Appendix for "Investment-less Growth: An Empirical Investigation"

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A Data Appendix

This Appendix presents additional details, definitions and discussion related to our datasets. Section A.1 discusses data validation exercises. Section A.2 discusses the BEA segment definition and associated Compustat coverage. Section A.3 provides a detailed discussion of the data sources, definitions and limitations of our explanatory variables for all hypotheses.

A.1 Data Validation

A.1.1 Industry Data

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 Financial Accounts (see Figure 1). 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 of the main body.

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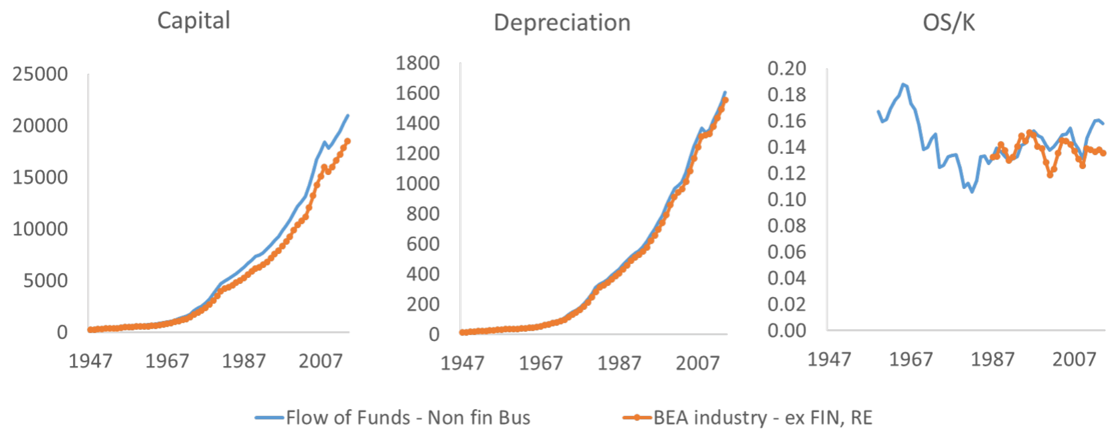
Figure 1: Reconciliation of Financial Accounts and BEA industry datasets



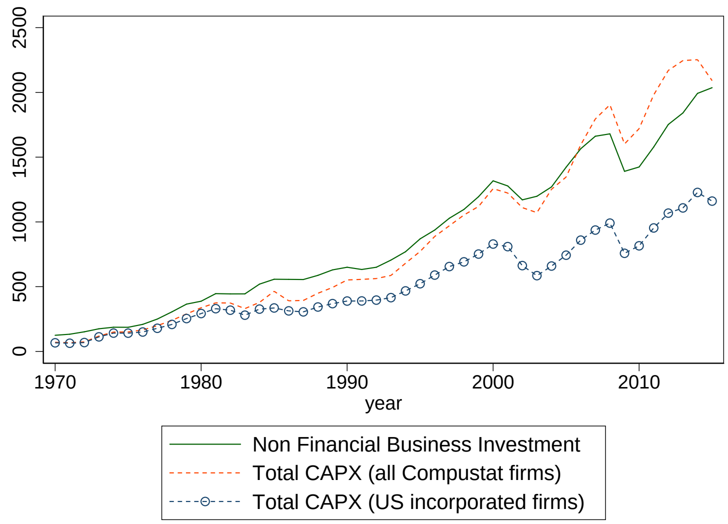
Notes: Financial Accounts data for non financial business sector; BEA data for all industries except Finance and Real Estate. Remaining differences – particularly for OS/K – appear to be driven by non-businesses (households and non profit), which are included in the BEA series but not in the Financial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

A.1.2 Firm Data

The sample of Compustat firms that we study represents a wide cross-section of firms in the US. It covers the largest firms in each industry which, as argued by Grullon et al. [2014], "account for most of the variation in aggregate net fixed private nonresidential investment." Asker et al. [2014] estimate that public firms account for 41% of sales and 47% of aggregate fixed investment. Still, this set of firms is not perfectly representative of aggregate and industry-level patterns (see, for example, **?**). The differences between public and private firms are, in fact, a primary reason why we study aggregate-, industry- and firm-level investment separately and compare results across levels of aggregation. Otherwise studying Compustat firms would suffice. We find that our main conclusions are robust across datasets and levels of aggregation, suggesting that our choice of datasets is not driving the results. Nonetheless, we performed a substantial data validation exercise to ensure Compustat provides reasonable proxies of investment, and industry-level variables such as Q.

Investment. We begin by noting that Compustat captures investment by 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 2 plots the gross fixed capital formation for non financial businesses (from the Financial Accounts) 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 Financial Accounts 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

Figure 2: Comparison of Financial Accounts and Compustat CAPX ($B)



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

from 1980 to 2000 and 59% from 2008 to 2015, on average. 60% is much closer to the 47% share of pubic firm investment estimated by Asker et al. [2014] – the remainder may be investment abroad.[1] In order to more closely mirror US aggregate figures, we restrict our sample to US incorporated firms; but also confirm that qualitative conclusions are robust to the inclusion of all firms irrespective of country of incorporation.

Coverage. 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 1 shows the coverage for the 43 industries under consideration. As shown, our Compustat sample provides good coverage for the majority of material industries. Coverage is generally lower for PP&E than CAPX: the ratio of total Compustat CAPX to BEA investment is ∼60%, compared to ∼25-30% for PP&E. The difference is explained by more aggressive asset depreciation in accounting standards compared to national accounts. For instance, the weighted average PP&E depreciation rate in Compustat is nearly 2x higher than the corresponding depreciation rate in the BEA.

Nonetheless, Compustat provides at least 10% coverage across both metrics for 29 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

[1] More broadly, these results suggest that foreign-incorporated firms are investing more than US-incorporated firms, but this investment is occurring outside the US.

qualitative results remain stable when including only industries with $>10\%$ coverage across both metrics and $> 25\%$ coverage under CAPX.

Table 1: Investment and coverage, by industry

Rank	**Industry**	**Total Capital** ('14; BN)	**Total inv.** ('00-'15; BN 09USD)	**% of total investment**	**PPE Coverage** ('00-'15)	**CAPX Coverage** ('00-'15)
1	Inf_telecom	$1,353	$431.8	11%	32%	56%
2	Health_hospitals	$1,011	$427.6	11%	4%	5%
3	Nondur_chemical	$900	$357.7	9%	34%	40%
4	Retail_trade	$1,236	$255.5	7%	15%	34%
5	Prof_serv	$595	$251.7	7%	7%	9%
6	Educational	$558	$191.9	5%	1%	2%
7	Min_Oil_and_gas	$1,475	$186.0	5%	36%	93%
8	Wholesale_trade	$590	$162.4	4%	7%	9%
9	Inf_data	$168	$155.5	4%	23%	23%
10	Agriculture	$630	$142.4	4%	2%	2%
11	Health_other	$417	$120.8	3%	2%	3%
12	Other_ex_gov	$620	$111.3	3%	1%	1%
13	Arts	$324	$100.9	3%	6%	7%
14	Adm_and_waste_mgmt	$292	$98.3	3%	3%	5%
15	Inf_motion	$288	$98.3	3%	6%	7%
16	Transp_pipeline	$227	$96.9	3%	15%	20%
17	Acc_accomodation	$359	$84.2	2%	20%	31%
18	Nondur_Petro	$221	$79.8	2%	100%	100%
19	Dur_Computer	$506	$76.6	2%	30%	40%
20	Construction	$285	$66.4	2%	2%	4%
21	Transp_truck	$144	$63.3	2%	9%	11%
22	Nondur_Food	$336	$62.3	2%	39%	63%
23	Inf_publish	$197	$54.2	1%	12%	18%
24	Dur_Transp	$384	$49.9	1%	51%	57%
25	Min_support	$142	$47.7	1%	37%	65%
26	Min_exOil	$187	$47.3	1%	51%	63%
27	Transp_air	$249	$29.0	1%	28%	48%
28	Acc_food	$249	$28.4	1%	23%	42%
29	Dur_Misc	$115	$22.9	1%	14%	23%
30	Dur_Machinery	$234	$21.7	1%	25%	49%
31	Transp_rail	$406	$19.7	1%	29%	67%
32	Dur_fab_metal	$175	$12.6	0%	12%	19%
33	Nondur_plastic	$104	$6.7	0%	14%	17%
34	Dur_nonmetal	$87	$5.8	0%	14%	20%
35	Dur_Furniture	$23	($0.4)	0%	17%	27%
36	Dur_Wood	$43	($1.7)	0%	39%	29%
37	Nondur_Apparel	$18	($6.4)	0%	52%	100%
38	Transp_other	$269	($6.9)	0%	20%	44%
39	Nondur_Printing	$49	($9.9)	0%	8%	13%
40	Dur_Electrical	$74	($12.9)	0%	23%	43%
41	Dur_prim_metal	$166	($17.0)	0%	18%	39%
42	Nondur_Textile	$40	($23.2)	-1%	8%	21%
43	Nondur_Paper	$121	($26.0)	-1%	53%	63%

Note: Only US-incorporated firms included in Compustat sample.

A.2 BEA segment definition

Industry-level investment data 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; good Compustat coverage; and yield stable investment and concentration time series. 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 2, 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 2: 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...	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...	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 2: Mapping of BEA industries to segments (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	Utilities	Utilities	Omitted	
420	Wholesale trade	Wholesale_trade	590.1	3.6%

A.3 Explanatory Variables

This section provides a detailed discussion of the explanatory variables used to test our 8 theories of under-investment. See Table 2 in main body for a summary of the fields.

A.3.1 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 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 INVT), decreases in receivables (item RECT), and increases in payables (item AP).[2] 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.[3] 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. We test whether bank-dependent firms or industries are under-investing but we note that our test is limited because we have few small firms in our sample. These small firms do not account for much CAPX or R&D in the aggregate, but they do account for a significant share of employment, so one should not interpret our results as dismissing the importance of bank dependence.

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 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.

[2] 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

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

A.3.2 Measurement Error

Intangibles. For Intangibles, we compute three types of metrics. First, we compute the investment rate for tangible and intangible assets separately 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 industry-level share of investment in intangibles (as % of total investment) and the share of intangible capital (as % of total capital). We use these to study intangible intensity over time and across industries. Last, we compute the firm-level ratio of intangibles to assets and intangibles excluding goodwill to assets (Compustat (INTAN-GDWL)/AT); and use these ratios to test for measurement error in intangibles. See main body for additional details. Because goodwill is available only after 1988, we use the ratio of intangibles to assets in regressions from 1980, and exclude goodwill in regressions after 1990. We prefer to exclude goodwill because it primarily measures M&A activity, not formation of intangible capital.

Globalization. For Globalization, we use two data sources – both of which carry some limitations.

First, 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. Unfortunately, it is reported only by some firms,[4] but there are no other indicators of the extent of a firm's foreign operations available in Compustat [Foley et al., 2007]. To mitigate these limitation in firm-level analyses, we consider three transformations of foreign activities: 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. 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).

Second, we gather data on the foreign activities of US Multinational Enterprises from the BEA, from 1995 to 2015. These data are based on mandatory surveys of virtually all US business enterprises that have foreign affiliates. They include total assets, sales, net income, value added and labor compensation for Majority-Owned Foreign Affiliates (MOFAs) of US entities, and the corresponding US parents. In principle, these data provide a direct – and complete – measure of foreign activities. But the industry categorizations and data availability pose four challenges:[5]

1. **Population:** The BEA's MNE accounts cover non-bank enterprises through 2009, and include banks thereafter. So the population included in aggregate quantities varies over time.

2. **Data definitions**: the majority of definitions (except value added measures) follow GAAP accounting standards; which sometimes differ from National Accounts.

[4] 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.

[5] See BEA [2009] for additional details.

3. **Industry categories**: Data is available at the industry-level, albeit at fairly aggregated segments that vary over time. Since 1999, data follows an ISI/NAICS-based segmentation. It is available at a roughly NAICS Level 3 granularity for MOFAs and slightly lower granularity for US Parents. Before 1999, data follows an SIC-based segmentation at a slightly lower level of granularity. Given the limited granularity (both before 1999 and in the US Parent data), we are unable to map the MNE dataset to our 43 BEA segments. We can map to 33 more aggregated segments, which we use in our analyses. But this requires a very high level of aggregation for some industries (e.g., all of 'Transportation and Warehousing' and 'Information' industries are grouped together, respectively),which limits our ability to reach conclusions.

4. **Industry assignments**: Each US parent or foreign affiliate is mapped to the industry that accounted for its largest percentage of sales.[6] And the affiliate data is only available by affiliate industry; while the parent data is available by parent industry. This implies that affiliates of a given parent may be mapped to different industries; and that enterprises with activities spanning multiple industries are mapped to individual industries.

By contrast, our primary BEA investment dataset follows a NAICS-based segmentation since 1947 and aims to map individual transactions to relevant industries. We cannot, therefore, simply add transactions of foreign affiliates to our BEA investment measures – the definitions and industry mappings would differ. Instead, we estimate proxies of industry-level foreign activity as the ratio of total assets, sales, net income, value added and labor compensation captured by MOFAs to the corresponding quantities for US Parents, by industry. Some inconsistencies remain between industry segments of MOFAs and US Parents, but this was the best proxy we could find. We also discuss aggregate trends, which are unaffected by industry segments.

A.3.3 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. When necessary, we aggregate the regulation index from NAICS level 3 industries into BEA industries by taking the mean number of

[6] From the BEA methodology document: "each US parent or foreign affiliate was classified by industry on the basis of its sales (or, for holding companies, on the basis of its total income) in a three-step procedure. First, a given US parent or foreign affiliate was classified in the NAICS sector that accounted for the largest percentage of its sales.18 Second, within the sector, the US parent or foreign affiliate was classified in the three-digit sub-sector in which its sales were largest; a three-digit sub-sector consists of all four-digit industries that have the same first three digits in their four-digit ISI code. Third, within its three-digit subsector, the US parent or foreign affiliate was classified in the four-digit industry in which its sales were largest. This procedure ensured that the US parent or foreign affiliate was not assigned to a four-digit industry outside either its sector or its three-digit subsector."

restrictions across all NAICS-3 industries within a given BEA industry. We acknowledge that using the Mercatus Regulation index carries some limitations (e.g., it is not entirely clear how different regulations are weighted, whether the regulations are actually enforced or not, etc.). But it serves as a (noisy) proxy for rising regulations, that is available over a long period and across industries.

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.[7]

Market power 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 market power: (i) the log-change in the number of firms in a given industry as a measure of entry and exit; (ii) sales Herfindahls[8], (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 Grullon et al. [2016] and define the Lerner Index as operating income before depreciation minus depreciation (OIBDP - DP) divided by sales (SALE). 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 US 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 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. Where necessary, we aggregate concentration ratios to our 43 BEA industry groupings by taking the weighted average by sales across NAICS level 3 industries. We use only NAICS Level 3 segments that can be mapped consistently to BEA categories over time.

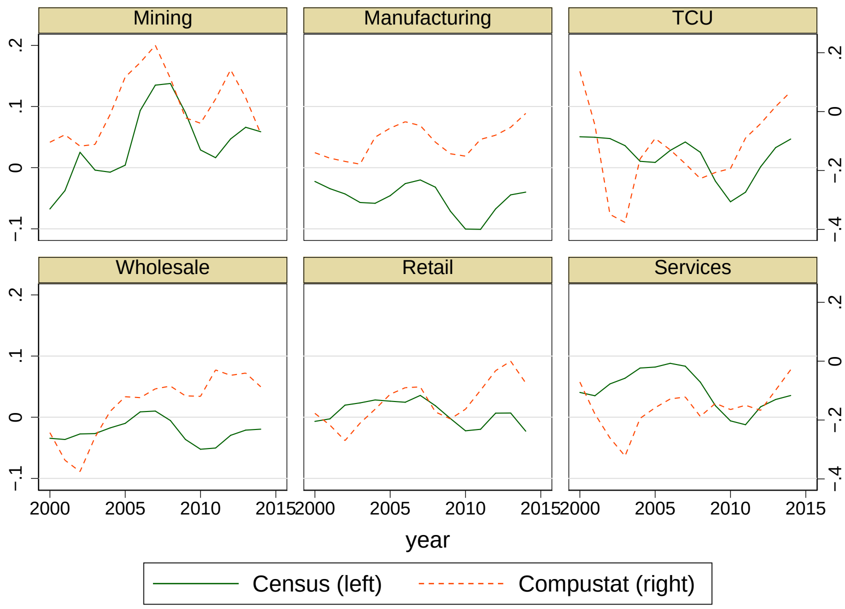
The main benefit of the census data is that it covers all US firms (public and private). But the limited granularity/coverage poses significant limitations for its use in regression analyses. We mapped the 9 SIC sectors for which census entry/exit data are available to the BEA investment categories and analyzed sector-level investment patterns. However, limited conclusions could be reached given the very broad sectors: Q exhibited significant measurement error leading to unintuitive coefficients. Because of this, we only use Census entry/exit data to validate the representativeness of relevant Compustat series. For instance, Figure 3 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

[7]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.

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

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 3: 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

The census concentration data is available at a more granular level (down to NAICS Level 6), 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 to compute this (see the next subsection). The Modified Herfindahl – described in Salop and O'Brien [2000] and Azar et al. [2016] – is defined as[9]

[9] According to the theory, it would better to compute $MHHI = HHI + \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$, where γ_{ij} denotes the control share of investor i in firm j. However, 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).

$$MHHI = \sum_j s_j^2 + \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \beta_{ij}\beta_{ik}}{\sum_i \beta_{ij}^2} \tag{1}$$

$$= HHI + HHI_{adj} \tag{2}$$

where s_j and s_k denote the share of sales for firms j, k in a given industry; and β_{ik} denotes the ownership share of investor i in firm j. 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 in a Cournot setting as shown by Salop and O'Brien [2000]. See Schmalz [2018] and Azar et al. [2016] 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 β_{ij} as the 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 few firms. It would not induce common ownership links. Second, following Azar et al. [2016], we restrict the data to holdings of at least 0.5% of shares outstanding. In computing the $MHHI$, we manually combine funds that belong to some of the largest institutions yet are reported separately.[10] We also use the NBER-CES dataset to study the Superstar Hypothesis as a potential driver of concentration.

A.3.4 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.[11] 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 institutional ownership.

[10] In particular, we manually search for funds within BlackRock, Capital Research, Dimensional Fund Advisors, Fidelity, State Street and Vanguard. This list may not be complete, but it captures the largest owners – which in turn drive the MHHI values.

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

This category includes 'pure' index investors as well as actively managed investors that hold diversified portfolios and benchmark against these indices. Quasi-indexer ownership is therefore heavily influenced by index position and participation. Still, quasi-indexers maintain some discretion on which firms to invest in: beyond their requirements to track and/or benchmark against particular indices, their investment decisions are aimed at maximizing alpha (see, for example, Wurgler [2011]). Indeed, we can infer investor preferences by studying the characteristics of stocks with higher quasi indexer ownership. For instance, firms with lower leverage seem to have higher quasi indexer ownership after controlling for other firm- and industry- characteristics.

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], Aghion et al. [2013] and Crane et al. [2016] all use Bushee's classifications when studying the implications of institutional ownership on governance, payouts and/or investment. The classification is available from 1981 to 2015.[12]

A.3.5 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; the ratio of share repurchases (item PRSTKC), dividends (item DVT) and payouts (PRSTKC + DVT) to assets as measures of payouts. These additional variables cut across several hypothesis. Acquisitions clearly have an impact on competition, but 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.

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 and payouts are capped at 10% of assets, and Q^{used} is capped at 10 while Q^{alt} is capped at 15.

[12] 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.

B Additional Results

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

1. Additional Results for Non-Financial Sector
   (a) Current Account of Non-Financial Sector
   (b) Operating Returns
   (c) Depreciation and Relative Price of Investment
2. Detailed Regression Results
   (a) Table 4: Industry regressions: Concentration vs. TFP
   (b) Table 5: Aggregate Moving Average Regressions
   (c) Table 6: Industry regressions: all explanations except competition
   (d) Table 7: Industry regressions: competition
   (e) Table 8: Industry regressions: ownership
   (f) Table 9: Firm regressions: all explanations except governance and short-termism
   (g) Table 10: Firm regressions: governance and short-termism
   (h) Table 11: Post-2000 Industry regressions: all explanations except competition
   (i) Table 12: Post-2000 Industry regressions: competition
   (j) Table 13: Post-2000 Firm regressions: all explanations except governance and short-termism
   (k) Table 14: Post-2000 Firm regressions: governance and short-termism

Table 3: Current Account of Non financial Sector

Name	Notation	Value in 2014 ($ billions)		
		Corporate[1]	Non corporate[2]	Business[1+2]
Gross Value Added	$P_t Y_t$	$8,717	$3,175	$11,892
Net Fixed Capital at Rep. Cost	$P_t^k K_t$	$14,968	$6,238	$21,206
Consumption of Fixed Capital	$\delta_t P_t^k K_t$	$1,286	$299	$1,585
Net Operating Surplus	$P_t Y_t - W_t N_t - T_t^y - \delta_t P_t^k K_t$	$1,680	$1,721	$3,401
Gross Fixed Capital Formation	$P_t^k I_t$	$1,636	$369	$2,005
Net Fixed Capital Formation	$P_t^k \left(I_t - \delta_t K_t\right)$	$350	$70	$420

B.1 Additional Results for Non-Financial Sector

Table 3 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.

Figure 4 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:

$$\text{Net Operating Return} = \frac{P_t Y_t - \delta_t P_t^k K_t - W_t N_t - T_t^y}{P_t^k K_t} \tag{3}$$

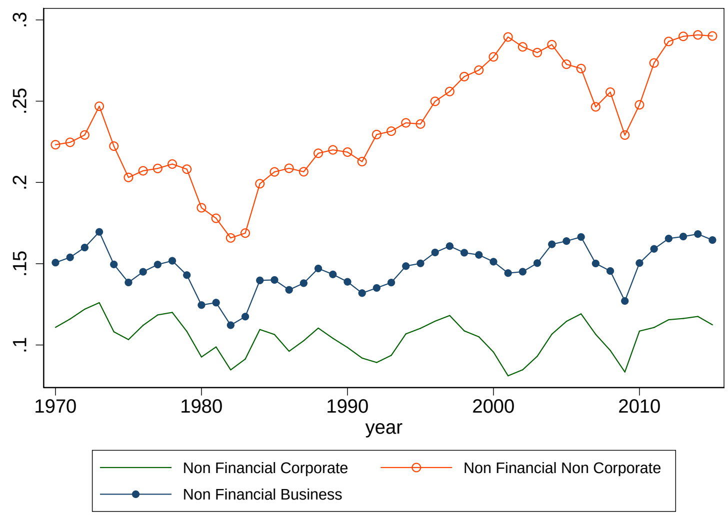
As shown, the operating return for corporates has been quite stable over time while the operating return of non corporates has increased substantially since 1990. For corporates, the yearly average from 1971 to 2015 is 10.5%, with a standard deviation of only one percentage point. The minimum is 8.1% 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.[13]

Figure 5 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 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

[13] Gomme et al. [2011] implement a related calculation of the after-tax return to business capital and find similar conclusions.

Figure 4: Net Operating Return, by Sector

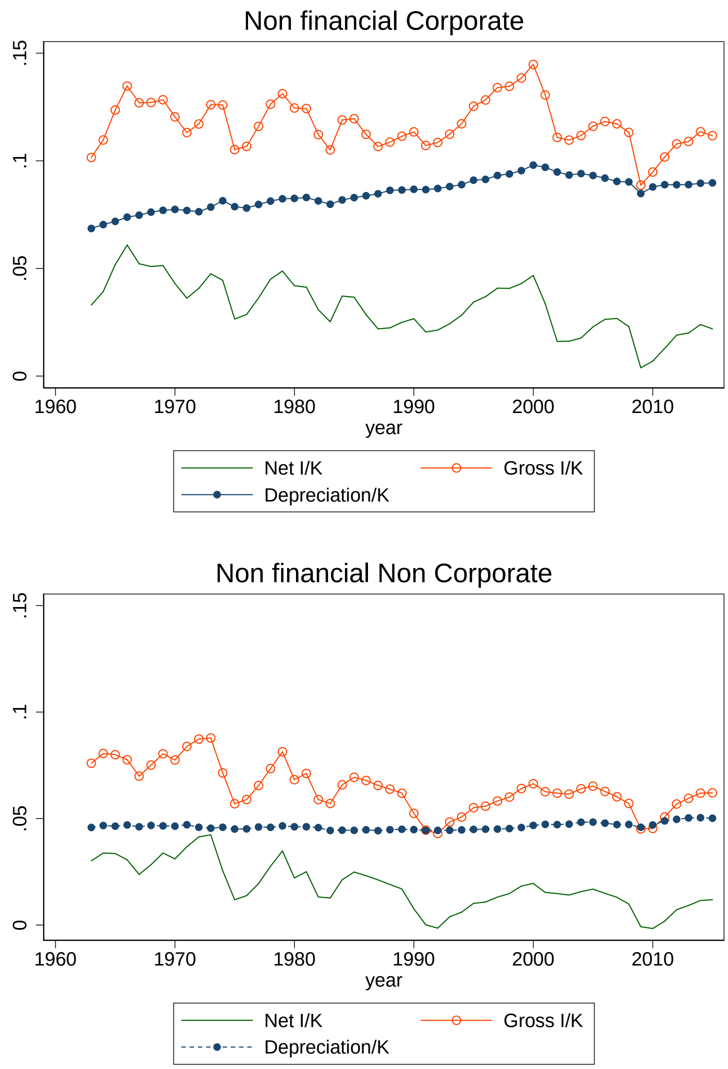


Note: Annual data, by Non financial Business sector.

structures and equipment to intangibles). As a result, the trend in net investment is significantly lower than the trend in gross investment. 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 3).

Figure 6 shows the relative price of nonresidential investment goods and equipment, defined as the ratio of the 'Fixed investment: Nonresidential (implicit price deflator)' to the 'Personal consumption expenditures (implicit price deflator)'. As shown, the relative price of capital decreased drastically since the 1980s, but has remained relatively stable after 2000. Thus, the recent under-investment is unlikely to be driven by changes in investment prices.

Figure 5: 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.

Figure 6: Relative price of investment goods

Note: Annual data. Relative price of investment goods defined as the ratio of the 'Fixed investment: Nonresidential (implicit price deflator)' to the 'Personal consumption expenditures (implicit price deflator)'

B.2 Detailed Regression Results

Table 4: Industry regressions: Concentration vs. TFP

Table shows the results of industry-level OLS regressions of contemporaneous changes in TFP and Concentration over the periods specified. TFP from NBER-CES database; CR4 ratio from Economic Census. Includes only manufacturing industries. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(3)
	ΔTFP	
	97-02	02-12†
ΔCensus CR4	**0.478****	**-0.255**
	[0.108]	**[0.266]**
Observations	469	299
R^2	4%	0%

† 2011 for TFP due to data availability

Table 5: 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
Agg. Compustat Q (t-1)	0.010*	0.005	0.011*	0.021**	0.016**	0.018**
	[2.17]	[1.41]	[2.24]	[3.34]	[3.15]	[2.98]
Median Sales Herfindahl(t-1)†		-0.378**	-0.284		-0.317**	-0.229+
		[-3.04]	[-1.62]		[-3.80]	[-1.65]
Mean % QIX own (t-1)			-0.035			-0.023
			[-1.18]			[-0.83]
MA (t-1)	1.068	1.019**	0.887**	0.800**	0.762**	0.696*
	[0.01]	[4.39]	[3.28]	[4.52]	[2.93]	[2.39]
MA (t-2)	1	0.343	0.192	0.740**	0.251	0.284
	[0.00]	[1.27]	[0.64]	[4.58]	[0.85]	[0.85]
Observations	36	36	34	26	26	26
Log-likelihood	142.18	149.29	144.607	108.662	112.813	113.642

Notes: Investment from the Financial Accounts; 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 6: 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. Variables are de-meaned at industry level over the regression period (i.e., we apply a 'within' transformation) where noted. All regressions include our 'core' explanations: Q, modified Herfindahl and quasi-indexer ownership, as well as Age controls (mean log-age), and time fixed effects. 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 Log-Q (t-1)	0.170**	0.163**	0.257**	0.246**	0.245**	0.146**	0.144**	0.140**
	[14.633]	[16.812]	[12.098]	[12.814]	[14.513]	[15.754]	[16.411]	[15.154]
Mean % QIX own (t-1)†	-0.091*	-0.118**	-0.015	0.073	-0.078	-0.110**	-0.127**	-0.120**
	[-2.276]	[-3.068]	[-0.177]	[1.101]	[-1.017]	[-3.003]	[-3.786]	[-3.548]
Mod-Herfindahl (t-1)†	-0.056*	-0.056*	-0.122**	-0.109**	-0.127**	-0.046*	-0.045*	-0.040*
	[-2.556]	[-2.394]	[-2.696]	[-2.950]	[-2.946]	[-2.248]	[-2.087]	[-2.042]
Med ext fin dep ('96-'00)			-0.004					
			[-0.143]					
Mean % bank dep ('96-'00)				0.104**				
				[3.828]				
% rated AA to AAA ('96-'00)					-0.328			
					[-1.225]			
IP share of investment(t-1)						**-0.063***		-0.058*
						[-2.223]		[-2.107]
Mean % foreign prof (t-1)‡							**-0.065****	-0.057**
							[-3.278]	[-2.931]
Observations	1,445	1,110	687	687	687	1,110	1,110	1,110
Age controls	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	YES	NO	NO	NO	YES	YES	YES
ρ^2	0.38	0.39	0.7	0.683	0.673	0.395	0.38	0.394

† Quasi-indexer ownership and Modified Herfindahl measured as the change from average 1996-1999 level in columns 3, 4 and 5
‡ Foreign profits set to zero if missing

Table 7: Industry regressions: competition

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. All variables are de-meaned at industry level over the regression period (i.e., we apply a 'within' transformation). All regressions include Q, quasi-indexer ownership, Age controls, and alternate measures of competition; as well as time effects and a control for age. Herfindahls, Lerner index and (Compustat and Census) concentration appear significant. 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	'97-'12	≥1990	≥2000
Median Log-Q (t-1)	0.210**	0.163**	0.275**	0.253**	0.146**	0.169**	0.081**	0.143**	0.163**
	[11.231]	[16.812]	[6.610]	[4.508]	[16.178]	[16.064]	[2.630]	[3.211]	[24.786]
Mean % QIX own (t-1)	-0.119*	-0.118**	-0.125*	-0.114*	-0.131**	-0.122**	-0.094*	-0.085+	-0.093**
	[-2.381]	[-3.068]	[-2.454]	[-1.961]	[-3.416]	[-2.986]	[-2.428]	[-1.767]	[-2.637]
3YΔLog#of Firms (t-1)	0.005								
	[0.376]								
Mod-Herfindahl (CP) (t-1)		**-0.056***							
		[-2.394]							
Sales Herfindahl (CP) (t-1)			**-0.093****						
			[-2.614]						
CO Herf adjustment (t-1)			**-0.104***						
			[-2.373]						
Lerner Index (t-1)				**-0.053+**					
				[-1.779]					
% sales Top 8 (CP) (t-1)					**-0.064***				
					[-2.160]				
% MV Top 8 (CP) (t-1)						-0.023			
						[-1.146]			
% sales in Top 50 (Census) (t-1)‡							-0.045		
							[-1.475]		
Log of Reg index (t-1)								-0.001	
								[-0.169]	
% Licensed ('08)									0.003
									[0.583]
Observations	1,110	1,110	1,110	1,110	1,110	1,110	566	798	687
Age 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	0.443	0.39	0.499	0.486	0.385	0.4	0.42	0.358	0.423

‡ When a given BEA category includes more than one NAICS Level 3 code, we use the sales-weighted average of Census-based concentrations across all relevant NAICS Level 3 categories. Only consistent NAICS L3 categories included. We interpolate concentration between census years (e.g., from 1997 to 2002).

Table 8: Industry regressions: ownership

Table shows the results of industry errors-in-variables panel regressions of Net I/K over the periods specified. All variables are de-meaned at industry level over the regression period (i.e., we apply a 'within' transformation). All regressions include Q, modified Herfindahl, Age controls, and alternate measures of ownership; as well as time effects and a control for age. Annual data. T-stats in brackets. + p<0.10, * p<0.05, ** p<.01.

	(1)	(2)	(3)	(4)
	Net I/K			
	≥1990	≥1990	≥1990	≥1990
Median Log-Q (t-1)	0.163**	0.138**	0.151**	0.202**
	[16.812]	[14.467]	[14.299]	[16.313]
Mod-Herfindahl (CP) (t-1)	-0.056*	-0.053*	-0.054*	-0.070**
	[-2.394]	[-2.458]	[-2.464]	[-2.851]
Mean % QIX own (t-1)	**-0.118****			
	[-3.068]			
Mean % INS own (t-1)		**-0.115****		
		[-4.104]		
Mean % TRA own (t-1)			**-0.225***	
			[-2.470]	
Mean % DED own (t-1)				-0.006
				[-0.065]
Observations	1,110	1,110	1,110	1,110
Age controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Industry de-meaned	YES	YES	YES	YES
ρ^2	0.39	0.363	0.359	0.414

Table 9: 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 variables are de-meaned at firm- or industry-level over the regression period, as noted. All regressions include our 'core' firm-level explanations: Q, measures of competition and quasi-indexer ownership, as well as time effects and firm log-age. 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
Q (t-1)	0.218**	0.173**	0.212**	0.193**	0.216**	0.219**	0.217**
	[39.291]	[21.050]	[32.393]	[25.068]	[34.527]	[39.341]	[33.622]
% QIX own MA2	**-0.120****	**-0.106****	**-0.114****	**-0.108****	**-0.126****	**-0.121****	**-0.140****
	[-6.765]	**[-5.818]**	**[-5.926]**	**[-6.038]**	**[-6.732]**	**[-6.776]**	**[-6.867]**
Mod-Herfindahl (t-1)	**-0.071****	**-0.115****	**-0.138****	**-0.142****	**-0.069***	**-0.072****	**-0.095****
	[-2.639]	**[-2.697]**	**[-3.208]**	**[-3.591]**	**[-2.446]**	**[-2.690]**	**[-3.106]**
Ext fin dep ('96-'00)		-0.002					
		[-1.471]					
Bank dep ('00)			-0.001				
			[-0.109]				
AA to AAA rating ('00)				-0.130**			
				[-5.179]			
(Intan ex GW)/at (t-1)					0.313**		
					[5.481]		
% foreign prof (t-1)						0.004	
						[1.037]	
Log of Reg index (t-1)							0.013
							[1.104]
Observations	77,772	23,531	36,377	32,801	64,425	77,731	61,208
Age controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Firm de-meaned	YES	NO	NO	NO	YES	YES	YES
Industry de-meaned	NO	YES	YES	YES	NO	NO	0.248
ρ^2	0.263	0.261	0.397	0.321	0.249	0.264	0.248

Table 10: 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. All variables are de-meaned at firm-level over the regression period (i.e., we apply a 'within' transformation). Regressions include alternate measures of ownership as well as firm-level Q, log-age and time effects. 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
Q (t-1)	0.218**	0.234**	0.222**	0.221**
	[39.291]	[46.101]	[38.123]	[38.846]
Mod-Herfindahl (t-1)	-0.071**	-0.024	-0.077**	-0.090**
	[-2.639]	[-0.851]	[-2.879]	[-3.301]
% QIX own MA2	**-0.120****			
	[-6.765]			
% Inst own MA2		**-0.137****		
		[-9.365]		
% TRA own MA2			**-0.258****	
			[-7.350]	
% DED own MA2				**0.056+**
				[1.762]
Observations	77,772	86,001	77,775	76,479
Age controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm de-meaned	YES	YES	YES	YES
ρ^2	0.263	0.304	0.261	0.264

Table 11: 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. Variables are de-meaned at industry level over the regression period (i.e., we apply a 'within' transformation) where noted. All regressions include our 'core' explanations: Q, modified Herfindahl and quasi-indexer ownership, as well as Age controls (mean log-age), and time effects. 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 Log- Q (t-1)	0.163**	0.257**	0.246**	0.245**	0.165**	0.160**	0.162**
	[13.130]	[12.098]	[12.814]	[14.513]	[14.762]	[12.691]	[14.355]
Mean % QIX own (t-1)†	-0.105**	-0.015	0.073	-0.078	-0.096*	-0.109**	-0.100**
	[-2.657]	[-0.177]	[1.101]	[-1.017]	[-2.402]	[-2.865]	[-2.581]
Mod-Herfindahl (t-1)†	-0.067+	-0.122**	-0.109**	-0.127**	-0.068+	-0.062+	-0.063+
	[-1.844]	[-2.696]	[-2.950]	[-2.946]	[-1.907]	[-1.725]	[-1.796]
Mean ext fin dep ('96-'00)		-0.004					
		[-0.143]					
Mean % bank dep ('96-'00)			0.104**				
			[3.828]				
% rated AA to AAA ('96-'00)				-0.328			
				[-1.225]			
IP share of investment(t-1)					**-0.040***		-0.039*
					[-2.193]		[-2.131]
Mean % foreign prof (t-1)‡						-0.028	-0.026
						[-1.620]	[-1.465]
Observations	687	687	687	687	687	687	687
Mean Age controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Industry de-meaned	YES	NO	NO	NO	YES	YES	YES
ρ^2	0.431	0.7	0.683	0.673	0.446	0.428	0.443

† Quasi-indexer ownership and Modified Herfindahl measured as the change from average 1996-1999 level in columns 2, 3 and 4
‡ Foreign profits set to zero if missing

Table 12: 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 variables are de-meaned at industry level over the regression period (i.e., we apply a 'within' transformation). All regressions include Q, quasi-indexer ownership, age controls, time effects, and alternate measures of competition. Herfindahls, Lerner index and (Compustat and Census) concentration appear significant. 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	97-12	≥2000	≥2000
Median Log-Q (t-1)	0.148**	0.163**	0.169**	0.158**	0.160**	0.132**	0.081**	0.095**	0.134**
	[11.718]	[13.130]	[14.206]	[9.584]	[11.955]	[11.337]	[2.630]	[5.509]	[10.378]
Mean % QIX own (t-1)	-0.111**	-0.105**	-0.107**	-0.105*	-0.114**	-0.112**	-0.094*	-0.087*	-0.110**
	[-2.807]	[-2.657]	[-2.708]	[-2.473]	[-2.871]	[-3.002]	[-2.428]	[-2.018]	[-2.912]
3YΔLog#of Firms (t-1)	0.004								
	[0.287]								
Mod-Herfindahl (CP) (t-1)		**-0.067+**							
		[-1.844]							
Sales Herfindahl (CP) (t-1)			**-0.089+**						
			[-1.780]						
CO Herf adjustment (t-1)			**-0.057+**						
			[-1.677]						
Lerner Index (t-1)				**-0.054+**					
				[-1.668]					
% sales Top 8 (CP) (t-1)					**-0.092***				
					[-2.001]				
% MV Top 8 (CP) (t-1)						-0.018			
						[-0.859]			
% sales in Top 50 (Census) (t-1)‡							-0.045		
							[-1.475]		
Log of Reg index (t-1)								-0.012	
								[-1.643]	
% Licensed ('08)									0
									[-0.935]
Observations	687	687	687	687	687	687	566	495	687
Age 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	0.429	0.431	0.44	0.455	0.449	0.404	0.42	0.344	0.408

‡ When a given BEA category includes more than one NAICS Level 3 code, we use the sales-weighted average of Census-based concentrations across all relevant NAICS Level 3 categories. Only consistent NAICS L3 categories included. We interpolate concentration between census years (e.g., from 1997 to 2002).

Table 13: 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 variables are de-meaned at firm- or industry-level over the regression period, as noted. All regressions include our 'core' firm-level explanations: Q, measures of competition and QIX ownership, as well as firm log-age and time effects. 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
Q (t-1)	0.212**	0.173**	0.212**	0.193**	0.206**	0.212**	0.198**
	[29.422]	[21.050]	[32.393]	[25.068]	[26.802]	[29.421]	[26.030]
% QIX own MA2	-0.071**	-0.106**	-0.114**	-0.108**	-0.082**	-0.071**	-0.103**
	[-3.238]	[-5.818]	[-5.926]	[-6.038]	[-3.735]	[-3.234]	[-4.256]
Mod-Herfindahl (t-1)	-0.074*	-0.115**	-0.138**	-0.142**	-0.078*	-0.074*	-0.081*
	[-2.275]	[-2.697]	[-3.208]	[-3.591]	[-2.419]	[-2.273]	[-2.296]
Ext fin dep ('96-'00)		-0.002					
		[-1.471]					
Bank dep ('00)			-0.001				
			[-0.109]				
AA to AAA rating ('00)				-0.130**			
				[-5.179]			
(Intan ex GW)/at (t-1)					0.330**		
					[5.235]		
% foreign prof (t-1)						0.001	
						[0.138]	
Log of Reg index (t-1)							-0.013
							[-0.906]
Observations	45,264	23,531	36,377	32,801	41,163	45,253	34,779
Age controls	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES
Firm de-meaned	YES	NO	NO	NO	YES	YES	YES
Industry de-meaned	NO	YES	YES	YES	NO	NO	0.245
ρ^2	0.276	0.261	0.397	0.321	0.244	0.276	0.245

Table 14: 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. All variables are de-meaned at firm-level over the regression period (i.e., we apply a 'within' transformation). Regressions include alternate measures of governance and short-termism as well as firm-level Q, log-age and time effects. 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
Q (t-1)	0.212**	0.234**	0.218**	0.215**
	[29.422]	[35.168]	[28.756]	[28.949]
Mod-Herfindahl (t-1)	-0.074*	-0.088*	-0.079*	-0.076*
	[-2.275]	[-2.462]	[-2.372]	[-2.254]
% QIX own MA2	**-0.071****			
	[-3.238]			
% Inst own MA2		**-0.134****		
		[-6.958]		
% TRA own MA2			**-0.226****	
			[-5.411]	
% DED own MA2				**0.072+**
				[1.766]
Observations	45,264	48,849	45,267	43,971
Age controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Firm de-meaned	YES	YES	YES	YES
ρ^2	0.276	0.332	0.278	0.28

C Model

We use the model of Jones and Philippon [2016] to simulate data from an economy with changes in market power. This is a standard DSGE model with capital accumulation, nominal rigidities, and time varying competition in the goods markets. For simplicity, we separate firms into capital producers – who lend their capital stock at price R_t^k – and good producers – who hire capital and labor to produce goods and services. The variables of interests are: Y_t, N_t, W_t, C_t, K_t, x_t, $\texttt{MC}_t$, $\texttt{MRS}_t$, R_t^k, Λ_t, D_t, V_t^n, Q_t, Q_t^k, Q_t^{obs}, R_t, π_t, π_t^w. The equations are as follows. Net investment:

$$x_t = \frac{I_t}{K_t} - \delta \tag{4}$$

Production function, with fixed costs:

$$Y_t = A_t K_t^{\alpha} N_t^{1-\alpha} - \Phi Y \tag{5}$$

where Y is steady state output. Resource constraint:

$$Y_t = C_t + P_{k,t} I_t + \frac{\varphi_k}{2} P_{k,t} K_t x_t^2 \tag{6}$$

where φ_k is the capital adjustment cost. Evolution of capital:

$$K_{t+1} = (1-\delta) K_t + I_t \tag{7}$$

Capital-labor ratio:

$$\frac{N_t}{K_t} = \frac{1-\alpha}{\alpha} \frac{R_t^k}{W_t/P_t} \tag{8}$$

Marginal cost:

$$\texttt{MC}_t = \frac{1}{A_t} \left(\frac{R_t^k}{\alpha}\right)^{\alpha} \left(\frac{W_t/P_t}{1-\alpha}\right)^{1-\alpha} \tag{9}$$

Marginal rate of substitution:

$$\texttt{MRS}_t = N_t^{\varphi} C_t^{\gamma} \tag{10}$$

where γ is the CRRA and φ is the curvature of labor disutility. Pricing kernel:

$$\Lambda_{t+1} = \beta \left(\frac{C_t}{C_{t+1}}\right)^{\gamma} \tag{11}$$

Euler equation:

$$1 = \mathbb{E}_t \left[\Lambda_{t+1} \frac{P_t}{P_{t+1}} R_t\right] \tag{12}$$

Investment equation:

$$x_t = \frac{1}{\varphi_k} \left(Q_t^k - 1\right) \tag{13}$$

Capital producing firms:

$$Q_t^k = \mathbb{E}_t \left[\frac{\beta^k}{\beta} \frac{\Lambda_{t+1}}{P_t^k} \left(R_{t+1}^k + P_{t+1}^k \left(Q_{t+1}^k - \delta + \frac{1}{2\varphi_k} \left(Q_{t+1}^k - 1 \right)^2 \right) \right) \right] \tag{14}$$

where β^k is the discount rate for (risky) corporate capital. Goods-producing (monopolists) firms:

$$V_t^n = D_t + \mathbb{E}_t \left[\frac{\beta^k}{\beta} \Lambda_{t+1} V_{t+1}^n \right] \tag{15}$$

with real dividends

$$D_t = (1 - \mathtt{MC}_t) A_t K_t^\alpha N_t^{1-\alpha} - \Phi Y \tag{16}$$

Goods-producing Q:

$$Q_t = \frac{\mathbb{E}_t \left[\frac{\beta^k}{\beta} \Lambda_{t+1} V_{t+1}^n \right]}{P_t^k K_{t+1}} \tag{17}$$

Total Q (mapped into observed Q in the data):

$$Q_t^{\text{obs}} = Q_t^k + Q_t \tag{18}$$

Policy rule, taking into account the ZLB:

$$R_t = \max \left[1, R_{t-1}^{\phi_r} \left(\frac{\pi_t^p}{\pi} \right)^{(1-\phi_r)\phi_\pi} \left(\frac{\pi_t^w}{\pi} \right)^{(1-\phi_r)\phi_w} \left(\frac{N_t}{N} \right)^{(1-\phi_r)\phi_y} \right] \tag{19}$$

Log-linear equations We take log-linear approximations of the above equations, together with standard New Keynesian equations with Calvo stickiness in prices and wages.

$$\pi_t^p = \beta \mathbb{E}_t \left[\pi_{t+1}^p \right] + \lambda_p \mathtt{mc}_t \tag{20}$$

$$\pi_t^w = \beta \mathbb{E}_t \left[\pi_{t+1}^w \right] + \lambda_w \left(\mathtt{mrs}_t - \omega_t \right) \tag{21}$$

$$\omega_t = \omega_{t-1} + \pi_t^w - \pi_t^p \tag{22}$$

with $\lambda_p \equiv \frac{(1-\vartheta_p)(1-\beta\vartheta_p)}{\vartheta_p}$ and $\lambda_w \equiv \frac{(1-\beta\vartheta_w)(1-\vartheta_w)}{\vartheta_w} \frac{1}{1+\varphi\epsilon_w}$ as in Gali [2008] and Woodford [2003].

Shocks Shocks in the log-linear equations.

1. Productivity:

$$a_t = \rho_a a_{t-1} + \epsilon_{a,t}$$

2. Demand/ZLB shock:

$$\mathbb{E}_t \left[\lambda_{t+1} + r_t - \pi_{t+1}^p \right] = -\zeta_t^d$$

$$\zeta_t^d = \rho_d \zeta_{t-1}^d + \epsilon_t^d$$

3. Shock to the valuation of corporate assets:

$$q_t^k = \mathbb{E}_t \left[\lambda_{t+1} + \zeta_t^q + \frac{R_k}{R_k + Q^k - \delta} r_{k,t} + \frac{Q^k}{R_k + Q^k - \delta} q_t^k \right]$$

$$v_t = (1-\beta) d_t + \lambda_{t+1} + \zeta_t^q + \beta v_{t+1}$$

$$q_t = \lambda_{t+1} + \zeta_t^q + v_{t+1} - k_{t_1}$$

$$\zeta_t^q = \rho_d \zeta_{t-1}^q + \epsilon_t^q$$

4. Shock to the policy rule:

$$r_t = \max \left[0, \phi_r r_{t-1} + (1-\phi_r) \left(\phi_\pi \pi_t + \phi_w w_t + \phi_y y_t \right) + \epsilon_{r,t} \right]$$

5. Transitory shock to markups:

$$\pi_t^p = \beta \mathbb{E}_t \left[\pi_{t+1}^p \right] + \lambda_p \mathtt{mc}_t + \zeta_t^e$$

$$\zeta_t^e = \rho_e \zeta_{t-1}^e + \epsilon_t^e$$

In addition, there is a permanent shock to competition in the form of a unanticipated and permanent change to the elasticity of substitution between intermediate goods.

Steady state $P_k = 1$, $x = 0$, $Q^k = 1$, $A = 1$, $\mathtt{mc} = \frac{\varepsilon_p - 1}{\varepsilon_p}$

$$R^k = \frac{1}{\beta^k} - 1 + \delta$$

$$(W/P)^{1-\alpha} = \mathtt{MC}(1-\alpha)^{1-\alpha} \left(\frac{R^k}{\alpha} \right)^{-\alpha}$$

$$N/K = \frac{1-\alpha}{\alpha} \frac{R^k}{W/P}$$

$$\frac{Y}{K} = \frac{1}{1+\Phi} \left(\frac{N}{K} \right)^{1-\alpha}$$

$$\frac{C}{K} = \frac{Y}{K} - \delta$$

Since wages are sticky, we have $\mathtt{mrs} = \frac{W}{P} \left(\frac{\varepsilon_w - 1}{\varepsilon_w} \right)$, then:

$$K^{\varphi+\gamma} = \mathtt{mrs} \left(\frac{C}{K} \right)^{-\gamma} \left(\frac{N}{K} \right)^{-\varphi}$$

With K, we get the other steady-state aggregates.

$$V^n = \frac{D}{1-\beta^k}$$

$$Q = \frac{\beta^k V^n}{K}$$

Calibrated parameters Calibrate the following parameters. The discount factor used in the valuation of corporate assets is $\beta^k < \beta$. Risk aversion and Frisch elasticity taken from Smets and Wouters [2007].

```
bet     = 0.97^0.25 ;
betq    = bet*0.96^0.25 ;
alph    = 1/3 ;   % technology capital share
varphi  = 1.92 ;  % disutility of labor
gamm    = 1.4 ;   % risk aversion
elasp   = 6 ; % Subsitution across goods (initial value)
elasw   = 6 ; % Subsitution labor types.
phifc   = 0.1 ; % Fixed cost as fraction of output
delt    = 0.025 ;
phik    = 40 ; % Capital adjustment costs
```

Estimation Shocks and monetary policy parameters are estimated over 1984Q1 to 2015Q3. We also estimate the ZLB duration, with the prior on each ZLB duration being derived from the NY Federal Reserve survey of primary dealers.

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