"The Reliability of the Contribution of Intellectual Property Products to GDP Growth"

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The Reliability of the Contribution of Intellectual Property Products to GDP Growth *

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Abstract

Given the attention to intangible capital in studying industry dynamics and productivity in the last couple of decades, this paper provides a descriptive analysis of Intellectual Property Products (IPP) as measured by the Bureau of Economic Analysis (BEA) with attention directed to their three components: R&D, Software, and Entertainment, literary and artistic originals (ELAO).

We show that the component movements can be very different from the aggregate in the 7 industry sectors examined.

Contrary to the common perception, it does not appear that trends in multifactor productivity (MFP) are dependent on trends in IPP investment and capital stock.

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1 Introduction

Measuring the accuracy of national account estimates is challenging because it is impossible to know the true values of the estimates. Regular revisions to estimates usually arise from the flow of source data; that is, partial and preliminary data are replaced with more complete data. Other revisions arise from changes in the economic concepts and methods underlying the estimates that are necessary to provide an accurate picture of the evolving U.S. economy. For example, the accounts contain no entry for business investment in computer software before 1959, since the amount of software prior to that year was negligible. When software investment was first included in the accounts in the late 1990s, the level and rates of growth of the economy were raised, and by 2012, business investment in software was 1.7 percent of the size of GDP. In 2013, the Bureau of Economic Analysis (BEA) took on a comprehensive revision of the NIPAs to fulfill its mission of providing a timely and accurate picture of the conditions of the U.S. economy. Among other changes and additions, a new category of investment, "intellectual property products," (IPP) was formed; this new category consists of research and development (RD); entertainment, literary, and artistic originals (ELAO); and software. This last component, software, was also measured before, but was being bundled with equipment, in a category called "equipment and software". Meanwhile, the weight of IPP in GDP has slowly increased from 5.2% at the beginning of 2013 to 5.8% by 2020. Moreover, as part of the 2018 comprehensive update, BEA began including the value of the return to fixed capital (that is, capital services) into estimates of private fixed investment in own-account software and in own-account RD beginning with 2007.

In this paper we show that IPP cannot be considered as a single aggregate when looking at investment by industry or with respect multifactor productivity. More specifically we show that there is considerable heterogeneity.

Our paper is in the spirit of Corrado Hulten and Sichel (2009) and Corrado et. al (2016) that examine the importance of intangible to explanations of movements in productivity. It is also similar to Crouzet and Eberly (2021) that examines the role of intangible in the trend of total factor productivity.

More specifically, we consider 7 sectors and show the trends of IPP investment, its components and the attending capital stock and how they relate to labor productivity and multifactor productivity.

Unless otherwise noted, all data are from BEA, except for the multifactor productivity Figures which come from BLS data.

Generally we find that in the 80's, at the beginning of our data sample, the sectors whose total investment was highest were also the sectors whose investment in IPP started to increase first. However, as production processes for a lot of sectors became more mobile as indicated by the decrease in the use of capital structures, and equipment, by the end of our sample in

2020, the sectors with the highest investment in IPP were not sectors that also invested in capital structures and equipment. Moreover, all sectors without exception had increased the share of IPP investment and capital used in production greatly, significantly transforming the way they deliver commodities and services. However, this increase in IPP investment was very heterogeneous, especially in its composition. Investment in software took the lead ahead of investment in R&D, while at the same time prices of software decreased significantly but prices of R&D did not, benefiting some sectors more than others. We find that the sectors more reliant on R&D like Manufacturing and Professional and Technical services did not increase investment in IPP to the same extent that sectors whose IPP investment was centered in software like Information, Finance and Insurance, and some others. In our opinion, the relationship between IPP investment and capital with multifactor productivity continuous to be evasive, and needs a more disaggregated exploration than previous studies.

2 Background

Before delving into the sectors it is useful to provide some context on the role of IPP investment relative to total investment.

2.1 Measuring Nominal IPP growth

Because BEA provides vintage estimates, Figure 1 compares The advanced estimate that the BEA releases a month after every quarter changes quite considerable as the data incorporated in that estimate is scarce and analysts are forced to use judgmental adjustments, so Figure 1 only shows the third quarterly estimate, this is, the estimate released three months past a quarter, the first annual estimate (usually release about a year after the corresponding quarter) and the latest estimate available of IPP quarterly growth.

As one can see in Figure 1, the quarterly annualized rate of nominal IPP in our sample ranges from around -3% in the second quarter of 2013, to more than 12% in the second quarter of 2018. Moreover, the average growth for the sample period was 5.5% and the standard deviation was almost 3%.

As mentioned above, the value of IPP as a percentage of GDP has been increasing through our sample period from 5.2% at the beginning of 2013 to 5.8% by 2020. This 0.6% increase in value is coming solely from an increase in private IPP, such that by the beginning of 2020, private IPP constituted around 4.7% of GDP and government funded IPP the remaining 1.1%.

Figure 1: Nominal IPP growth by vintage

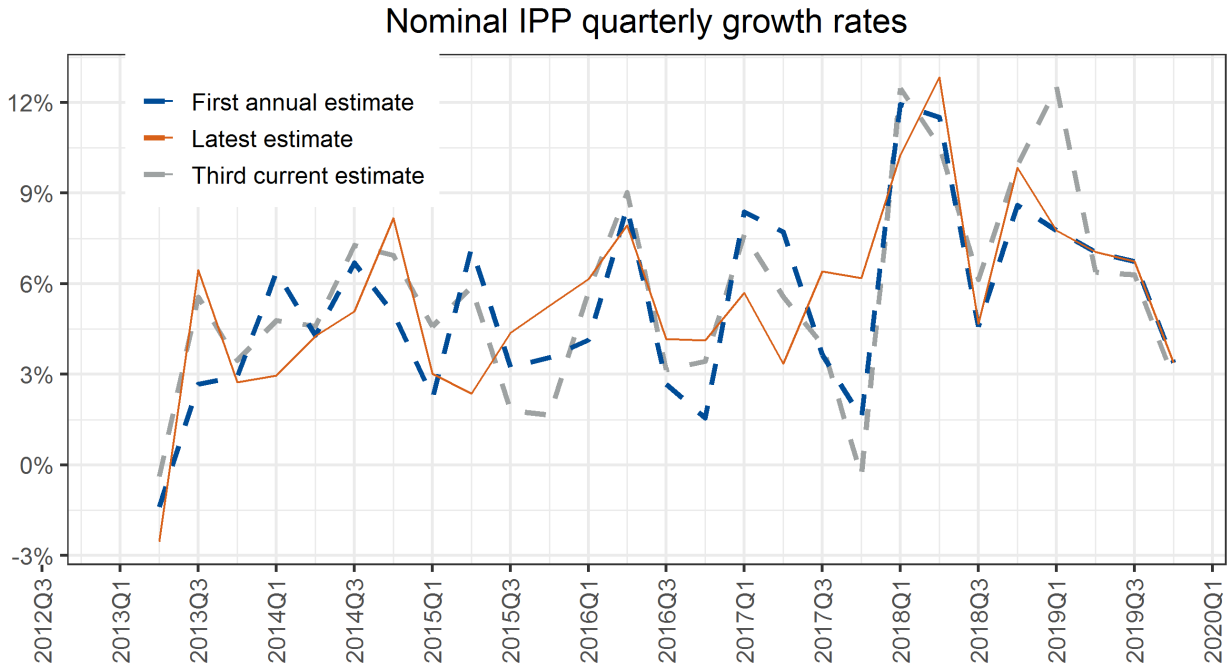
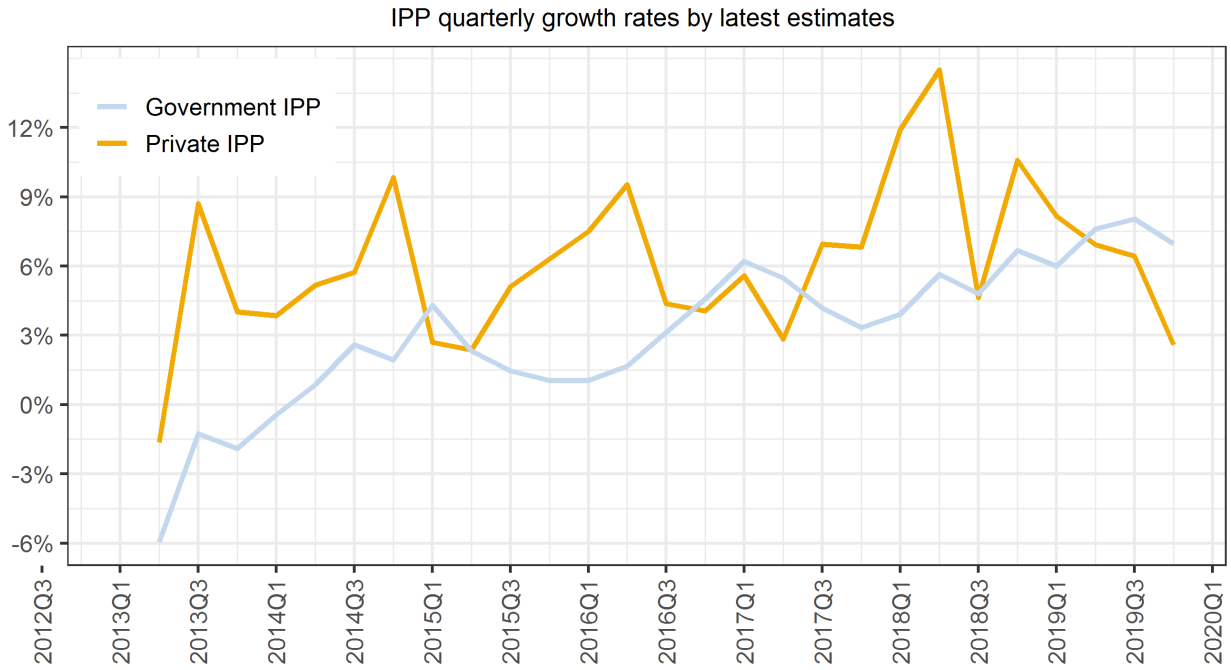


Figure 2 shows the annualized quarterly growth rates of government and private IPP. As one can see, private IPP growth is larger than government IPP for most of the sample period, although government IPP growth exhibits a slightly positive trend.

Figure 2: Government versus Private IPP nominal growth



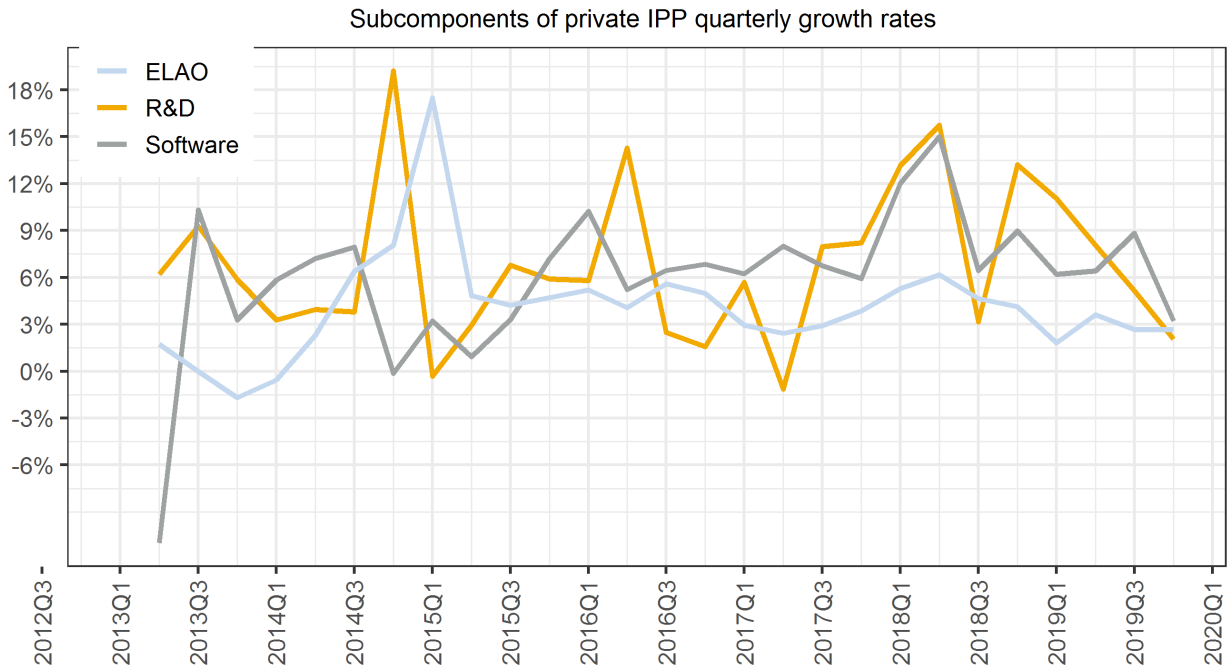
For the whole sample period, the average private IPP growth was 6.1%, with a standard deviation of 3%, while the average government IPP growth was 3.1%, with a standard deviation of 2.7%.

As mentioned before, the major components of private IPP are Software, R&D, and ELAO. The weight of ELAO as a percentage of GDP remained stable around 0.4% in our sample period, while the weights of Software and R&D increased from 1.7% to 1.9%, and from 2% to 2.3% respectively.

Figure 3 shows the annualized quarterly growth rates of these three components.

The average growth rates for Software, R&D are relatively similar, 6 and 6.8 percent respectively, while the average growth rate of ELAO is 4.1 percent. In terms of volatility, the standard deviations of Sofware and ELAO are slightly above 3 percent, while the standard deviation of R&D is higher, around 5 percent.

Figure 3: Major Components of Private IPP nominal growth



Moreover, the correlation between Software and R&D growth was 0.15, indicating that these two subcomponents are somehow complements in firms' investment endeavors, while the correlation of Software and R&D growth with ELAO was almost 0.

2.2 Nominal versus Real IPP Growth

To try to disentangle the growth in quantities and the growth in prices, we show next the real growth of total IPP, private and government funded IPP, and the major components of private IPP.

The distinction between nominal and real growth is especially important for IPP since the bumpy and uneven adoption of technological products is usually linked to sharp decreases in prices and rapid innovation.

Figure 4 shows the annualized quarterly growth of real IPP for our whole sample period computed using the third current estimate, the first annual estimate, and the latest estimate available. The broad picture of growth for the whole period does not change much no matter which of these three estimates we use to compute growth, although the comprehensive revisions included in the latest estimate have changed our understanding of growth in the second half of 2015 and 2018.

As one can see in Figure 1, the quarterly annualized rate of real IPP in our sample ranges from around -3% in the second quarter of 2013, to around 10% in the second quarter of 2018.

A quick comparison between nominal and real IPP growth between Figures 1 and 4 shows that the average real growth of IPP was lower, 4.8% versus 5.5%, and more volatile, 3.4% versus 3% than the nominal growth of IPP.

A lower real growth during this period indicates that prices of IPP grew faster than the actual quantities of IPP produced during this period, showing a strong demand for this kind of investment.

Figure 4: Real IPP growth by vintage

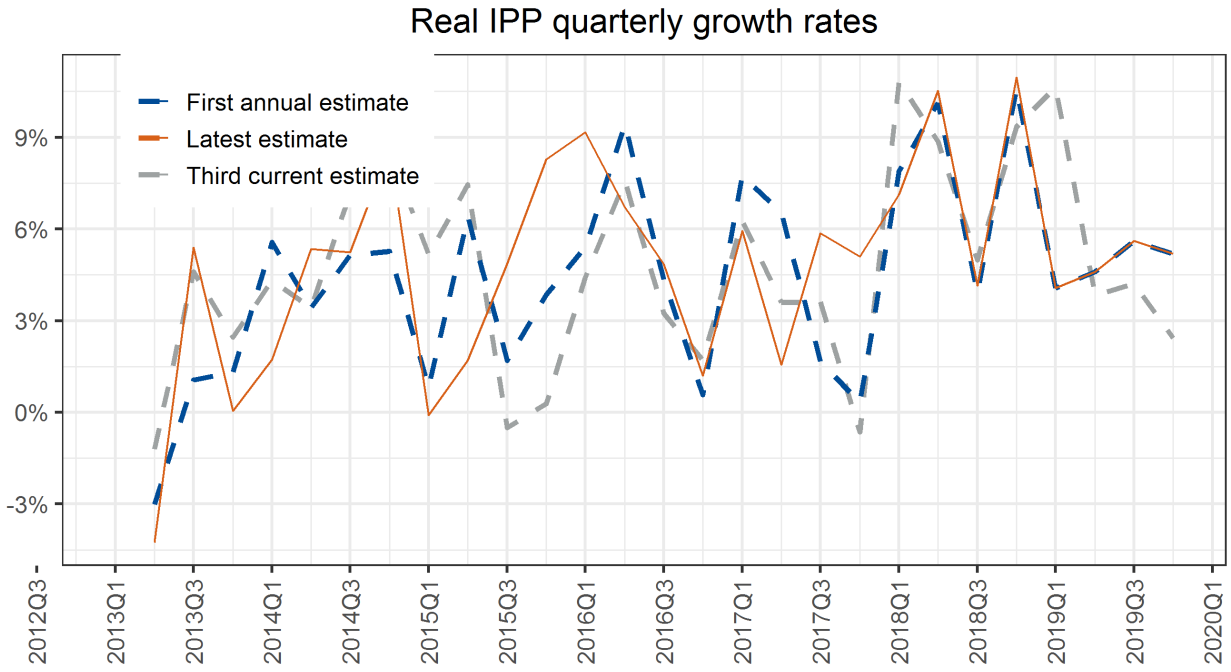


Figure 5 shows the different annualized quarterly real growth rates of government and private sector IPP.

As in their nominal counterparts, real growth of government IPP was lower than that of the private sector, 2% and 5.5% respectively, and as for total IPP, real growth rates were lower than nominal ones, but their volatility was higher.

Looking at each of the growth rates of the major subcomponents of real private IPP, and comparing then with their nominal counterparts, gives us information about the relative evolution of prices of Software, R&D, and ELAO.

Figure 6 shows that as it was the case for nominal growth, average real growth of R&D and Software is higher than ELAO (4.7%, 7.3% and 2.8% respectively). However, Software is the only subcomponent for which real growth is higher than nominal growth, 7.3% versus 6%, pointing to a decrease in Software prices during our sample period.

Figure 5: Government versus Private IPP real growth

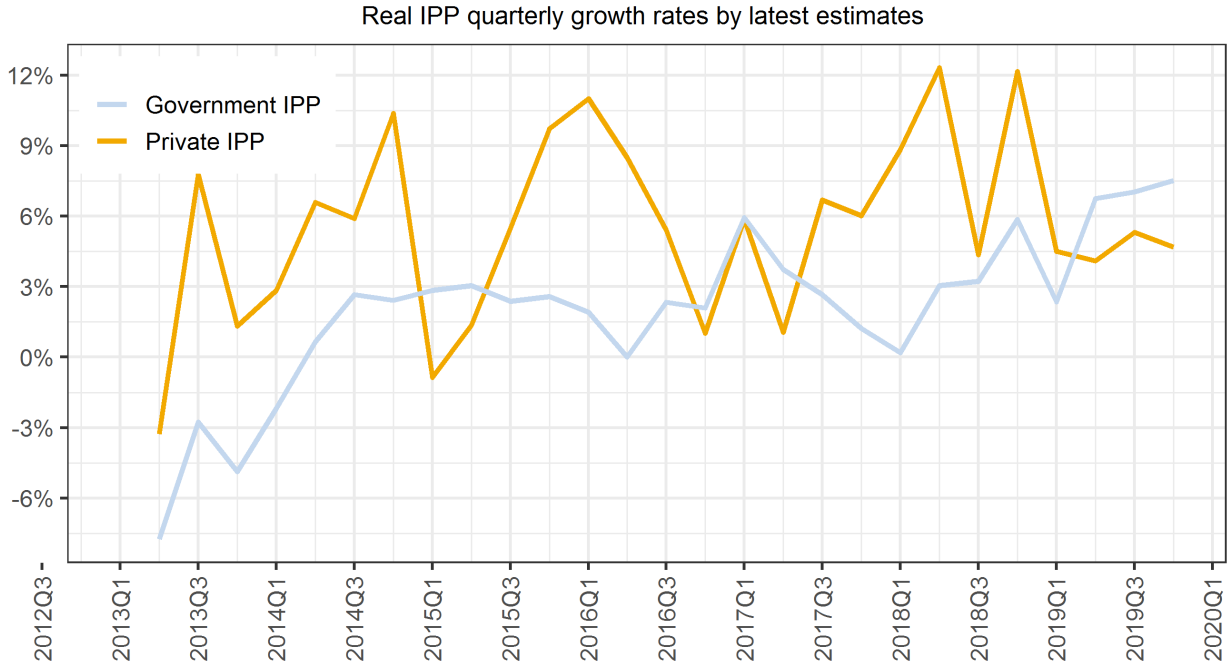
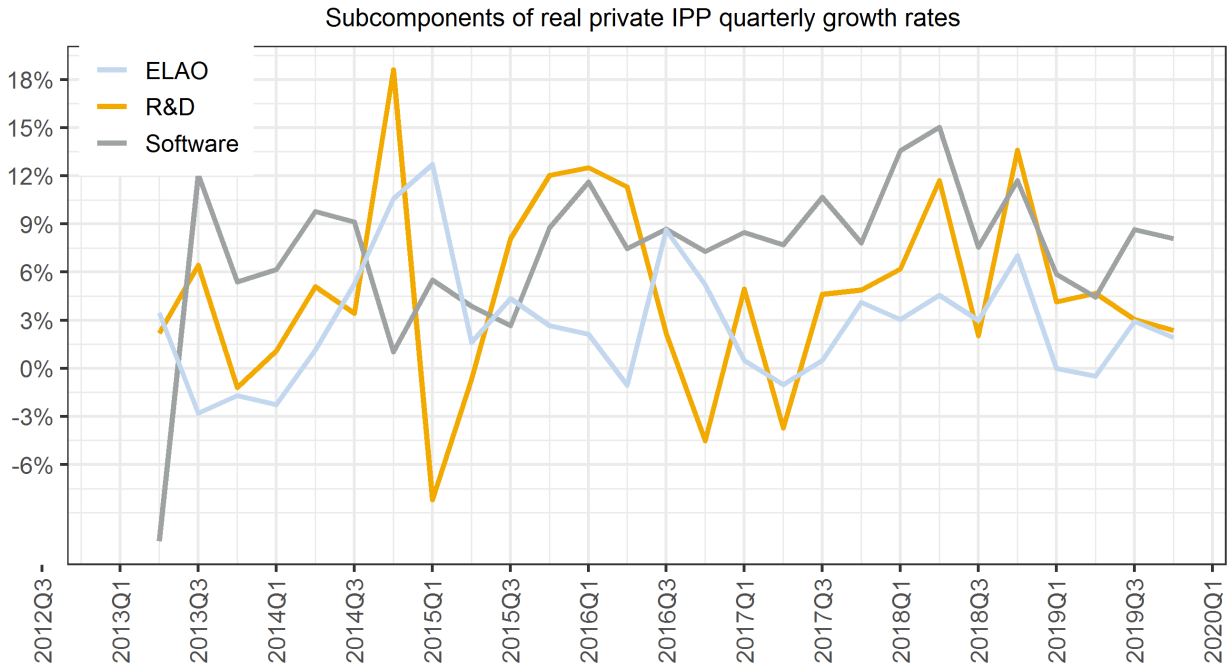


Figure 6: Major Components of Private IPP nominal growth



3 Sector Analysis

As De Loecker and Syverson (2021) point out, the access to micro data since the beginning of this century has exploded, making firm-level data more easily available. However, we think the sector level is the right aggregate to study the relationship between IPP investment and capital and productivity.

To illustrate the heterogeneity of investment patterns in IPP by industry, we examine the sectors listed in Table . We have settled in the following sectors as they are a good representation of the U.S. economy as a whole. The industries are listed from bottom to top in terms of nominal gross output.

Without loss of generality, from now on, we will use the first year of available data as a reference year to construct relative or indexed measures. This means that for tables or figures using nominal and real gross output, and labor productivity from the BEA database, 1998 will be our year of reference. For series such as investment and capital, the earliest year available is 1980.

Table 2 shows the industries that comprise each of our chosen sectors. All are standard, except the Healthcare sector, where social assistance has been excluded, and the Consumer services sector, that we have built ad hoc.

More importantly, table 2 also shows nominal output per worker in each industry relative to all industries. Here, it is interesting to notice that the majority of industries inside the

Table 1: Nominal gross output in 1998

2012 Codes	NAICS	Dollars
623	Nursing and residential care facilities	44581.04
72	Accommodation and food services	56514.10
61	Educational services	60120.00
485	Transit and ground passenger transportation	72368.85
44-45	Retail trade	72655.78
622	Hospitals	84241.86
71	Arts, entertainment, and recreation	100623.96
621	Ambulatory health care services	107288.98
55	Management of companies and enterprises	140202.40
54	Professional, scientific, and technical services	154016.79
482	Rail transportation	179896.23
52	Finance and insurance	209307.07
32-33	Durable goods	211371.30
481	Air transportation	218167.92
31-32	Nondurable goods	260428.46
51	Information	266353.54

Source: Bureau of Economic Analysis

Healthcare and Consumer services sectors have lower output per worker compared to other sectors.

Table 3 shows the initial full-time employment levels in 1998 and their average annual growth[1]

Up to 2019, to exclude the effects of COVID-19 in our trend study. It is worth noticing two trends: first, that the employment growth in the sector with lowest relative productivity in 1998, the Consumer services and the Healthcare sector have seen a strong growth in employment throughout our sample. And second, that the three most productive sectors in 1998, this is, Durable and Nondurable goods and Information have suffered significant employment losses by the end of 2019.

All the data on investment flows by industry and type is publicly available and comes from the Nonresidential Detailed Estimates produced by the BEA at https://apps.bea.gov/national/FA2004/Details/Index.htm.

For some sectors, investment in structures and equipment is available since 1901, however, the first investment in software recorded for most industries starts in 1980, so when we can, we use data since then[2].

[1] Average annual growth between years t+T and t has been constructed as $(\frac{Employment_{t+T}}{Employment_t} - 1)/T$

[2] Eckert at al (2021) study the combination of ITC investment and the high skill wage premium of the 80's to explain the urban concentration of some sectors.

Table 2: Relative nominal output per worker in 1998.
Normalized to 1.00 for All industries.

Healthcare sector	
Nursing and residential care facilities	0.32
Hospitals	0.61
Ambulatory health care services	0.78
Consumer services sector	
Accommodation and food services	0.41
Educational services	0.44
Transit and ground passenger transportation	0.53
Retail trade	0.53
Arts, entertainment, and recreation	0.73
Rail transportation	1.31
Air transportation	1.58
Management of companies and enterprises	1.02
Professional, scientific, and technical services	1.12
Finance and insurance	1.52
Manufacturing	
Durable goods	1.53
Nondurable goods	1.89
Information	1.93

Source: Bureau of Economic Analysis

Table 4 below shows how the investment in IPP and its two main components have changed by sector from 1980 to 2020.

Table 4 ranks the industries by IPP investment share. IPP investment shares have been computed as shares of total investments, while Software and R&D investment shares have been computes as shares of IPP investment. It is interesting to note how the position of the industries marked in red have changed over time. And also note how the shares of IPP in 2020 are generally much larger than those in 1980.

Table 3: Evolution of full-time employment by sectors

	Employment 1998	Annual growth 2019-1998
Durables	10781	-1.28 %
Nondurables	6465	-1.35 %
Information	3035	-0.62 %
Fin&Ins	5318	0.88 %
Prof&Tech	5776	2.85 %
Management	1581	2.04 %
Consumer	24686	1.38 %
Healthcare	9532	2.72 %

Source: BEA. Full-time equivalent employees in thousands.

Table 4: Investment shares patterns and Production functions changes

Rank 1980	IPP 1980	Software 2020	R&D 2020	Rank 2020	IPP 2020
Prof&Tech	0.46	0.26	0.42	Management	0.72
Durables	0.35	0.08	0.56	Prof&Tech	0.68
Information	**0.24**	0.21	0.20	Durables	0.64
Nondurables	0.22	0.04	0.56	Nondurables	0.61
Management	0.11	0.69	0.02	Fin&Ins	0.49
Fin&Ins	0.10	0.44	0.04	**Information**	**0.41**
Healthcare	0.04	0.08	0.06	Consumer	0.23
Consumer	0.02	0.14	0.09	Healthcare	0.14

Source: BEA at https://apps.bea.gov/national/FA2004/Details/Index.htm

4 Manufacturing sector

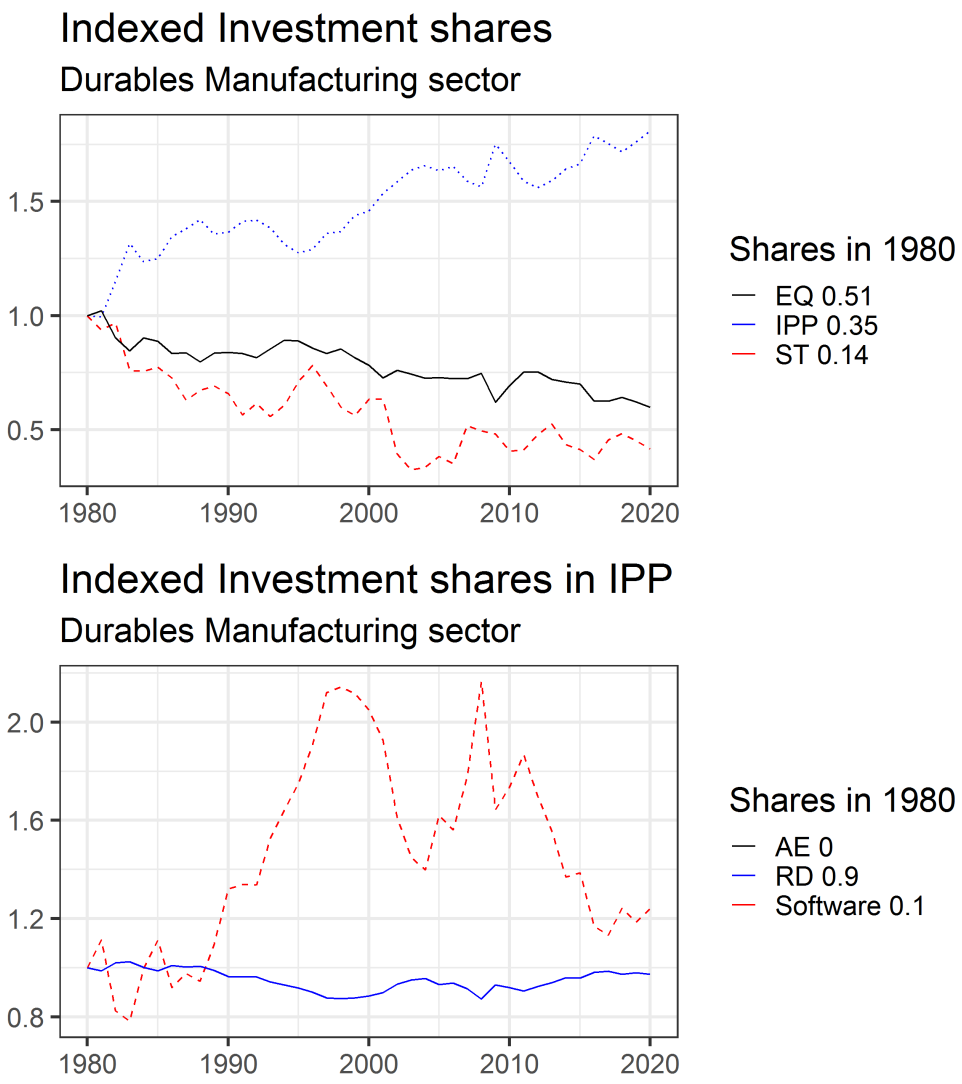
The manufacturing sector is composed of many different industries, so we are going to classify it between durable (NAICS 33) and nondurable goods (NAICS 31 and 32).

The durables manufacturing sector is composed by many industries. These industries are Wood products (NAICS 321), Nonmetallic mineral products (NAICS 327), Primary metals (NAICS 331), Fabricated metal products (NAICS 332), Machinery (NAICS 333), Electronic and computer products (NAICS 334), Electrical equipment, appliances, and components (NAICS 335), Motor vehicles, bodies and trailers, and parts (NAICS 3361-3), Other transportation equipment (NAICS 3361-3), Furniture and related products (NAICS 337), and lastly Miscellaneous manufacturing (NAICS 339). The industries with highest investment throughout our sample are Electronics products and Computers, and Motor vehicles, bodies and trailers, and parts.

As shown in table 4 the durable and non-durable industries have been among the leaders

in IPP investment over our time period.

Figure 7: Growth of investment shares



In Figure 7 and in the rest of figures in the paper, the shares of investment of type i at time t in the broader category of investment I, $s_{t,i}$, have been indexed to year 1980 or t=80, and constructed as following:

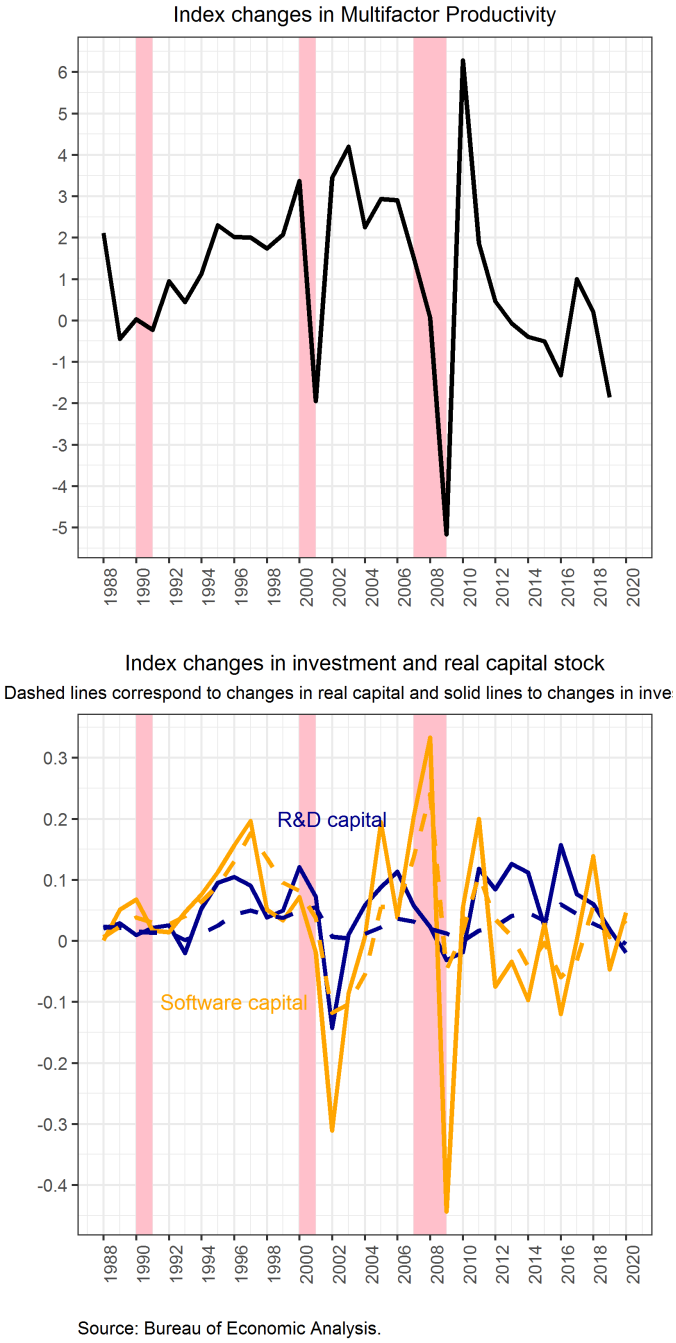
$Is_{t,i} = \frac{s_{t,i}}{s_{80,i}}$, where $s_t = \frac{Inv_{t,i}}{Inv_{t,I}}$.

So the index series shown in Figure 7 all start in 1980 and have a value of 1, and the difference between two points in time, t_1 and t_2 there can be interpreted as the growth in investment shares of type i between t_1 and t_2, this is, $Is_{t_2,i} - Is_{t_1,i}$.

The top panel of Figure 7 shows that IPP investment in 1980 was absorbing more than a third of total investment expenses, and its importance relative to investment in equipment and structures during our sample period grew steadily.

The lower panel shows that in 1980, 90% of the investment in IPP was destined to R&D, although IPP investment in Software outgrew investment in R&D, specially until the end of the 90's and then again immediately before and after the Great Recession.

Figure 8: Trend changes in MFP and IPP: Durables



Data on multifactor productivity (MFP) at the industry level comes from the BLS and it is available since 1988. We have also computed changes in labor productivity using gross

output and full-time employment by industry using the data available at the BEA, and the correlation between both series is very high (around 0.9 for this sector), so given that labor productivity is only available since 1998, Figure 8 only shows annual index changes in multifactor productivity (top panel) and in nominal investment and real capital stock of the components of IPP (lower panel).

The index changes in contemporaneous MFP and investment in Software and R&D are positively correlated, and as expected, this correlation is higher than the correlation between the changes in MFP and real capital in Software and R&D.

In the three recessions shown in Figure 8, one can see that software capital and investment were still increasing while MFP had begun to fall. The same was true for changes in R&D investment except during the Great Recession were this investment started declining early on along with MFP.

We also see that after the Great Recession the stock of the components of IPP capital and the attending investment moved in different directions.

The nondurables manufacturing sector is also composed of many industries: Food, beverage, and tobacco products (NAICS 311 and 312), Textile mills and textile product mills (NAICS 313 and 314), Apparel and leather and allied products (NAICS 315 and 316), Paper products (NAICS 322), Printing and related support activities (NAICS 323), Petroleum and coal products (NAICS 324), Chemical products (NAICS 325), and finally Plastics and rubber products (NAICS 326). The industries with highest investment throughout our sample are Chemical products and Food, beverage, and tobacco products.

The top panel of Figure 9 shows that IPP investment in 1980 was absorbing 22% of total investment expenses, compared to 35% for nondurables, and its importance relative to investment in equipment and structures grew continuously.

Meanwhile, the lower panel of Figure 9 shows that similar to durables most of the IPP investment is 1980 was dedicated to RD, 94%, and even though there was an increase in the share of IPP investment in software until the end of the 90's, by 2020, this trend had reversed almost completely.

Figure 9: Growth of investment shares

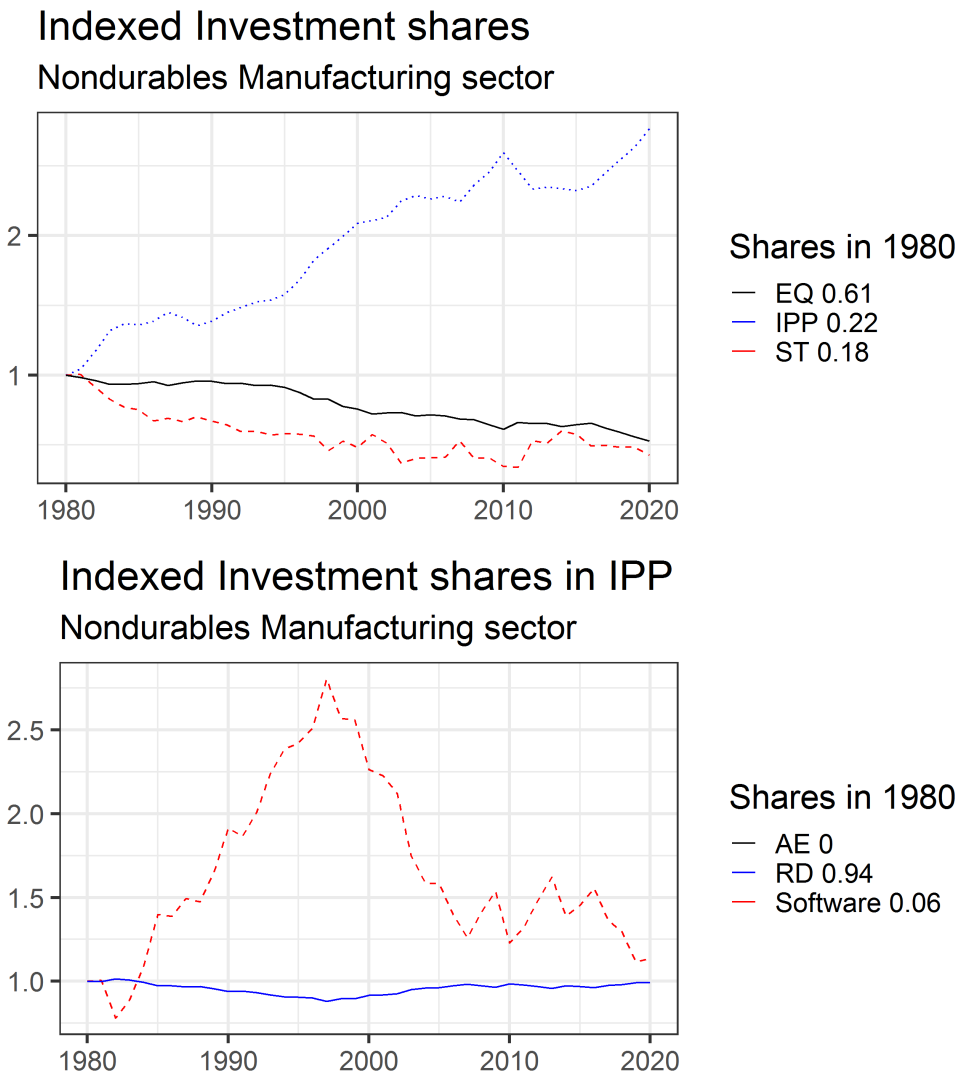
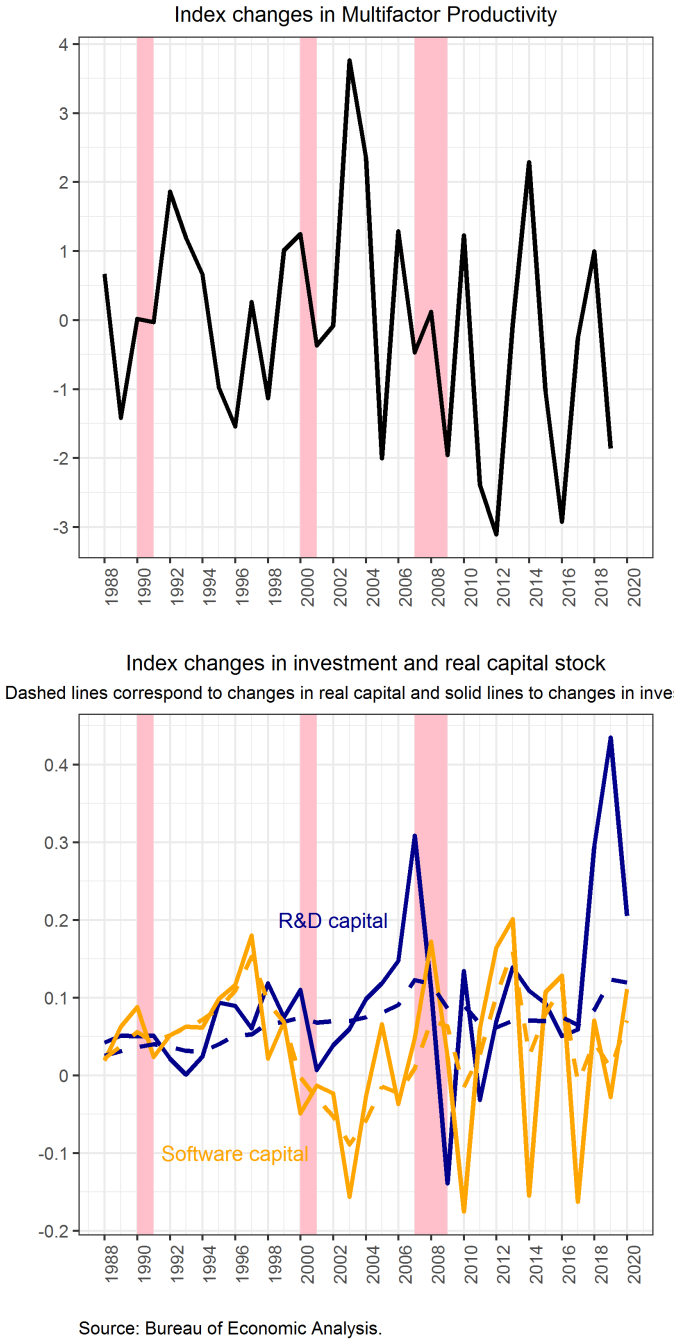


Figure 10 shows changes in MFP for nondurables along with the changes in IPP capital and investment. Note that the changes in MFP for the nondurable sector are much more volatile than similar changes in the durable sector, and the patterns in the comovements with RD and software investment and capital are much harder to see. RD investment is weakly positively correlated with MFP, but software investment is negatively correlated, and for this sector MFP is only weakly correlated to labor productivity, as opposed to what we found in the durable sector.

Figure 10: Trend changes in MFP and IPP: Nondurables

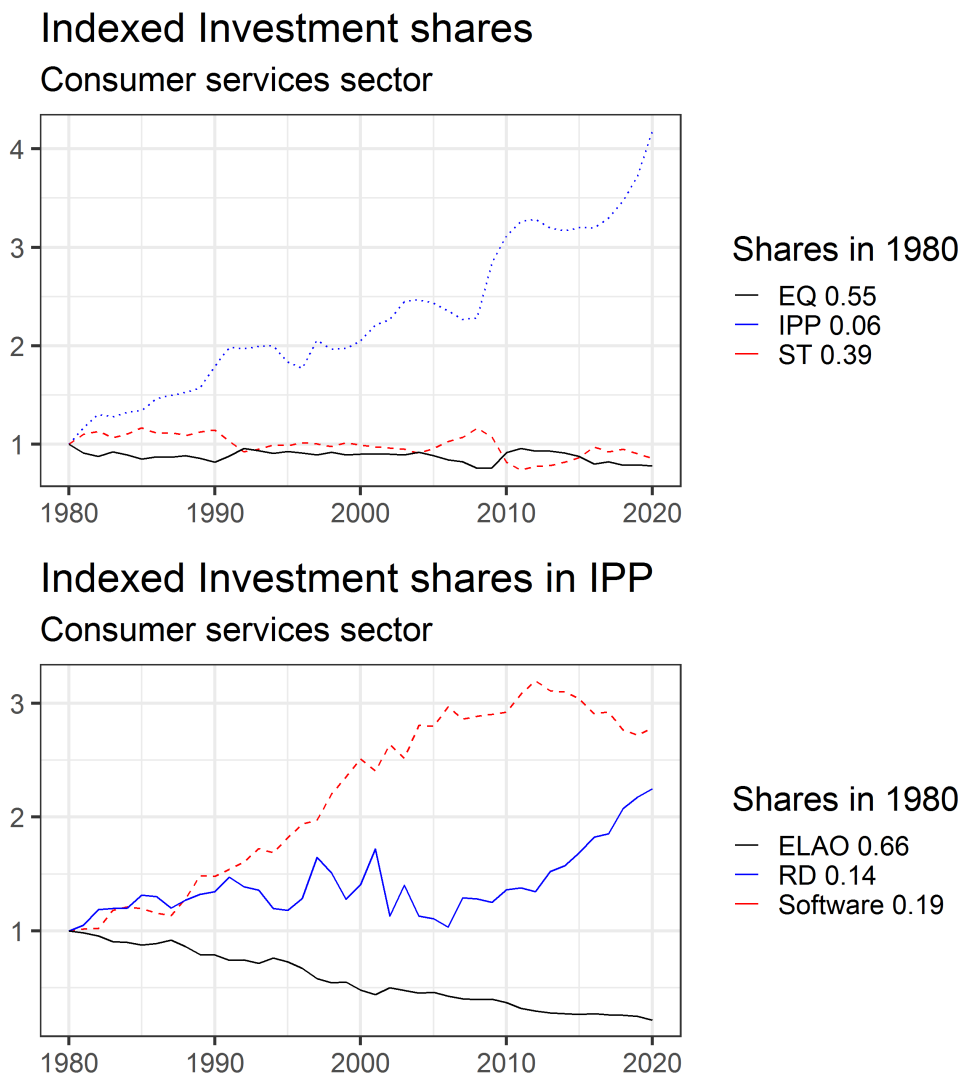


5 Consumer services

This sector comprises Retail (NAICS 44 and 45), Accommodation, Food, and Education services (NAICS 72 and 61), Arts, entertainment, and recreation (NAICS 71), and Air, Rail, Transit and Ground transportation (NAICS 481, 482, and 485).

In 1980, top panel of Figure we see that IPP had a very small investment share, but that investment share steadily grew over time.

Figure 11: Growth of investment shares



The lower panel show that about 14% of IPP investment went to R&D, 19% went to software, and the remaining 66% went to ELAO. The ELAO investment was concentrated on Arts, entertainment, and recreation. Since the beginning of our sample until the Great Recession, investment in software has been increasing, slowly displacing investment in ELAO, but after the Great Recession, the share of ELAO investment has stabilized, and the share of R&D investment has steadily increasing eroding the share of software investment.

Figure 12: Trend changes in MFP and IPP: Consumer services sector

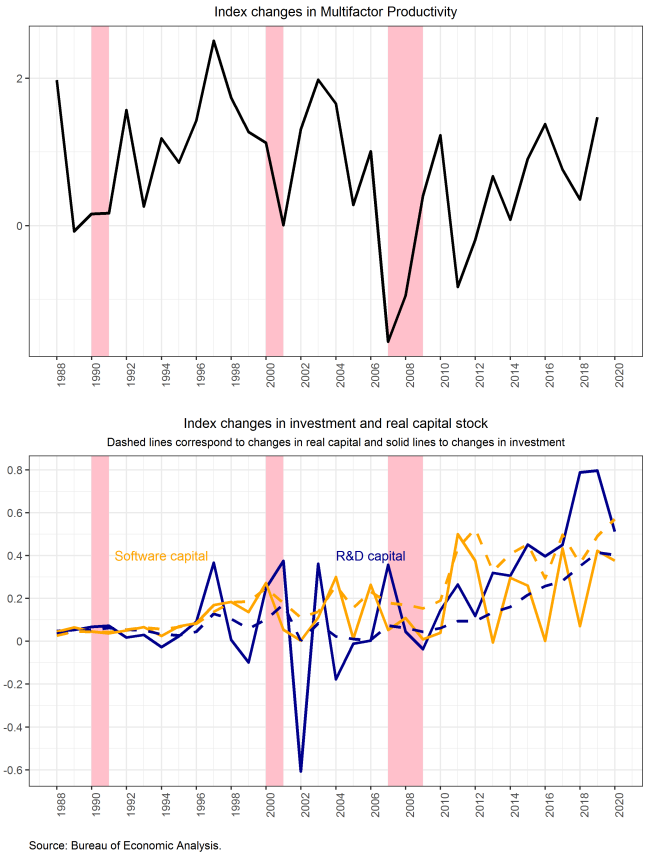


Figure 12 shows the changes in MFP along with the changes in IPP investment and capital stock. We see that changes in R&D and software stock relatively stable while MFP moves around much more. Because there is a steady decline in investment in ELAO, as indicated above, we did not place its trend in the Figure 12 .

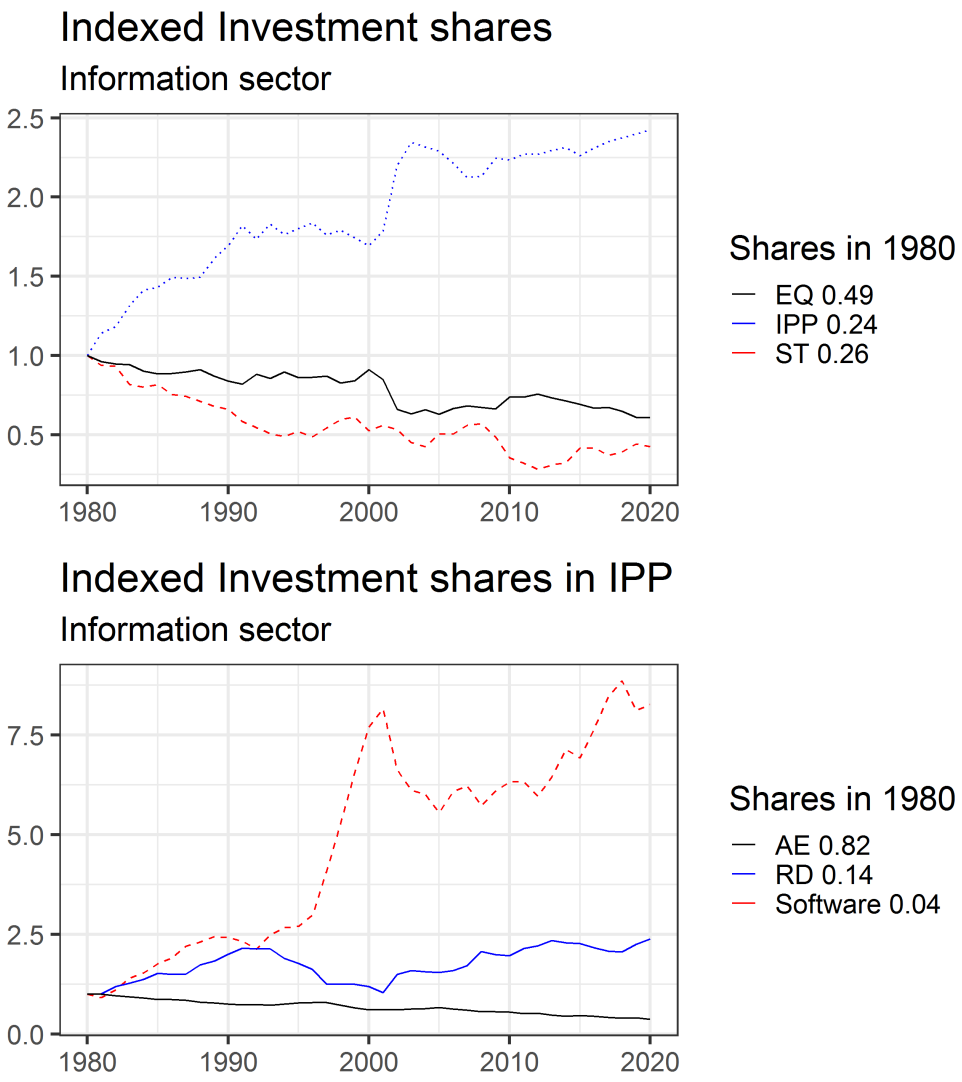
6 Information sector

As mentioned above, the Information sector has received special attention in the most recent decades as a growing employer of high skilled labor and experiencing continuous productivity increases. The sector grew at a rapid pace up to the 2001 High tech bubble bust but continued to grow at a considerable pace after that.

The Information sector is composed of Publishing industries (NAICS 511, including software), Motion picture and sound recording industries (NAICS 512), Broad- casting and telecommunications (NAICS 515 and 517), and Information and data processing services (NAICS 518 and 519). Up to 2000, investment in broadcasting and telecommunications accounted for more than 60% of total investment in this sector, but since then, its share has been shrinking steadily in favor of information and data processing services and publishing

industries.

Figure 13: Growth of investment shares



The top panel of Figure 13 illustrates the decomposition of total investment among structures, equipment, and IPP, and as one can see the initial shares of investment in 1980 were very similar to those of the nondurable sector above.

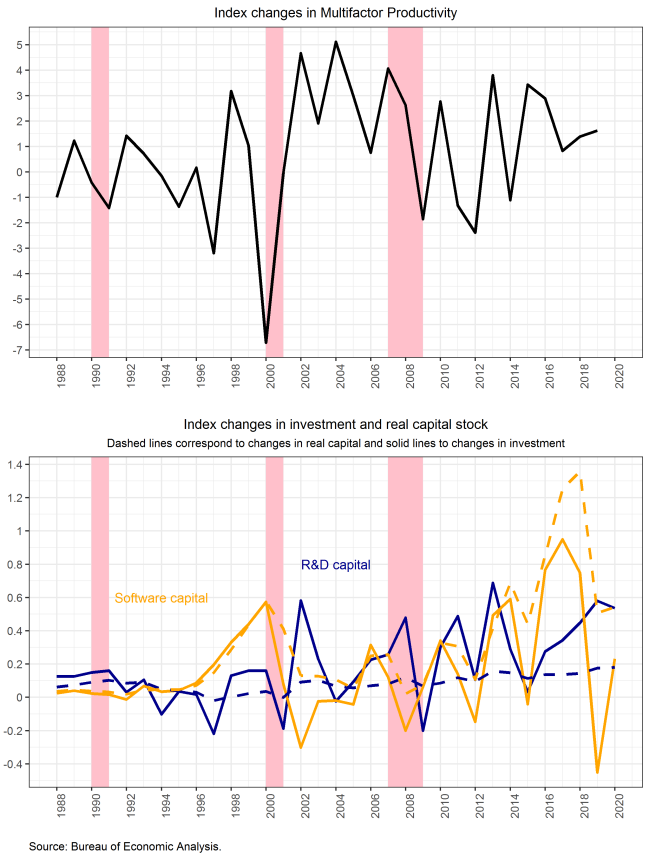
The Information sector, together with the Arts, entertainment, and recreation industry inside the Consumer services sector, is one of the few sectors in which investment in artistic and entertainment originals plays a significant role. But we see in the lower panel of Figure 13 that investment in software has grown the most since 1980.

The lower panel decomposes the IPP category into software, research and development, and artistic and entertainment originals. Consistent with the importance of broadcasting and telecommunications industries within the Information sector at the beginning of the

80's, the initial share of investment in artistic and entertainment originals was very high, 82%, but by the end of 2020, the share of the three major subcomponents of IPP investment inside the Information sector was much more balanced.

Next, Figure 14 below shows the relationship between IPP investment and productivity in the information sector. In this figure, it is interesting to notice that most of the IPP investment coming into the High tech bubble bust of 2000-2001 was in software, and the recovery in MFP after that was quick and sustained until the MFP losses observed during and after the Great Recession.

Figure 14: Trend changes in MFP and IPP: Information sector



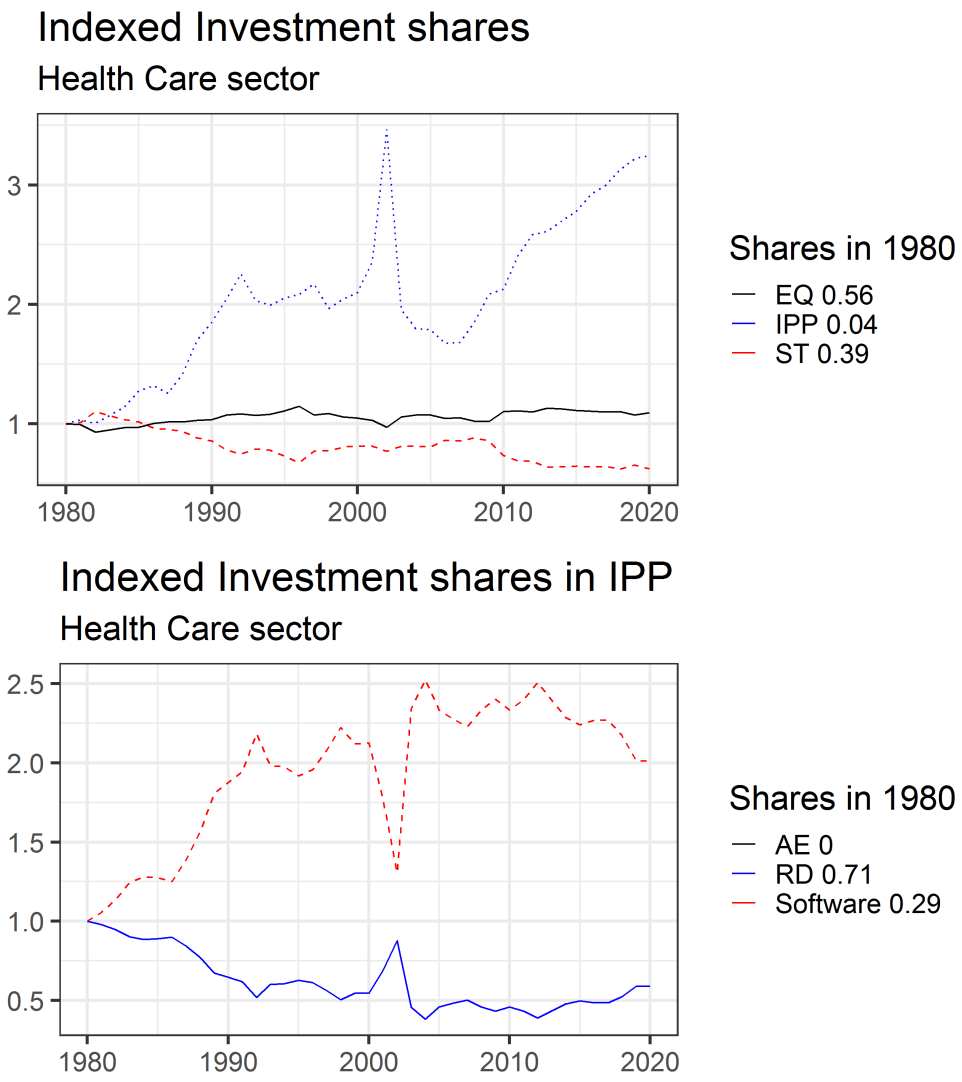
7 Healthcare sector

This sector is composed of Ambulatory services (NAICS 621), Hospital care (NAICS 622), and Nursing and other residential facilities (NAICS 623). In 1980, 56% of investment that year was used to buy equipment, 39% went to structures, and only the remaining 4% was invested in IPP. However, as the top panel of Figure refhealth shows investment flows into structures as a percentage of total investments suffered a slow but steady decline in favor of IPP investment during the period analyzed, changing the composition of the capital used in

production in this sector.

The top panel of Figure 15 shows the meager expenses in IPP investment at the beginning of our sample, while the lower panel shows the decomposition of investment inside the IPP category, into software, research and development, and artistic and entertainment originals. In 1980, the majority of IPP investment in the healthcare sector went into RD, (71%), but by 2020, the share of RD investment inside IPP had fallen by about a half, and software had become the major subcomponent of IPP investment, absorbing about 60% of the new investment in IPP in the sector.

Figure 15: Growth of investment shares



In 2002, we observe a huge spike in R&D investment expenses. We plan to investigate this in next versions of the paper.

Figure 16: Trend changes in MFP and IPP: Healthcare sector

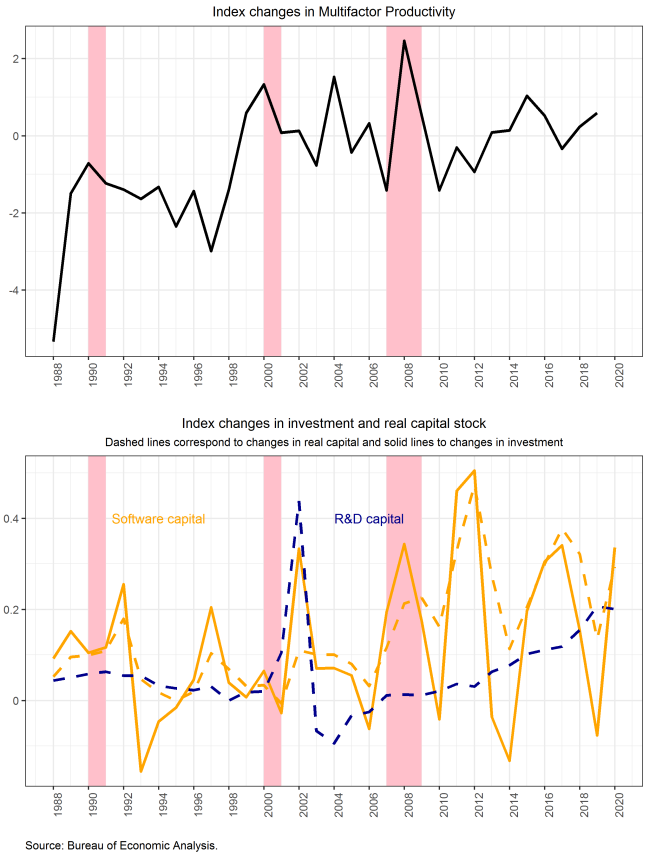


Figure 16 below shows how the trends in measured productivity in the top panel compared to the trends in the investments in IPP in the bottom one. As the production functions in the industries comprising the health care sector are quite varied, one must look at these trends by industry and this will be done in future work. Note also that there is no solid line for R&D investment as in similar figures for previous sectors because the magnitude of the change in 2002 is off the charts.

8 Professional, scientific, and technical services sector

This sector is composed of three industries, Legal services (NAICS 5411), Computer systems design and related services (NAICS 5415), and Miscellaneous professional, scientific, and technical services (NAICS 5412).

Figure 17 shows the path of investment shares. In the top panel, we want to highlight that the IPP share in this sector was one of the highest in 1980. A significant 46% of investment was used to buy or develop IPP, 39% went to equipment, and only the remaining 16% was invested in structures. Through time, investment flows into IPP grew even more, increasing their share of total investment, taking up funds from investment in both equipment and

structures.

The lower panel shows that inside IPP investment. Note that the investment share of R&D inside IPP investment remained relatively constant. The share of investment in software grew, but mostly at the expense of artistic and entertainment originals.

Figure 17: Growth of investment shares

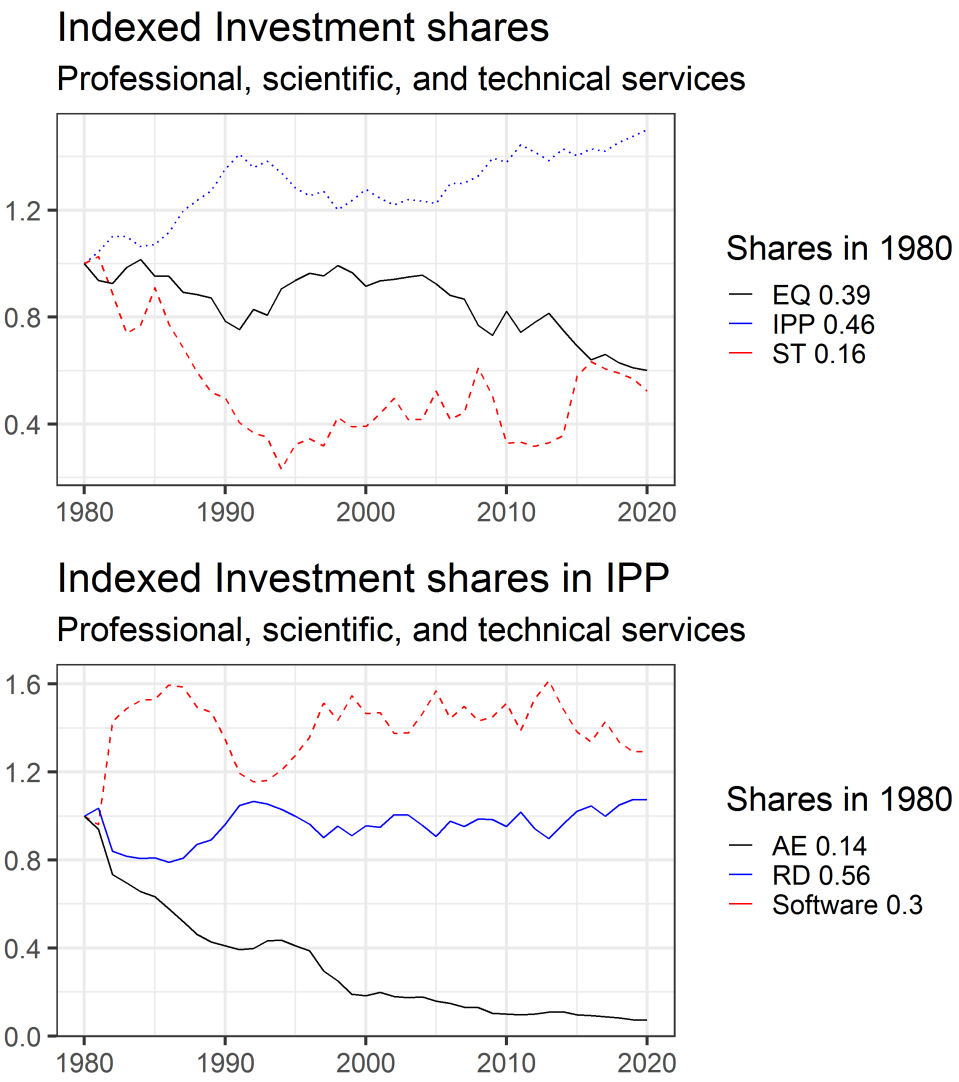
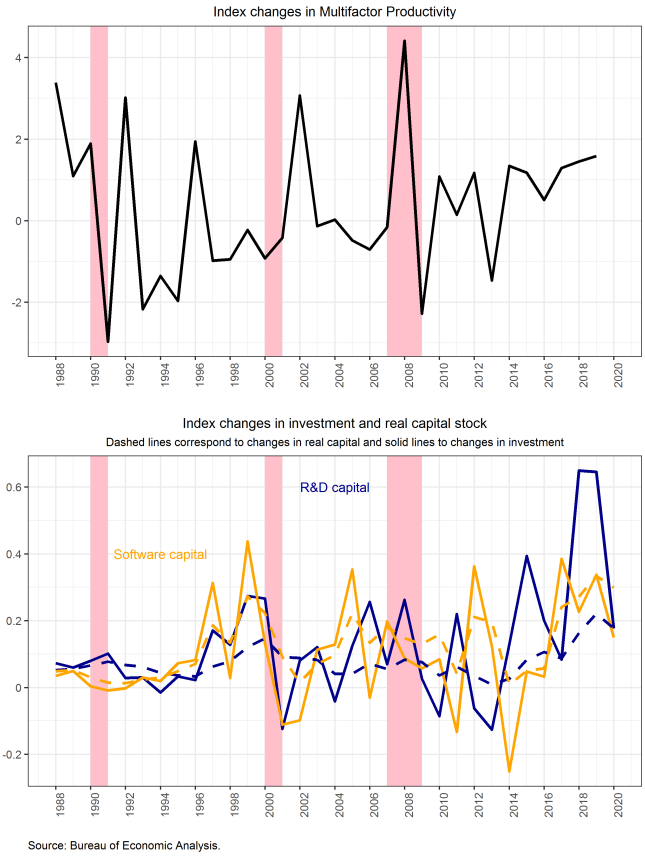


Figure 18 shows the trends in IPP investment and productivity. As Table 3 showed, this sector has the largest employment annual growth rate in the 1998-2019 period. Also, note in the 2000 recession, IPP investment and capital is decreasing while MFP is rising. However in the Great Recession this relationship turned positive.

Figure 18: Trend changes in MFP and IPP:
Prof&Tech services sector



9 Finance and Insurance

The finance and insurance sector in the economy has received special attention since the 80's due mostly to the innovation of financial products introduced during the 90's. This sector is composed of Federal Reserve banks (NAICS 521), Credit, intermediation and related activities (NAICS 522), Securities, commodity contracts and investments (NAICS 523), Insurance carriers and related activities (NAICS 524), and Funds, trusts, and other financial vehicles (NAICS 525).

During our time period investment flows into equipment and structures as a percentage of total investments suffered a slow but steady decline in favor of IPP investment during the period analysed, changing the composition of the capital used in production in this sector. For example, while expenses in equipment and structures grew about 10 times, expenses in IPP grew 50 times. This is illustrated in the top panel of Figure 19. The bottom panel of Figure 19 illustrates looks at the components of IPP investment and shows that in 1980, all IPP investment in the finance sector went into software, and by 2020, even though software

remained the bulk of IPP investment (90% of it), RD investment had grown up to 10% of it.

Figure 19: Growth of investment shares

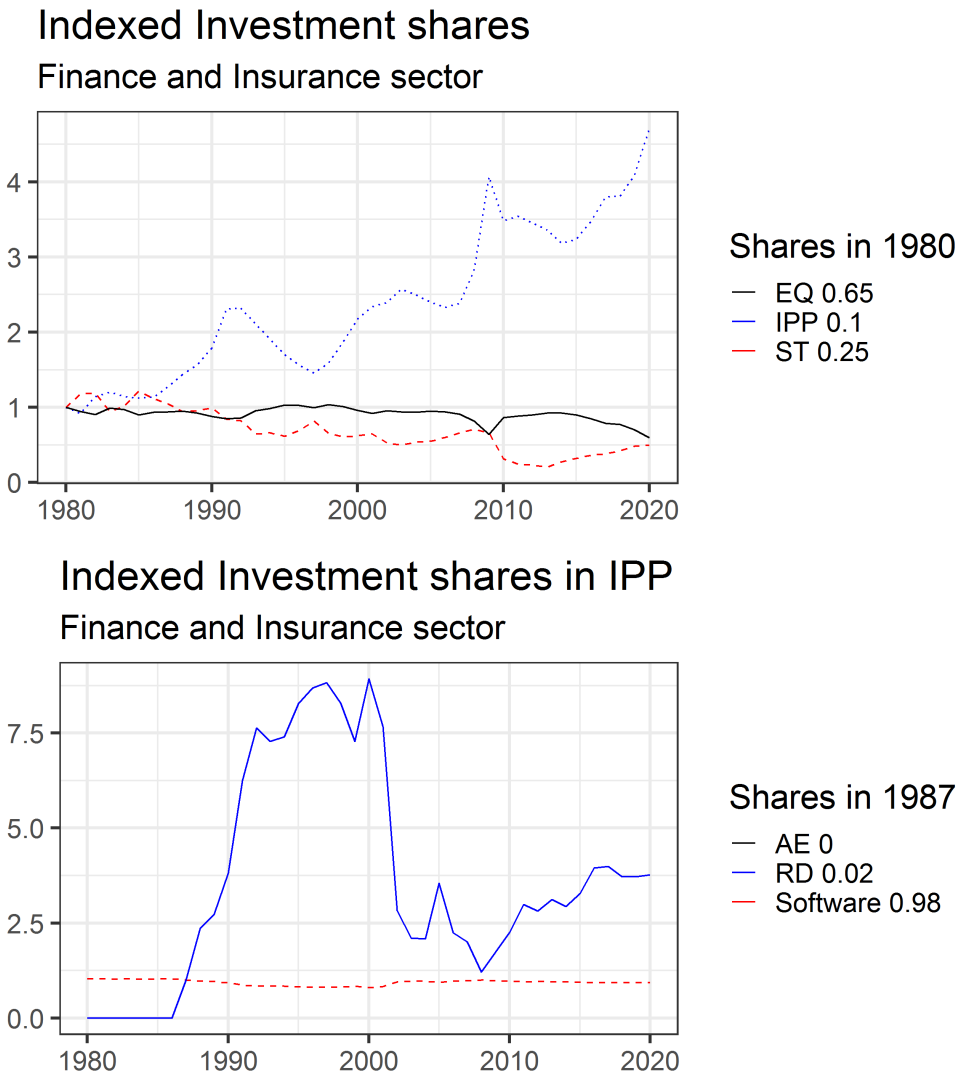
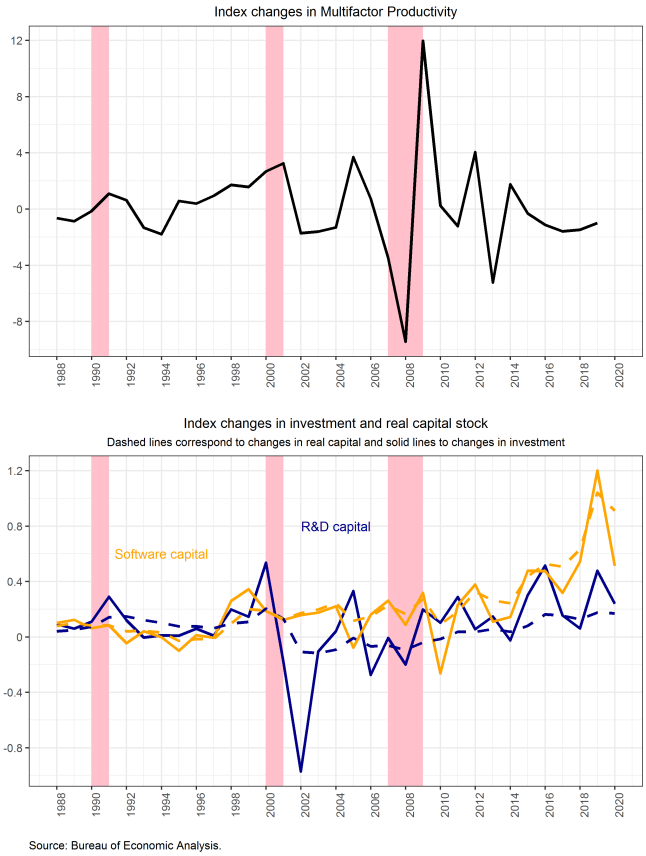


Figure 20 illustrates the trend in productivity along with the components of IPP. As can be seen in the lower panel of Figure 20, RD has been the most volatile component of IPP investment, although it is also the smallest (as shown in Figure 19. In any case, it is also clear that the huge swings in MFP in the top panel are not related to the relatively mild swings in RD and Software shown in the lower panel.

Figure 20: Trend changes in MFP and IPP: Finance and Insurance sector



10 Management of Companies and Enterprises sector

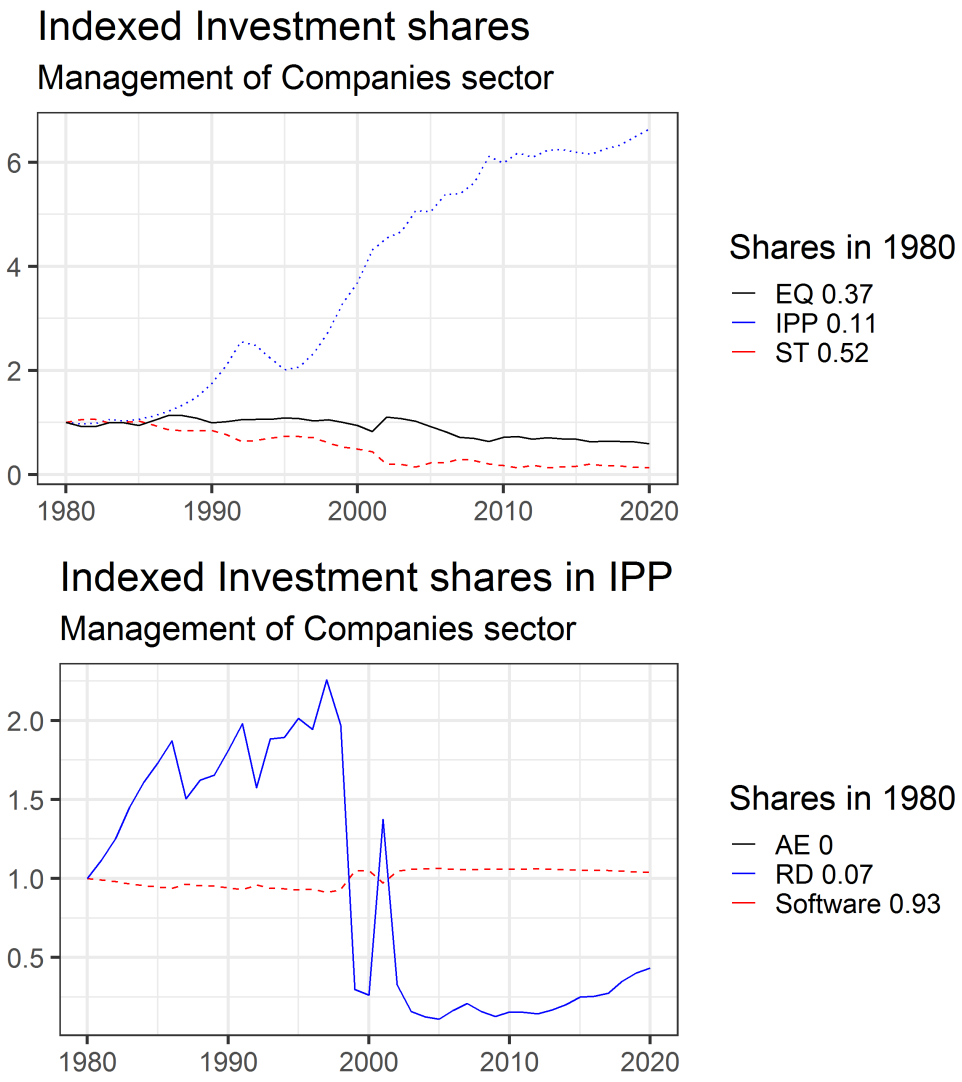
This sector (NAICS 55) comprises establishments that hold securities or equity interests of other companies for the purpose of controlling or influencing management decisions and establishments that administer, oversee, and manage strategic or organizational planning and decision-making of companies. Establishments in this sector perform activities that are often undertaken in-house by establishments in many other sectors of the economy.

Government establishments engaged in administering, overseeing, and managing governmental programs are not included in this sector, and are classified in the Public Administration (NAICS 92). Other establishments primarily engaged in providing a range of day-to-day office administrative services, such as financial planning, billing and record keeping, personnel, and physical distribution and logistics, are classified as Office Administrative Services (NAICS 56111).

The upper panel of Figure 21 shows how investment in IPP did not take off until 1995, while the lower panel shows that most of IPP investment was in software. Note that the importance of IPP investment has steadily grown, and unsurprisingly, most of the investment

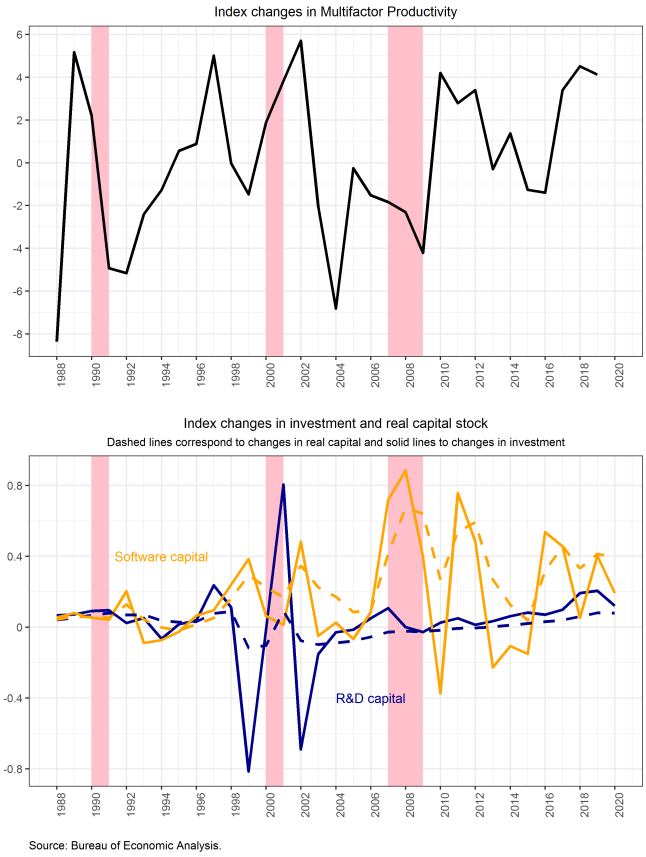
in IPP has continued to be in software.

Figure 21: Growth of investment shares



Finally, Figure 22 shows the trends in productivity and the trends in IPP investment. There are large swings in MFP and software investment, and the correlation between these two series is positive.

Figure 22: Trend changes in MFP and IPP:
Management of companies sector



11 Summary and Conclusions

Discussions of intangible capital generally look at aggregates, even when the attention is directed to aggregates. In this paper we use the BEA decomposition of intellectual property products to show that industry investment in intellectual property products is an aggregation of sometimes very different trends in the components: R&D, Software, and Entertainment, literary and artistic originals. Our descriptive analysis examines seven industry sectors: Manufacturing (Durable and Non-durable); Healthcare; Finance and Insurance; Consumer Services; Management of companies and enterprises; Professional scientific and technical services; and Information. One of the main reasons for the attention paid to intangible capital is its potential role in explaining trends in productivity. In the 7 sectors that we examine, it is generally true that trends in MFP are not dependent on trends in IPP capital stock or investment. Our analysis is conditioned on the measures compiled by BEA and when computing capital stock volumes there is the potential of mismeasurement. In future work, we will examine the IPP trends more closely and see if they are better suited to explaining

labor productivity.

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