yearly cumulative totals across all firms in each category. Firms mapped to categories based on 2006 ratings.

4.2.6 Drill-down: Intangible investment

The top graph of Figure 16 shows the ratio of intangibles to assets (with and without goodwill) for all US-incorporated firms in Compustat. As shown, the share of intangibles has been increasing rapidly since 1985, and experienced its largest increase in the late 1990s. The rise is primarily driven by goodwill, such that total intangibles are primarily a measure of past M&A activity rather than a true shift in the asset mix. Intangibles excluding goodwill remained low until the 2000s but have increased rapidly since then, to ~7% of assets. The bottom graph shows the share of intellectual property capital and investment reported by the BEA (as a percent of total capital and investment, respectively). As shown, both series experienced a substantial increase from 1980 to about 2000, but have remained stable since.

Figure 16: Intangibles and IP investment





Notes: Annual data. Top chart includes all US incorporated firms in Compustat. Bottom chart based on BEA-reported figures for the industries in our sample (see Section 3).

The rise of intangibles may affect investment in two ways: first, intangible investment is difficult to measure and is therefore prone to measurement error. This can be seen, for instance, in the very different trends between the share of intangibles in BEA data and the intangibles excluding goodwill in Compustat. If intangible investment is under-estimated, K would be under-estimated, and therefore Q would be over-estimated. Second, intangible assets might be more difficult to accumulate. A rise in the relative importance of intangibles could lead to a higher equilibrium value of Q even if intangibles are correctly measured. We test each of these hypothesis separately. We find some support for them but their impact seems to be quantitatively limited.

Measurement error. Denote net investments in tangible and intangible assets by $NI^T$and NI^I, such that total investments are $NI = NI^T + NI^I$. Assume that tangible capital is perfectly measured but intangible capital is under-estimated by a factor α – that is, assume that intangible investment is consistently under-estimated across all industries. This is a simplifying assumption, but it highlights the main reason for concern.

Under this assumptions, *measured* investment is given by

$$\hat{NI} \equiv \hat{NI}^T + \hat{NI}^I$$

$$= NI^T + \alpha NI^I$$

The under-estimation of investment leads to under-estimation of capital $\hat{K}$ and, since $\hat{Q}$ is the ratio of market value to replacement cost of capital, it leads to over-estimation of Q. Thus, a regression of the form

$$\frac{\hat{NI}_{it}}{\hat{K_{it-1}}} = \beta \hat{Q}_{i,t-1} + \boldsymbol{\gamma} \frac{\hat{K}^I}{AT_{i,t-1}} + \mu_i + \eta_t + \varepsilon_{it}$$

would yield a negative and significant coefficient γ. More complex measurement errors would yield different structures, but broadly the negative coefficient should remain. Industries with higher dependence on intangibles would appear to be under-investing due to an over-estimation of Q and an under-estimation of investment.

We test this in two ways. First, we run measurement-error corrected regressions at the industry level, using BEA measures of investment (which includes intellectual property investment) and the traditional Compustat Q. The results are shown in columns 1 and 2 of Table 10. As shown, the coefficient on intangibles is significant and negative, suggesting that industry-years with a larger share of intangibles exhibit more under-investment relative to the traditional Q.

Second, we replace the Compustat Q with the 'total Q' of Peters and Taylor [2016]. Total Q aims to correct for measurement error in intangibles by recognizing R&D and part of SG&A expenses as investments. This procedure reduces the measurement error in Q due to intangibles, and should therefore reduce the explanatory power of $\frac{\hat{K^I}}{AT_{i,t-1}}$. The results are shown in column 3. Intangibles remain significant but the corresponding coefficient is 30% smaller than using the Compustat Q, as

Table 10: Industry regressions: Intangible Measurement Error

Table shows the results of industry errors-in-variables panel regressions of Net I/K on intangible assets, over the periods specified. NI/K from BEA; remaining variables primarily from Compustat. Total Q from Peters and Taylor [2016], aims to correct for measurement error in intangibles. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)
	Intan Net I/K		
	≥1990	≥1990	≥1990
Median Stock Q (t-1)	0.102**	0.098**	
	[6.180]	[6.579]	
Median 'Total' Q (t-1)			**0.048****
			[12.535]
Mean % QIX own (t-1)	-0.118*	-0.131**	-0.064+
	[-2.417]	[-2.935]	[-1.800]
Mod-Herfindahl (t-1)	-0.067*	-0.066*	-0.031*
	[-2.491]	[-2.463]	[-2.077]
Intan ex. GW/Assets(t-1)		**-0.359****	**-0.234****
		[-3.465]	**[-3.492]**
Observations	1,063	1,063	1,063
Age and Size Controls	YES	YES	YES
Year FE	YES	YES	YES
Industry de-meaned	YES	YES	YES
ρ^2	0.35	0.37	0.32

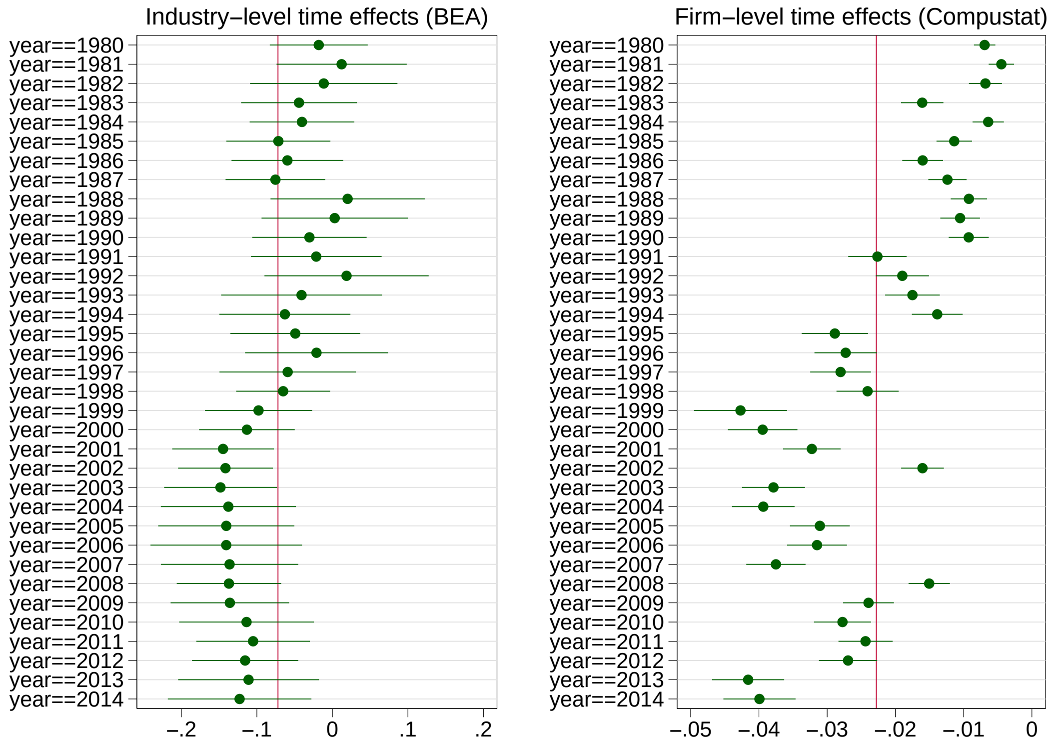
expected.

These results provide some support for the intangibles hypotheses. Note, however, that our 'core' hypotheses of competition and quasi-indexer ownership remain significant, and the addition of intangibles in the regression has limited effect on the coefficients (when using the Compustat Q, otherwise coefficients change due to differences in the total Q series) or the R^2. Intangibles therefore appear to have limited explanatory power.

Higher equilibrium Q. A rise in the relative importance of intangibles could lead to a higher equilibrium value of Q even if intangibles are correctly measured. This would result in lower aggregate investment relative to Q, particularly at industries with a large share of intangible assets. We test this by analyzing investment patterns on tangible and intangible assets separately. If this hypothesis is correct, the under-investment relative to Q should vanish when considering asset types separately.

To begin with, Figure 17 shows the time effects from industry- and firm-level regressions of intangible investment on Q (i.e., the same analysis as above, but using net investment in intellectual property as the industry level dependent variable, and the ratio of R&D expenses to assets as the firm-level dependent variable). Time effects exhibit very similar patterns as those observed above for total investment at the industry-level and CAPX at the firm-level. In particular, industry time effects were above average in the 1980s and 1990s but decrease substantially since 2000. Firm time effects decrease consistently since the 1980s. They are near the average in the 1990s and well below-

Figure 17: Time Effects from Intangible Asset Regressions



Note: Time fixed effects from errors-in-variables panel regressions of de-meaned net investment on median/firm-level Q. Industry IP investment data from BEA; firm investment based on XRD/Assets from Compustat; omits firms with zero or missing R&D expenses. See Section 4.2.1 for additional details on regression approach.

average in the 2000s. They again increase at the height of the great recession but reach their lowest level in 2013 and 2014.

It may be, however, that the effect of competition and quasi-indexer ownership applies only for tangible investment. In that case, our conclusions would only apply to a subset of asset types. We test this by replicating the core industry-level regressions above, but separating tangible and intangible assets; and by analyzing firm-level investment in R&D.

Industry-level results are shown in Table 11. Quasi-indexer ownership exhibits significantly negative coefficients for all assets and non-IP assets; and negative but insignificant coefficients for IP. Measures of competition are significant in almost all tests. Note that the t-stat on Q and the R^2 is the largest for all assets. This aligns with results in Peters and Taylor [2016] who find that the 'traditional' measure of Q explains explains total investment better than either physical or intangible investment separately.

Firm level results are shown in Table 12 (they should be compared to Table 7). As shown, increased concentration and quasi-indexer ownership leads to under-investment in R&D.

Combined, these results suggest that the rise of intangibles accounts for some but not all of the observed under-investment. Corporations have reduced investment in both tangible and intangible

Table 11: Industry regressions, by asset type

Table shows the results of industry errors-in-variables panel regressions of Net I/K since 1990, split by asset type. NI/K from BEA; remaining variables primarily from Compustat. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
	Net I/K					
	All fixed assets[1+2]	Excluding IP[1]	IP[2]	All fixed assets[1+2]	Excluding IP[1]	IP[2]
Median Q (t-1)	0.102**	0.044*	0.069**	0.100**	0.046*	0.094**
	[6.180]	[2.529]	[3.424]	[5.784]	[2.560]	[4.763]
Mean % QIX own (t-1)	**-0.118***	**-0.092***	**-0.183**	**-0.114***	**-0.092***	**-0.193**
	[-2.417]	**[-2.545]**	**[-1.018]**	**[-2.391]**	**[-2.523]**	**[-1.068]**
Mod-Herfindahl (t-1)	**-0.067***	**-0.040***	**-0.078+**			
	[-2.491]	**[-2.137]**	**[-1.843]**			
Herfindahl (t-1)				**-0.033+**	**-0.032+**	**-0.072**
				[-1.697]	**[-1.909]**	**[-1.544]**
CO Herf adjustment (t-1)				**-0.116****	**-0.054+**	**-0.123***
				[-3.015]	**[-1.826]**	**[-2.322]**
Observations	1,063	1,063	1,062	1,063	1,063	1,062
Age and Size Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES	YES	YES
ρ^2	0.35	0.27	0.164	0.336	0.267	0.165

Table 12: Firm regressions: R&D expenses

Table shows the results of firm errors-in-variables panel regressions of R&D expenses over assets, for the periods specified. Firms with missing or zero R&D are omitted. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)
	R&D/Assets		
	≥1990	≥1990	≥1990
Stock Q (t-1)	0.031**	0.025**	0.030**
	[24.563]	[17.412]	[24.455]
% QIX own MA2(t-1)	**-0.016***	**-0.011****	**-0.013+**
	[-2.045]	**[-2.787]**	**[-1.687]**
Mod-Herfindahl (t-1)	**-0.035****	**-0.028****	
	[-2.888]	**[-4.915]**	
Observations	29,334	29,334	29,334
Age and Size Controls	YES	YES	YES
Year FE	YES	YES	NO
Industry de-meaned	YES	NO	NO
Firm de-meaned	NO	YES	NO
Industry-Year de-meaned	NO	NO	YES
ρ^2	0.27	0.173	0.259

assets since 2000, suggesting that other factors are in play.

5 Conclusion

Private fixed investment in the United States has been lower than expected since the early 2000's. The trend started before 2008, but the Great Recession made it more striking. Investment in the is low despite high levels of profitability and Tobin's Q. This simple observation rules out a whole class of theories that would explain low investment by low values of Tobin's Q. We test 8 alternative theories that can explain the investment gap, i.e., low investment despite high Q. Among these, the only ones that find consistent support in our industry and firm level datasets are decreased competition, tightened governance and, potentially, increased short-termist pressures. Combined, the competition and governance measures explain about 80% of the aggregate under-investment relative to Q. The rise of intangibles explains some of the remaining investment gap, and it does not diminish the explanatory power of competition and governance.

The above conclusions are based on simple regressions and therefore cannot establish causality between competition, governance and investment. In follow-up work Gutiérrez and Philippon [2017] we use a combination of instrumental variables and natural experiments to test the causality of our two main explanations: lack of competition and tight or short-termist governance.

References

Viral Acharya and Guillaume Plantin. Monetary easing and financial instability. 2016.

Philippe Aghion, Stefan Bechtold, Lea Cassar, and Holger Herz. The causal effects of competition on innovation: Experimental evidence. Working Paper, 2014.

Omar Al-Ubaydli and Patrick A. McLaughlin. Regdata: A numerical database on industry-specific regulations for all united states industries and federal regulations, 1997 to 2012. *Regulation & Governance*, 2015.

Lewis Alexander and Janice Eberly. Investment hollowing out. *Working Paper*, 2016.

Laura Alfaro, Thorsten Beck, and Charles Calomiris. Foreign bank entry and entrepreneurship. *Working Paper*, 2015.

Heitor Almeida, Vyacheslav Fos, and Mathias Kronlund. The real effects of share repurchases. *Journal of Financial Economics*, 119(1):168–185, jan 2016.

Ian R. Appel, Todd A. Gormley, and Donald B. Keim. Passive investors, not passive owners. *Journal of Financial Economics*, 121(1):111 – 141, 2016a.

Ian R. Appel, Todd A. Gormley, and Donald B. Keim. Standing on the shoulders of giants: The effect of passive investors on activism. September 2016b.

John Asker, Joan Farre-Mensa, and Alexander Ljungqvist. Corporate investment and stock market listing: A puzzle? *Review of Financial Studies*, 2014.

Jose Azar, Sahil Raina, and Martin C. Schmalz. Ultimate ownership and bank competition. 2016a.

Jose Azar, Martin C. Schmalz, and Isabel Tecu. Anti-competitive effects of common ownership. 2016b.

Jan Bena, Miguel A. Ferreira, Pedro P. Matos, and Pedro Pires. Are foreign investors locusts? the long-term effects of foreign institutional ownership. *European Corporate Governance Institute (ECGI) - Finance Working Paper No. 468/2016*, 2016.

Ben S. Bernanke. Irreversibility, uncertainty, and cyclical investment. *The Quarterly Journal of Economics*, 98(1):85–106, 1983.

Bruce A. Blonigen and Justin R. Pierce. Evidence for the effects of mergers on market power and efficiency. October 2016.

Brian J. Bushee. The influence of institutional investors on myopic r&d investment behavior. *The Accounting Review*, 73(3):305–333, 1998.

Brian J. Bushee. Do institutional investors prefer near-term earnings over long-run value? *Contemporary Accounting Research*, 18(2):207–246, 2001.

Ricardo J. Caballero and Emmanuel Farhi. The safety trap. February 2014.

CEA. Benefits of competition and indicators of market power. Issue Brief, April 2016.

Yen-Cheng Chang, Harrison Hong, and Inessa Liskovich. Regression discontinuity and the price effects of stock market indexing*. *Review of Financial Studies*, 2014.

Brian Chen, Samuel G. Hanson, and Jeremy C. Stein. The decline in big-bank lending to small businesses: Causes and consequences. *Working paper*, 2016.

Alan D. Crane, Sebastien Michenaud, and James P. Weston. The effect of institutional ownership on payout policy: Evidence from index thresholds. *Review of Financial Studies*, 2016.

Sudip Datta, Mai Iskandar-Datta, and Vivek Singh. Product market power, industry structure, and corporate earnings management. *Journal of Banking & Finance*, 37(8):3273 – 3285, 2013.

Ryan Decker, John Haltiwanger, Ron Jarmin, and Javier Miranda. The role of entrepreneurship in us job creation and economic dynamism. *Journal of Economic Perspectives*, 28(3):3–24, August 2014.

Ryan A. Decker, John Haltiwanger, Ron S. Jarmin, and Javier Miranda. Where has all the skewness gone? the decline in high-growth (young) firms in the u.s. November 2015.

Avinash K. Dixit and Robert S. Pindyck. *Investment under Uncertainty.* Princeton University Press, 1994.

Timothy Erickson, Colin Huan Jiang, and Toni Whited. Minimum distance estimation of the errors-in-variables model using linear cumulant equations. *Journal of Econometrics*, 183(2):211–221, 2014.

Steven Fazzari, R. Glenn Hubbard, and Bruce C. Petersen. Financing constraints and corporate investment. September 1987.

Jan Fichtner, Eelke M. Heemskerk, and Javier Garcia-Bernardo. Hidden power of the big three? passive index funds, re-concentration of corporate ownership, and new financial risk. 2016.

C. Fritz Foley, Jay C. Hartzell, Sheridan Titman, and Garry Twite. Why do firms hold so much cash? a tax-based explanation. *Journal of Financial Economics*, 86(3):579–607, dec 2007.

Murray Z. Frank and Vidhan K. Goyal. Testing the pecking order theory of capital structure. *Journal of Financial Economics*, 2003.

Jason Furman. Business investment in the united states: Facts, explanations, puzzles, and policies. 2015.

Simon Gilchrist and Egon Zakrajsek. Credit spreads and business cycle fluctuations. forthcoming in American Economic Review, 2011.

Xavier Giroud and Holger M. Mueller. Does corporate governance matter in competitive industries? *Journal of Financial Economics*, 95(3):312 – 331, 2010.

Xavier Giroud and Holger M. Mueller. Corporate governance, product market competition, and equity prices. *The Journal of Finance*, 66(2):563–600, 2011.

Joao F. Gomes. Financing investment. *American Economic Review*, 91(5):1263–1285, December 2001.

Paul Gompers, Joy Ishii, and Andrew Metrick. Corporate governance and equity prices. *The Quarterly Journal of Economics*, 118(1):107–156, 2003.

Germán Gutiérrez and Thomas Philippon. Competition, governance and investment. mimeo NYU, 2017.

Robert E. Hall. The stock market and capital accumulation. *American Economic Review*, 91(5): 1185–1202, December 2001.

Jarrad Harford, Sattar A. Mansi, and William F. Maxwell. Corporate governance and firm cash holdings in the us. *Journal of Financial Economics*, 87(3):535 – 555, 2008.

Fumio Hayashi. Tobin's marginal q and average q: A neoclassical interpretation. *Econometrica*, 50 (1):213–224, 1982.

Christopher A. Hennessy and Toni M. Whited. How costly is external financing? evidence from a structural estimation. *The Journal of Finance*, 62(4):1705–1745, 2007.

Michael Jensen. Agency costs of free cash flow, corporate finance, and takeovers. *American Economic Review*, 76(2):323–29, 1986.

Christine Jolls. Stock repurchases and incentive compensation. Mar 1998.

Callum Jones and Thomas Philippon. The secular stagnation of investment? 2016.

Boyan Jovanovic and Peter L. Rousseau. Extensive and intensive investment over the business cycle. *Journal of Political Economy*, 122(4):863–908, aug 2014.

Steven N. Kaplan and Luigi Zingales. Do investment-cash flow sensitivities provide useful measures of financing constraints? *The Quarterly Journal of Economics*, 112(1):169–215, 1997.

Anil K Kashyap, Owen A. Lamont, and Jeremy C. Stein. Credit conditions and the cyclical behavior of inventories. *The Quarterly Journal of Economics*, 109(3):565–592, 1994.

Morris M. Kleiner and Alan B. Krueger. Analyzing the Extent and Influence of Occupational Licensing on the Labor Market. *Journal of Labor Economics*, 31(S1):S173 – S202, 2013.

William Lazonick. Profits without prosperity. Harvard Business Review, September 2014.

Dong Wook Lee, Hyun-Han Shin, and Rene M. Stulz. Why does capital no longer flow more to the industries with the best growth opportunities? *Fisher College of Business Working Paper*, 2016 (15), September 2016.

Roger Martin. Yes, short-termism really is a problem. Harvard Business Review, October 2015.

Simon Mongey. Market structure and monetary non-neutrality. *Working paper*, 2016.

Nathalie Moyen. Investment cash flow sensitivities: Constrained versus unconstrained firms. *The Journal of Finance*, 59(5):2061–2092, 2004.

Vasia Panousi and Dimitris Papanikolauo. Investment, idiosyncratic risk, and ownership. *The Journal of Finance*, 67(3):1113–1148, 2012.

Ryan H. Peters and Lucian A. Taylor. Intangible capital and the investment-q relation. *Journal of Financial Economics*, 2016. ISSN 0304-405X.

Robert S. Pindyck. Irreversible investment, capacity choice, and the value of the firm. *The American Economic Review*, 78(5):969–985, 1988.

Raghuram G. Rajan and Luigi Zingales. Financial dependence and growth. *American Economic Review*, 88:559–586, 1998.

Scott A. Richardson. Over-investment of free cash flow. *Review of Accounting Studies*, 11(2-3): 159–189, jun 2006.

Steven C. Salop and Daniel P. O'Brien. Competitive effects of partial ownership: Financial interest and corporate control. *Antitrust Law Journal*, 2000.

Cornelius Schmidt and Rudiger Fahlenbrach. Do exogenous changes in passive institutional ownership affect corporate governance and firm value? *Journal of Financial Economics, Forthcoming*, 2016.

Jules H. van Binsbergen and Christian C. Opp. Real anomalies. *Working paper*, 2016.

Jeffrey Wurgler. On the economic consequences of index-linked investing. *Challenges to Business in the Twenty-First Century*, 2011.

Appendix I: Industry Investment Data

As noted above, investment is available for 63 granular industry groupings from the BEA. These are grouped into 47 categories (3 of which are omitted) to ensure all groupings have material investment and better Compustat coverage. Industries are grouped to ensure measures of investment and concentration are stable over time. In particular, we group industries to ensure each group has at least ~10 firms, on average, from 1990 - 2015 and it contributes a material share of investment. The groupings are summarized in Table 13, including the BEA industry code, the granular industry name and the mapped industry group. We also include the dollar value and % of total capital as of 2014. Table 14 shows the total (nominal) investment from 2000 to 2015 by grouping, along with the Compustat coverage ratios defined as described in the text.

Table 13: Mapping of BEA industries to segments

BEA code	Industry	Mapped segment	Capital (2014)	% of total
721	Accommodation	Acc_accommodation	358.9	2.2%
722	Food services and drinking places	Acc_food	249.2	1.5%
561	Administrative and support services	Adm_and_waste_mgmt	189.2	1.2%
562	Waste management and remediation services	Adm_and_waste_mgmt	102.3	0.6%
110	Farms	Agriculture	567.7	3.5%
113	Forestry, fishing, and related activities	Agriculture	62.3	0.4%
713	Amusements, gambling, and recreation industries	Arts	163.7	1.0%
711	Performing arts, spectator sports, museums, and related activities	Arts	159.9	1.0%
230	Construction	Construction	284.6	1.7%
334	Computer and electronic products	Dur_Computer	506.3	3.1%
335	Electrical equipment, appliances, and components	Dur_Electrical	73.5	0.5%
333	Machinery	Dur_Machinery	234.4	1.4%
337	Furniture and related products	Dur_Furniture	22.8	0.1%
338	Miscellaneous manufacturing	Dur_Misc	115.1	0.7%
336	Motor vehicles, bodies and trailers, and parts	Dur_Transportation	383.7	2.4%
321	Wood products	Dur_Wood	42.6	0.3%
327	Nonmetallic mineral products	Dur_nonmetal	87.1	0.5%
331	Primary metals	Dur_prim_metal	165.5	1.0%
332	Fabricated metal products	Dur_fab_metal	175.3	1.1%
610	Educational services	Educational	557.7	3.4%
521	Federal Reserve banks	Finance	Omitted	
522	Credit intermediation and related activities	Finance	Omitted	
523	Securities, commodity contracts, and investments	Finance	Omitted	
524	Insurance carriers and related activities	Finance	Omitted	
525	Funds, trusts, and other financial vehicles	Finance	Omitted	
622	Hospitals	Health_hospitals	916.1	5.6%
623	Nursing and residential care facilities	Health_hospitals	94.6	0.6%

Table 14: Investment and coverage, by industry (cont'd)

BEA code	**Industry**	**Mapped segment**	**Capital (2014)**	**% of total**
621	Ambulatory health care services	Health_other	352	2.2%
624	Social assistance	Health_other	65.4	0.4%
514	Information and data processing services	Inf_data	168.3	1.0%
512	Motion picture and sound recording industries	Inf_motion	287.8	1.8%
511	Publishing industries (includes software)	Inf_publish	196.5	1.2%
513	Broadcasting and telecommunications	Inf_telecom	1352.5	8.3%
550	Management of companies and enterprises	Mgmt	401.4	2.5%
212	Mining, except oil and gas	Min_exOil	186.5	1.1%
211	Oil and gas extraction	Min_Oil_and_gas	1475.2	9.1%
213	Support activities for mining	Min_support	142	0.9%
325	Chemical products	Nondur_chemical	900.1	5.5%
311	Food and beverage and tobacco products	Nondur_food	336.4	2.1%
313	Textile mills and textile product mills	Nondur_textile	40.4	0.2%
315	Apparel and leather and allied products	Nondur_apparel	17.5	0.1%
322	Paper products	Nondur_paper	120.7	0.7%
323	Printing and related support activities	Nondur_printing	49.4	0.3%
326	Plastics and rubber products	Nondur_plastic	104.2	0.6%
324	Petroleum and coal products	Nondur_petroleum	221	1.4%
810	Other services, except government	Other_ex_gov	619.5	3.8%
541	Legal services	Prof_serv	42.6	0.3%
541	Computer systems design and related services	Prof_serv	74.3	0.5%
541	Miscellaneous professional, scientific, and technical services	Prof_serv	477.6	2.9%
531	Real estate	Real Estate	Omitted	
532	Rental and leasing services and lessors of intangible assets	Real Estate	Omitted	
44R	Retail trade	Retail_trade	1236.4	7.6%
481	Air transportation	Transp_air	249.1	1.5%
484	Truck transportation	Transp_ground	143.6	0.9%
485	Transit and ground passenger transportation	Transp_other	44.8	0.3%
487	Other transportation and support activities	Transp_other	132.6	0.8%
493	Warehousing and storage	Transp_other	46	0.3%
486	Pipeline transportation	Transp_pipeline	227.3	1.4%
482	Railroad transportation	Transp_rail	405.7	2.5%
483	Water transportation	Transp_other	45.6	0.3%
220	Omitted	Utilities	Omitted	
420	Wholesale trade	Wholesale_trade	590.1	3.6%

Table 14: Investment and coverage, by industry

Rank	Industry	Total investment ('00- '15; USD)	% of total	PPE Coverage ('00-'15)	CAPX Coverage ('00-'15)
1	Inf_telecom	$462.9	12%	32%	56%
2	Health_hospitals	$411.3	11%	4%	5%
3	Nondur_chemical	$358.3	9%	34%	39%
4	Prof_serv	$259.2	7%	7%	9%
5	Retail_trade	$225.1	6%	15%	34%
6	Min_Oil_and_gas	$201.6	5%	36%	93%
7	Educational	$174.4	5%	1%	2%
8	Inf_data	$160.2	4%	22%	23%
9	Wholesale_trade	$157.6	4%	7%	9%
10	Agriculture	$145.6	4%	2%	2%
11	Health_other	$120.2	3%	2%	3%
12	Adm_and_waste_mgmt	$101.1	3%	3%	5%
13	Other_ex_gov	$99.7	3%	1%	1%
14	Inf_motion	$98.5	3%	6%	7%
15	Transp_pipeline	$96.8	3%	15%	20%
16	Arts	$90.9	2%	6%	7%
17	Dur_Computer	$84.2	2%	30%	40%
18	Nondur_Petro	$81.4	2%	100%	100%
19	Acc_accomodation	$80.7	2%	20%	31%
20	Construction	$66.0	2%	2%	4%
21	Nondur_Food	$62.0	2%	39%	63%
22	Transp_truck	$61.9	2%	9%	11%
23	Min_support	$55.0	1%	37%	65%
24	Inf_publish	$54.6	1%	12%	18%
25	Dur_Transp	$51.3	1%	51%	57%
26	Min_exOil	$49.6	1%	51%	63%
27	Acc_food	$26.8	1%	23%	42%
28	Dur_Misc	$23.5	1%	14%	23%
29	Transp_rail	$23.3	1%	29%	67%
30	Dur_Machinery	$22.9	1%	25%	49%
31	Transp_air	$21.9	1%	28%	48%
32	Dur_fab_metal	$14.5	0%	11%	19%
33	Nondur_plastic	$8.3	0%	14%	17%
34	Dur_nonmetal	$5.4	0%	14%	20%
35	Dur_Furniture	($0.3)	0%	17%	27%
36	Dur_Wood	($0.9)	0%	39%	29%
37	Transp_other	($2.2)	0%	20%	44%
38	Nondur_Apparel	($7.3)	0%	52%	100%
39	Nondur_Printing	($7.7)	0%	8%	13%
40	Dur_Electrical	($10.3)	0%	23%	43%
41	Dur_prim_metal	($14.1)	0%	18%	39%
42	Nondur_Textile	($20.5)	-1%	8%	21%
43	Nondur_Paper	($23.8)	-1%	53%	63%

Appendix II: Detailed Regression Results

This appendix contains detailed regression results. In particular, it includes the following Tables:

1. Detailed regression results
   (a) Table 15: Aggregate Moving Average Regressions
   (b) Table 16: Industry regressions: all explanations except competition
   (c) Table 17: Industry regressions: competition
   (d) Table 18: Firm regressions: all explanations except governance and short-termism
   (e) Table 19: Firm regressions: governance and short-termism
2. Post-2000 regression results
   (a) Table 20: Post-2000 Industry regressions: all explanations except competition
   (b) Table 21: Post-2000 Industry regressions: competition
   (c) Table 22: Post-2000 Firm regressions: all explanations except governance and short-termism
   (d) Table 23: Post-2000 Firm regressions: governance and short-termism

Table 15: Aggregate Moving Average Regressions

Table shows the results of aggregate moving average regressions of Net I/K on Q, measures of competition and quasi-indexer institutional ownership over the periods specified. As shown, the coefficients remain stable and often significant even when accounting for serial correlation in the time series. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)
	Net I/K					
	≥1980	≥1980	≥1980	≥1990	≥1990	≥1990
Mean Stock Q (t-1)	0.008**	0.004+	0.007+	0.009*	0.007+	0.008*
	[3.01]	[1.70]	[1.87]	[2.31]	[1.78]	[2.19]
Median Sales Herfindahl(t-1)†		-0.288*	-0.234		-0.282+	-0.241
		[-2.39]	[-1.34]		[-1.85]	[-1.35]
Mean % QIX own (t-1)			-0.047+			-0.031
			[-1.83]			[-0.81]
MA (t-1)	1.103	1.045**	0.771**	1.011**	0.813**	0.727*
	[0.00]	[3.79]	[2.95]	[3.68]	[3.24]	[2.55]
MA (t-2)	1	0.614*	0.463+	1.082*	0.651*	0.7
	[0.00]	[2.40]	[1.71]	[2.08]	[2.07]	[1.59]
Observations	36	36	33	26	26	25
Log-likelihood	144.284	148.923	139.915	107.735	111.875	108.149

Notes: Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01. Investment from the US Flow of Funds; Q, Herfindahl and Ownership across all US incorporated firms in Compustat.

† Alternate measures of competition including changes in number of firms, concentration, firm entry and firm exit are also often significant.

Table 16: Industry regressions: all explanations except competition

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. All regressions include our 'core' explanations: Q, modified herfindahl and quasi-indexer ownership, as well as age and size controls (mean log-age and mean log-size), and time fixed effects. The dependent variable is de-meaned within each industry group. We add additional explanatory variables one by one in columns 3-7 and simultaneously (when significant and properly signed) in column 8. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Net I/K							
	≥1980	≥1990	≥2000	≥2000	≥2000	≥1990	≥1990	≥1990
Median Stock Q (t-1)	0.101**	0.102**	0.075**	0.077**	0.070**	0.098**	0.102**	0.099**
	[4.942]	[6.180]	[7.501]	[7.031]	[7.370]	[6.579]	[6.389]	[7.117]
Mean % QIX own (t-1)†	-0.108*	-0.118*	-0.089**	-0.067+	-0.162**	-0.131**	-0.122*	-0.135**
	[-2.272]	[-2.417]	[-2.657]	[-1.889]	[-4.755]	[-2.935]	[-2.440]	[-3.005]
Mod-Herfindahl (t-1)	-0.056**	-0.067*	-0.059+	-0.060+	-0.042+	-0.066*	-0.062*	-0.061*
	[-2.880]	[-2.491]	[-1.893]	[-1.829]	[-1.718]	[-2.463]	[-2.400]	[-2.382]
Mean ext fin dep ('96-'00)			0.001					
			[0.175]					
Mean % bank dep ('96-'00)				0.025				
				[0.809]				
% rated AA to AAA ('96-'00)					-0.355**			
					[-3.172]			
Mean (Intan ex GW)/at (t-1)						-0.359**		-0.366**
						[-3.465]		[-3.588]
Mean % foreign prof (t-1)‡							-0.049*	-0.051*
							[-2.068]	[-2.325]
Observations	1,398	1,063	630	630	630	1,063	1,063	1,063
Age and size controls	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES	YES	YES	YES	YES
ρ^2	0.33	0.35	0.32	0.32	0.33	0.37	0.35	0.38

† Quasi-indexer ownership measured as the change from average 1996-2000 level in columns 3, 4 and 5
‡ Foreign profits set to zero if missing

Table 17: Industry regressions: competition

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. All regressions include Q, quasi-indexer ownership, age and size controls, and alternate measures of competition. Regression includes time fixed effects and the dependent variable is de-meaned within each industry group. Herfindahl's, Lerner index and Census-based concentration remain significant once correcting for measurement error in Q. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Net I/K								
	≥1990	≥1990	≥1990	≥1990	≥1990	≥1990	≥1990	≥1990	≥2000
Mean Stock Q (t-1)	0.114**	0.102**	0.100**	0.110**	0.115**	0.112**	0.081	-0.041	0.080**
	[5.462]	[6.180]	[5.784]	[11.559]	[7.104]	[6.386]	[1.480]	[-0.510]	[4.909]
Mean % QIX own (t-1)	-0.076	-0.118*	-0.114*	-0.122*	-0.067	-0.074	-0.181**	-0.07	-0.013
	[-1.391]	[-2.417]	[-2.391]	[-2.280]	[-1.145]	[-1.289]	[-2.994]	[-1.562]	[-0.336]
3YΔLog#of Firms (t-1)	-0.007								
	[-0.551]								
Mod-Herfindahl (CP) (t-1)		-0.067*							
		[-2.491]							
Sales Herfindahl (CP) (t-1)			-0.033+						
			[-1.697]						
CO Herf adjustment (t-1)			-0.116**						
			[-3.015]						
Lerner Index (t-1)				-0.146**					
				[-3.054]					
% sales Top 8 (CP) (t-1)					0.021				
					[0.840]				
% MV Top 8 (CP) (t-1)						0.007			
						[0.330]			
% sales in Top 20 (Census) (t-1)‡							-0.001*		
							[-2.089]		
Log of Reg index (t-1)								0.001	
								[0.271]	
% Licensed ('08)									0.005
									[0.421]
Observations	1,063	1,063	1,063	1,063	1,063	1,063	530	735	643
Age and Size Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES	YES	YES	YES	YES	YES
ρ^2	0.348	0.35	0.336	0.34	0.351	0.351	0.333	0.188	0.308

‡ When a given BEA category includes more than one NAICS Level 3 code, we use the simple average of Census-based concentrations across all relevant NAICS Level 3 categories. We assume concentration remains flat at the last reported level between census (e.g., from 1997 to 2002).

Table 18: Firm regressions: all explanations except governance and short-termism

Table shows the results of firm-level errors-in-variables panel regressions of Net CAPX/PPE over the periods specified. All regressions include our 'core' firm-level explanations: Q, measures of competition and quasi-indexer ownership, as well as firm log-age and log-size. We add additional explanatory variables individually in columns 1-7. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Net CAPX/PPE						
	≥1990	≥2000	≥2000	≥2000	≥1990	≥1990	≥1990
Stock Q (t-1)	0.165**	0.075**	0.188**	0.159**	0.170**	0.165**	0.167**
	[24.868]	[8.912]	[27.752]	[18.854]	[19.612]	[24.871]	[20.260]
% QIX own MA2†	-0.126**	0.02	-0.034	-0.024	-0.140**	-0.125**	-0.125**
	[-7.938]	[0.733]	[-1.308]	[-0.925]	[-8.225]	[-7.867]	[-7.135]
Mod-Herfindahl (t-1)	-0.145**	-0.171**	-0.259**	-0.225**	-0.140**	-0.144**	0.005
	[-7.160]	[-4.778]	[-7.222]	[-6.680]	[-6.294]	[-7.132]	[0.240]
Ext fin dep ('96-'00)		0.007+					
		[1.837]					
Bank dep ('00)			0.037**				
			[3.339]				
AA to AAA rating ('00)				-0.106**			
				[-3.744]			
(Intan ex GW)/at (t-1)					0.103**		
					[2.972]		
% foreign prof (t-1)						-0.008+	
						[-1.719]	
Log of Reg index (t-1)							-0.025**
							[-10.560]
Observations	59,310	11,608	26,182	24,070	48,560	59,308	47,253
Age and Size Controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Firm de-meaned	YES	YES	YES	YES	YES	YES	YES
ρ^2	0.188	0.12	0.364	0.256	0.179	0.188	0.185

† Quasi-indexer ownership measured as the change from average 1996-2000 level in columns 2, 3 and 4

Table 19: Firm regressions: governance and short-termism

Table shows the results of firm-level errors-in-variables panel regressions of Net CAPX/PPE over the periods specified. Regressions include alternate measures of ownership as well as firm-level Q and firm demographics. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)
	Net CAPX/PPE			
	≥1990	≥1990	≥1990	≥1990
Stock Q (t-1)	0.165**	0.166**	0.167**	0.165**
	[24.868]	[24.418]	[22.813]	[24.788]
Mod-Herfindahl (t-1)	-0.145**	-0.149**	-0.138**	-0.130**
	[-7.160]	[-7.278]	[-6.759]	[-6.488]
% QIX own MA2	-0.126**			
	[-7.938]			
% Inst own MA2		-0.122**		
		[-9.309]		
% TRA own MA2			-0.328**	
			[-9.195]	
% DED own MA2				-0.059*
				[-2.252]
Observations	59,310	59,310	59,310	59,310
Age and Size Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm de-meaned	YES	YES	YES	YES
ρ^2	0.188	0.185	0.181	0.187

Table 20: Post-2000 Industry regressions: all explanations except competition

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. All regressions include our 'core' explanations: Q, modified herfindahl and quasi-indexer ownership, as well as age and size controls (mean log-age and mean log-size), and time fixed effects. The dependent variable is de-meaned within each industry group. We add additional explanatory variables one by one in columns 2-6 and simultaneously (when significant and properly signed) in column 7. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Net I/K			
	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000
Median Stock Q (t-1)	0.076**	0.075**	0.077**	0.070**	0.073**	0.076**	0.073**
	[7.551]	[7.501]	[7.031]	[7.370]	[7.158]	[7.767]	[7.305]
Mean % QIX own (t-1)†	-0.049	-0.089**	-0.067+	-0.162**	-0.058+	-0.052	-0.060+
	[-1.321]	[-2.657]	[-1.889]	[-4.755]	[-1.673]	[-1.360]	[-1.715]
Mod-Herfindahl (t-1)	-0.058*	-0.059+	-0.060+	-0.042+	-0.056*	-0.056*	-0.055*
	[-2.083]	[-1.893]	[-1.829]	[-1.718]	[-2.055]	[-2.058]	[-2.030]
Mean ext fin dep ('96-'00)		0.001					
		[0.175]					
Mean % bank dep ('96-'00)			0.025				
			[0.809]				
% rated AA to AAA ('96-'00)				-0.355**			
				[-3.172]			
Mean (Intan ex GW)/at (t-1)					-0.226**		-0.227**
					[-2.936]		[-2.996]
Mean % foreign prof (t-1)‡						-0.016	-0.016
						[-0.880]	[-0.933]
Observations	643	630	630	630	643	643	643
Mean age and size controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES	YES	YES	YES
ρ^2	0.305	0.323	0.322	0.33	0.326	0.302	0.324

† Quasi-indexer ownership measured as the change from average 1996-2000 level in columns 2, 3 and 4

‡ Foreign profits set to zero if missing

Table 21: Post-2000 Industry regressions: competition

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. All regressions include Q, quasi-indexer ownership, age and size controls, and alternate measures of competition. Regression includes time fixed effects and the dependent variable is de-meaned within each industry group. Herfindahl's, Lerner index and Census-based concentration remain significant once correcting for measurement error in Q. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(8)	(9)	(10)
	Net I/K								
	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000
Mean Stock Q (t-1)	0.083**	0.076**	0.073**	0.076**	0.078**	0.079**	0.062	0.166	0.080**
	[3.660]	[7.551]	[6.461]	[4.902]	[4.864]	[5.108]	[1.380]	[0.590]	[4.909]
Mean % QIX own (t-1)	-0.007	-0.049	-0.043	-0.038	0.001	-0.005	-0.116*	-0.006	-0.013
	[-0.165]	[-1.321]	[-1.144]	[-0.970]	[0.013]	[-0.115]	[-2.376]	[-0.051]	[-0.336]
3YΔLog#of Firms (t-1)	0.004								
	[0.274]								
Mod-Herfindahl (CP) (t-1)		-0.058*							
		[-2.083]							
Sales Herfindahl (CP) (t-1)			-0.033						
			[-1.586]						
CO Herf adjustment (t-1)			-0.092**						
			[-2.771]						
Lerner Index (t-1)				-0.082*					
				[-2.538]					
% sales Top 8 (CP) (t-1)					0.022				
					[1.234]				
% MV Top 8 (CP) (t-1)						0.011			
						[0.657]			
% sales in Top 20 (Census) (t-1)‡							-0.000+		
							[-1.802]		
Log of Reg index (t-1)								-0.01	
								[-0.618]	
% Licensed ('08)									0.005
									[0.421]
Observations	643	643	643	643	643	643	496	446	643
Age and Size Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES	YES	YES	YES	YES	YES
ρ^2	0.318	0.305	0.294	0.292	0.3	0.305	0.193	0.368	0.308

‡ When a given BEA category includes more than one NAICS Level 3 code, we use the simple average of Census-based concentrations across all relevant NAICS Level 3 categories. We assume concentration remains flat at the last reported level between census (e.g., from 1997 to 2002).

Table 22: Post-2000 Firm regressions: all explanations except governance and short-termism

Table shows the results of firm-level errors-in-variables panel regressions of Net CAPX/PPE over the periods specified. All regressions include our 'core' firm-level explanations: Q, measures of competition and QIX ownership, as well as firm log-age and log-size. We add additional explanatory variables individually in columns 2-7. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Net CAPX/PPE						
	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000	≥2000
Stock Q (t-1)	0.158**	0.075**	0.188**	0.159**	0.157**	0.158**	0.159**
	[25.734]	[8.912]	[27.752]	[18.854]	[22.321]	[25.796]	[22.763]
% QIX own MA2†	-0.087**	0.02	-0.034	-0.024	-0.091**	-0.086**	-0.097**
	[-4.640]	[0.733]	[-1.308]	[-0.925]	[-4.794]	[-4.577]	[-4.766]
Mod-Herfindahl (t-1)	-0.215**	-0.171**	-0.259**	-0.225**	-0.216**	-0.213**	-0.070*
	[-7.548]	[-4.778]	[-7.222]	[-6.680]	[-7.296]	[-7.502]	[-2.176]
Ext fin dep ('96-'00)		0.007+					
		[1.837]					
Bank dep ('00)			0.037**				
			[3.339]				
AA to AAA rating ('00)				-0.106**			
				[-3.744]			
(Intan ex GW)/at (t-1)					0.031		
					[0.829]		
% foreign prof (t-1)						-0.011*	
						[-2.218]	
Log of Reg index (t-1)							-0.028**
							[-10.903]
Observations	33,801	11,608	26,182	24,070	30,665	33,800	26,829
Age and Size Controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Firm de-meaned	YES	YES	YES	YES	YES	YES	YES
ρ^2	0.259	0.12	0.364	0.256	0.247	0.259	0.266

† QIX ownership measured as the change from average 1996-2000 level in columns 2, 3 and 4

Table 23: Post-2000 Firm regressions: governance and short-termism

Table shows the results of firm-level errors-in-variables panel regressions of Net CAPX/PPE over the periods specified. Regressions include alternate measures of governance and short-termism as well as firm-level Q and firm demographics. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)
	Net CAPX/PPE			
	≥2000	≥2000	≥2000	≥2000
Stock Q (t-1)	0.158**	0.158**	0.155**	0.157**
	[25.734]	[25.249]	[24.262]	[25.556]
Mod-Herfindahl (t-1)	-0.215**	-0.210**	-0.197**	-0.199**
	[-7.548]	[-7.347]	[-6.977]	[-7.071]
% QIX own MA2	-0.087**			
	[-4.640]			
% Inst own MA2		-0.050**		
		[-3.422]		
% TRA own MA2			-0.002	
			[-0.047]	
% DED own MA2				-0.058+
				[-1.868]
Observations	33,801	33,801	33,801	33,801
Age and Size Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm de-meaned	YES	YES	YES	YES
ρ^2	0.259	0.257	0.256	0.258