Marketing, Other Intangibles, and Output Growth in 61 United States Industries

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Abstract

Experts in the System of National Accounts (SNA) recently considered whether marketing could be included as a capital asset in the national accounts and later recommended that marketing should be an intangible in the 2025 SNA (IMF, 2022; IMF, 2023). This paper contributes to that discussion by developing macroeconomic measures of marketing investments and stocks for the United States. We also construct and analyze measures of how marketing and other intangibles contribute to output growth in the 61 industries that comprise the U.S. private business sector.

We find that marketing contributes approximately as much to output growth as software and R&D (research and development) do. From 1987 to 2020, our preferred estimates of the annual contribution to output growth are 0.15 percentage point for R&D, 0.19 for software, and 0.18 for marketing. Software grows more rapidly, whereas marketing has a larger factor share. Marketing contributes even more to output if quality is adjusted to allow for better targeting associated with digital advertising. There is a close relationship between data flows, software, and digital marketing, and national accountants must allocate expenditures among these categories.

Keywords

Marketing, advertising, intangibles, intellectual property capital

JEL Codes

M31, M37, O63

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1. Introduction

In recent years, intangibles have played an increasing role in discussions of economic growth. The early study by Corrado, Hulten, and Sichel (2005) was especially influential because it established the framework within which economists typically examine the importance of intangibles. Subsequent work has improved measurement and understanding of many intangible assets. Corrado, Hulten, and Sichel (2009) concluded that incorporating intangibles in national accounts substantially increased measures of capital deepening and somewhat raised labor productivity growth.

Empirical research has shown that marketing often increases purchases for several years and therefore qualifies to be counted as investment. An early experiment demonstrated that random adjustments in the amount of advertising on cable television affected household purchases of products for at least two years (Lodish *et al.*, 1995). More recent research used natural experiments to show that advertising influences behavior for years (Bursztyn and Cantoni, 2016; Bronnenberg *et al.*, 2012).

Corrado and Hao (2014) prepared comprehensive estimates of marketing investment for the U.S. macroeconomy, combining estimates of purchased advertising, several additional types of purchased marketing services, and own-account marketing. Heys and Fotopoulou (2022) consider investment in design, organizational capital, firm-specific training, branding, and financial product innovation. Corrado *et al.* (2022) conclude that economic researchers should include the full complement of intangibles.

Statistical agencies have been slower to bring intangibles into official statistics. The System of National Accounts (SNA) now includes software, research and development (R&D), and entertainment originals as investment.[1] The SNA has recently considered including marketing assets as an additional type of intangible investment.[2] As part of that discussion, the IMF requested comments on capitalization of marketing assets and, in response, we identify and discuss a number of relevant issues. A subsequent document (IMF, 2023) concluded that marketing should be a further intangible in the 2025 SNA and asked for "conceptual and practical guidance… to implement this recommendation." We think that many elements of our paper will be useful in implementation.

This paper develops macroeconomic measures of marketing assets broadly similar to Corrado and Hao (2014) and Heys and Fotopoulou (2022). We also construct and analyze measures of marketing investment for each of our 61 industries that jointly comprise the U.S. private business sector.

Our measures of marketing are based on input-output (IO) tables and occupational information. First, we obtain data on each industry's purchases of advertising from the U.S. IO tables; purchased advertising is defined as the commodity associated with North American Industry Classification System

[1] "Entertainment, literary, and artistic originals" is an expression used in the SNA. The U.S. Bureau of Economic Analysis refers to this category as "entertainment originals." We use that terminology throughout this paper.

[2] The 2022 IMF document is available at https://unstats.un.org/unsd/nationalaccount/SNAUpdate/GZTT.asp. The draft cited here is from row G.9 in the column marked Endorsed (IMF, 2022). The March 2023 document that supported marketing as an investment is IMF, 2023, as listed in the references.

(NAICS) industry 5418 (advertising, public relations, and related services).[3] Second, we measure each industry's purchases of other marketing services by its purchases from selected portions of NAICS industries 5182, 5415, 5416, and 5419, again from the IO tables. Third, we develop stocks of own-account marketing from occupational data collected by the U.S. Bureau of Labor Statistics (BLS) Occupational Employment and Wages Statistics (OEWS). We follow Corrado and Hao (2014) and Heys and Fotopoulou (2022) in converting measures of occupations into own-account stocks. By combining data from these three sources, we develop measures of marketing assets for the U.S. private economy and for each industry. The rest of this paper refers to these joint measures of purchased advertising, purchased other marketing services, and own-account marketing as marketing.

Our work contributes to ongoing discussion along two main lines. First, we develop prototype measures of the extent and impact of marketing investment in the United States. These measures cover the U.S. private economy and each industry. Our analysis shows that it is feasible to develop reasonable measures of marketing assets for the United States. The paper also considers several potential difficulties that statistical agencies will have to address as they measure marketing. Second, we use information on marketing and other intangibles to examine sources of growth in various industries.

2. Overview and Theoretical Framework

As in many studies of intangibles, we measure output by value added in constant dollars. Capital services are measured by quantities of assets weighted by their corresponding rental prices. Labor is measured in hours. We begin with a production function, expressed in growth rates:

$$v_{j,t} = (\alpha_k)_{j,t}\, k_{j,t} + (\alpha_l)_{j,t}\, l_{j,t} + tfp_{j,t} \quad (1)$$

where $v_{j,t}$ is the rate of growth of real value added in industry j in year t, $k_{j,t}$ is the rate of growth of capital service input, and $l_{j,t}$ is the rate of growth of labor input. $tfp_{j,t}$ is the corresponding growth of total factor productivity, typically calculated as a residual. $(\alpha_k)_{j,t}$ and $(\alpha_l)_{j,t}$ are the cost shares for capital and labor, each calculated as averages for years t and $t-1$.[4]

The effect that any specific capital service, i, has on output growth follows the framework implied in expression (1). Specifically:

$$v_{i,j,t} = (\alpha_k)_{i,j,t}\, k_{i,j,t} \quad (2)$$

[3] The intuition behind our approach is expressed most clearly in terms of the IO tables. In practice we use a slightly more complex procedure. The complexity arises because we wish to make sure that our measures of purchased marketing and our data on own-account marketing both contain similar elements of marketing. In order to match the occupations that we have data for, we remove conventions and trade shows, which are ordinarily included in the commodity advertising, from our advertising data and, conversely, add further data on signs that are not normally contained in the commodity advertising. Similarly, when we use data from the Economic Census or the Services Annual Survey to measure the presence of marketing as a proportion of output provided by each industry, we follow the IO tables by adjusting the Census data for the well-known issues associated with underreporting or misreporting of incomes (U.S. Bureau of Economic Analysis, 2021, pp. 11–14).

[4] Our measures of capital stocks and services are calculated as Tornqvist indexes, using BLS Productivity Program methods. Labor composition indexes are also prepared with Tornqvist aggregation. The BLS obtains value added output data from the Bureau of Economic Analysis; these data are based on Fisher indexes.

where $(\alpha_k)_{i,j,t}$ is the share of asset i in the value added of industry j in year t. $k_{i,j,t}$ is correspondingly the growth of service i in that same industry and year. The longer-term contribution of any capital service to output growth for the 33 years from 1987 to 2020, $LTCON_{i,j}$, is similarly:

$$LTCON_{i,j} = \left\{ \left[\prod_{t=1988}^{2020} (v_{i,j,t} + 1.00) \right]^{\left(\frac{1.0}{33.0}\right)} \right\} - 1 \qquad (3)$$

as calculated from the geometric mean of one plus the annual contributions.[5]

Our study considers seven different types of intangibles: R&D, entertainment originals, own-account software, custom software, pre-packaged software, purchased marketing, and own-account marketing. Each intangible is studied in 61 industries over the 1987–2020 period. To remove the effects of business cycles, we present results for the 1990–2000, 2000–2007, and 2007–2020 subperiods.[6] We often measure the relative importance of different forms of capital through their shares of capital services and their contributions to output.

Section 3 below describes how we develop measures of purchased and own-account marketing, which are the central ingredients of our study. Section 4 considers how these new measures of marketing investment affect United States macroeconomic growth. This section also compares the macroeconomic contribution of marketing with the impact of other sources of growth. Section 5 uses detailed industry data to examine several specific hypotheses about marketing. Section 6 examines the relationships between marketing, other intangibles, and additional sources of growth within data for individual industries. Section 7 concludes. The Appendices provide further information on how we calculate stocks of purchased and own-account marketing and measure their impact on the economy.

3. Stocks of Purchased and Own-Account Marketing

3.A Stocks of Purchased Advertising

As Corrado, Hulten, and Sichel (2009, page 670) remark, "Expenditures for advertising are a large part of the investments in brand equity." Purchased advertising is the largest single element of marketing that we consider in this study. We measure how much advertising each industry acquires by its purchases of the commodity "advertising."[7] This includes advertising purchased from NAICS industry 5418, "Advertising, public relations, and related services," as well as advertising purchased from other industries such as print media, radio and TV, and the internet. We work with the commodity version of

[5] Stiroh (2002, equation (7), page 1172) analyzes how industries contribute to national labor productivity growth in a value-added framework. In contrast, this paper concentrates on contributions to growth within industries.

[6] United States recessions begin in July 1990, March 2001, December 2007, and February 2020. We select 1990 and 2007 as initial points in which the economy was still growing for a considerable part of the year in question, and 2000 as the last normal year prior to March 2001. We extend the 2007–2019 period to include 2020 because the COVID–19 recession was brief.

[7] Corrado and Hao (2014, pages 21–24) present several reasons why they believe that advertising has an effect at the industry level and is not simply dissipated by marketing expenditures of rivals. The official guidelines for national accounting exclude externalities from the national accounts (United Nations Statistical Division, 2009, section 3.92) so long-lived marketing would be capitalized even if it were canceled out by competitors' advertising.

purchased advertising because the commodity data include all advertising that each industry purchases regardless of its source.

We use the IO tables to estimate industry purchases of advertising and other sources of purchased marketing services. For 1997 to 2020, we use the annual IO use tables developed by the Employment Projections program of the BLS. For 1982 to 1996, we use the U.S. Bureau of Economic Analysis (BEA Historical Input-Output Tables, which offer less industry detail. We calculate the ratio of "advertising, public relations, and related services" to "miscellaneous professional, scientific, and technical services" in each industry in 1997 and use each industry-specific ratio to approximate advertising expenditures from 1982 to 1996. Our assumptions concerning depreciation imply that investments made prior to 1982 have fully depreciated by the time our analysis begins in 1987.

There has been some controversy about the usefulness of IO information to measure advertising, both at the individual industry level (Rogers and Tokle, 1995) and at the aggregate level (Silk and Berndt, 2020). To illustrate how the IO commodity data measure aggregate advertising, consider data for the year 2012. Silk and Berndt (2020, p. 47) suggest that, in 2012, firms that supply advertising and marketing services, such as ad agencies, had receipts of approximately $90 billion, and that providers of media access, such as broadcasters or print and internet providers, had about an additional $180 billion in revenue, implying total expenditures of approximately $270 billion. The graph in figure 3 of their paper suggests that advertising expenditures reported to the IRS were perhaps a little closer to $280 billion. The data used in this paper imply that at the commodity level advertising expenditures in the private economy were approximately $305 billion in 2012.

To deflate advertising expenditures, for 1997 to 2020 we use the BEA price index for the gross output price of commodities in NAICS industry 5418 ("advertising, public relations, and related services").[8] This BEA price deflator incorporates Producer Price Indexes (PPIs) for internet publishers, newspapers, radio, and TV, and other industries that produce advertising and also reflects certain other costs. For years prior to 1997 we prepare a new commodity price index that also reflects PPIs and certain costs.[9] Appendix C briefly describes how we prepared prices for 1982 to 1997. We use the price index for advertising to measure the price of output for every form of marketing.

There is some question as to how well existing price deflators measure the output price of marketing. Mandel (2019) argues that the quality-adjusted price of advertising has declined rapidly in recent years because digital advertising is more effective than previous marketing methods. In particular, digital advertising can target potential customers more precisely than print or broadcast advertising can. Section 5.C considers Mandel's important hypothesis in more detail.

The question of what percentage of advertising expenditures represents investment is a central issue on which there is little conclusive evidence. We therefore adopt the same investment ratios used in other studies. The U.K. Office of National Statistics (ONS) has been a leader in the analysis of intangibles. Heys and Fotopoulou (2022), of the ONS, assume that 60 percent of purchased advertising services and 80

[8] The BEA deflator for advertising is from the "Gross Output by Industry" files, under Underlying Detail, tab UGO 204–A, table line 144. We do not use the Producer Price Index for "Advertising space and time sales" (WPU 36) because that does not cover all advertising services or years before 2009.

[9] Prior to 1997 the PPI provides much less information about the price of services.

percent of purchased marketing services represent investment. We adopt these percentages in our baseline measures. Our alternative measure follows Corrado, Hulten, and Sichel (2005; 2009) and Corrado and Hao (2014) and assumes that 60 percent of purchased advertising services and 95 percent of purchased marketing services represents investment.

On the basis of Corrado and Hao (2014), Villalonga (2004), and Corrado, Hulten, and Sichel (2009) we select 45 percent as the central rate of depreciation. We choose 65 percent as an alternative depreciation rate. These rates imply service lives of 4 and 2 years, respectively.[10] We use these same rates of depreciation for all forms of marketing. Once we have determined nominal expenditures, the deflator, the proportion of expenditures that is investment, and depreciation, we measure stocks of each asset through standard perpetual inventory calculations.

3.B Purchases of Other Marketing Services

Firms purchase marketing services from industries other than advertising (NAICS 5418). Corrado and Hao (2014) include purchases from marketing consulting (NAICS 541613) and market research (NAICS 541961). We also include website design and hosting purchased from NAICS industries 5182 and 5415.[11] To the best of our knowledge, our study is the first work to include web design and hosting as marketing investment. For NAICS industries 5182, 5415, 5416, and 5419, we first calculate the proportion of output from each industry that represents marketing services; we estimate the presence of marketing services from data in the quinquennial Economic Census and then adjust for under- and misreporting. Between Census years, we use the Services Annual Survey (SAS) to interpolate and extrapolate. Such data provide reasonable information on overall purchases of marketing services, but, as Appendix C explains, it is a challenge to assign these amounts to specific purchasing industries. IO tables do not provide sufficient detail to track purchases of very detailed goods. We are therefore forced to allocate purchased marketing services to the industries that use them through data for the next higher level IO sector. Since we include purchases of marketing from additional industries, our estimates of purchased marketing are generally larger than those in Corrado and Hao. Appendix A shows how much each type of marketing service contributes to investment in marketing in each year.

Nakamura, Samuels, and Soloveichik (2017) suggest that each of these estimates of marketing should be priced at the price of overall advertising. They find that advertising viewership costs are more closely associated with each other than with measures of content creation. Figure 9 of their study shows that the viewership cost of digital media is correlated with viewership costs in other media and that this correlation increased in the 2010s as digital media became more prevalent. For this reason, we use the BEA advertising price index, instead of a cloud price deflator or other content creation costs, to price all

[10] Corrado, Hulten, and Sichel (2005; 2009) initially assumed 60 percent annual depreciation. Corrado and Hao (2014, page 10) recommend lengthening the service life of investments in brand from three to about four years, which approximately corresponds to 45 percent depreciation. Consequently, we assume a 45 percent depreciation rate for our main analysis and 65 percent as an alternative depreciation rate. Vitorino (2014, page 20) selects a 20 percent depreciation rate for advertising. However, Bagwell (2005, page 44), using similar information, suggests a greater rate of depreciation. We believe that, on balance, the overall evidence indicates that advertising depreciates more rapidly than 20 percent per year.

[11] Section 2.A above used the commodity advertising rather than the industry advertising because the overall production of advertising is far greater than output in the advertising industry (5418). In other industries that supply marketing services, commodity output is very close to industry output, and we use the standard industry data.

forms of marketing purchases. Section 5.C emphasizes that the topic of adjusting marketing output prices for unmeasured quality change requires further consideration.

Stocks of Own-Account Marketing

The literature typically draws a sharp distinction between purchased marketing and own-account marketing expenditures. While it is useful to know the approximate magnitudes of each of these two types of expenditures, we caution that these expenditures are inevitably closely interrelated. Internal marketing personnel are highly involved in external marketing campaigns. From this perspective, estimates of total marketing are more reliable than separate estimates of purchased and own-account resources. In the final analysis, the total marketing effort is what really counts.[12]

Own-account marketing expenditures are generally measured based on occupational employment.[13] We use the presence of certain occupations in each industry to measure the quantity of own-account expenditures. We do not distinguish between own-account advertising and marketing but instead define an overall own-account category which we call own-account marketing.

We obtain each industry's occupational employment for 2002 to 2020 from the OEWS.[14] The OEWS is collected over a rotating three-year cycle, in which a third of the sample is collected each year. For every occupation-industry pair, we assign each three-year average to the middle year. Appendix B lists the occupations that we assigned to marketing and describes how information on occupations is converted into own-account marketing stocks. Before 2002, we extrapolate own-account marketing in each industry with data on aggregate occupational employment from the OEWS, on output of each industry, and on purchased marketing services.

Estimates of the time that each occupation spends on long-term investment would ideally depend on careful time studies. Unfortunately, this type of conclusive evidence does not appear to exist. Our baseline measure follows Heys and Fotopoulou (2022) and assumes that 30 percent of own-account expenditures are investment. Our alternative measure follows Corrado and Hao (2014) and assumes that 60 percent of own-account expenditures are investment. We assume that own-account marketing depreciates at the same 45 percent rate as purchased advertising, with 65 percent as an alternative. Once our assumptions about expenditures, deflators, the investment portion, and depreciation are set, we construct perpetual inventory stocks of own-account marketing for each industry.

Existing work on own-account marketing (Corrado and Hao, 2014; Heys and Fotopoulou, 2022) uses a relatively narrow list of relevant occupations. We think it is possible that a wider range of occupations, especially in sales, may also contribute to the value of marketing assets. Many sales workers develop continuing relationships with their customers that eventually lead to greater long-term sales. We do not know of any empirical studies that document how much time sales workers spend investing in longer

[12] It is also difficult to distinguish between own-account production and output that is sold to customers.

[13] Nakamura, Samuels, and Soloveichik (2017) also argue that measures of purchased advertising should be supplemented by data on own-account marketing. For example, a television network might use unsold advertising slots to promote an upcoming show. Following Soloveichik (2013) and Nakamura, Samuels, and Soloveichik (2017), we also include radio, TV, and other media expenditures that advertise their own product as part of own-account expenditures.

[14] The OEWS began collecting some initial data as early as the 1990s. However, the initial data used different industry codes and sometimes different occupations codes. Therefore, it cannot always be consistently linked.

term relationships. However, because sales workers are such a large group, even a small proportion of their time could substantially increase measures of marketing investment. We think that this is a potentially important topic that should be carefully considered before marketing is included in the accounts.

The IMF discussion of marketing assets frequently refers to the value of trademarks and logos. Dosi *et al.* (2022) estimated how much a new trademark, in itself, adds to the value of a firm. However, we believe that the value of a trademark more fundamentally reflects a firm's underlying assets, including its marketing, R&D, and organizational capabilities. We think that future work that integrates the value of a trademark with these underlying capabilities will strengthen the usefulness of measures of marketing assets.

3.C Adapting Existing Data to Include Marketing Assets as an Additional Intangible

The BLS Productivity Database contains many data elements that are useful in measuring the impact of marketing. This includes gross output and value added, in both current and constant dollars, and measures of K (capital), L (labor), E (energy), M (materials), and S (purchased services). The data on E, M, and S together provide measures of intermediate input. This subsection describes how we measure output and input from the BLS data and how we modify existing BLS data to allow for purchased and own-account marketing as additional intangibles.

We begin with the existing measures of gross output and purchased services and the new measures of marketing investment described above. For each of these series we have prices in current dollars and chain-type quantity indexes. In addition, we have measures of value added developed by BEA. BEA prepares value added by double deflation, deflating both gross output and intermediate inputs (Moyer *et al.*, 2004). The investment portion of marketing must be removed from each industry's purchased services and transferred to capital investment. By construction, a smaller quantity of purchased services requires that intermediate prices be recalculated for each industry. This new price is then used to compute adjusted quantities of intermediate inputs. We use the double deflation method described in Moyer *et al.* (2004) to remove marketing from purchased services, recalculate intermediates, and recalculate value added output by removing our new measures of intermediate input from gross output.

Gross output and value added both increase when portions of marketing are treated as investment. It is necessary to decide where to allocate the extra value-added income. Previous work on intangibles in the U.S. Accounts, such as studies of R&D (Fraumeni and Okubo, 2005) and software, has assumed that the added income from capitalization all goes to capital. To be consistent with those studies, we also assume that the added income from capitalization goes to capital, and that there is no effect on employee compensation.[15]

The decision to assign all additional income from capitalization of intangibles to capital has important implications. Koh, Santaeulalia, and Zheng (2020) show that the decline in the labor share observed in the U.S. occurs solely because all the additional income from intangibles is assigned to capital. They

[15] Our estimates assume that the increased income from marketing investment goes to an increase in the gross operating surplus. The increased surplus goes to corporate profits or to the capital or labor income of proprietors. We use ratios from the existing national accounts to assign the new surplus to each of these three categories in each industry. Almost all the additional surplus is assigned to capital, since proprietor labor income is typically a small share of total gross operating surplus.

argue that such an allocation is "extreme," and that a portion of the new value added created should instead be assigned to labor; they recommend detailed micro analysis to determine where extra output should be assigned. The Koh *et al.* study is insightful and thought provoking. If further work supports their interpretation, some of the value created by capitalizing marketing and other intangibles may eventually be assigned to labor, and existing estimates of property income and the associated rental prices are probably too high.

Once we have constructed stocks of purchased and own-account marketing and estimated the increase in property income associated with these investments, we are ready to value these stocks. To determine rental prices, we treat purchased and own-account marketing just like any other capital asset. As is standard procedure, we begin with data on property income in each industry and year, determine an internal rate of return for each industry/year, and then calculate rental prices that reflect asset price changes, rates of depreciation, and tax parameters.[16]

4. The Macroeconomic Impact of Marketing Assets

This section analyzes how the new measures of marketing assets affect macroeconomic growth in the private sector. First, we measure the contributions that purchased and own-account marketing, other intangibles, other inputs, and the Total Factor Productivity residual (TFP) make to output growth. Second, we look at the flow of capital services to goods and services industries.

4.A The Effect of Marketing on Output Growth

Panel A of figure 1 shows how intangibles, which now include the new purchased and own-account marketing assets, have consistently grown more rapidly than tangibles. Panel B shows that intangibles, which originally were less influential than information and communication technology capital or other assets, are now more important. This occurred because other forms of capital made less of a contribution, not because the contribution of intangibles increased.

Table 1 shows our central results using the basic assumptions summarized in table C.1. Of the presently recognized intangibles, R&D and software have the greatest impact on macroeconomic growth. Over the entire 1987 to 2020 period, R&D contributed 0.15 percent a year to output growth and the three types of software together added 0.19 percent a year. The two types of marketing contributed 0.18 percent a year to output growth. This evidence makes the important point that marketing contributes about as much to output growth as R&D or software do. Appendix C describes how we obtain these central results.

Background information helps to clarify the effects of both R&D and software. Table 1 includes only the direct effects of R&D—the immediate returns to firms that initially conduct research. Evidence shows that R&D spillovers account for more than half of the total returns to R&D and that the spillover portion of total returns has increased in recent years (Bloom *et al.*, 2013; Lucking *et al.*, 2019; Sveikauskas,

[16] BLS does not use an internal rate of return for every industry and year, because rates of return calculated from property income are sometimes negative or otherwise implausible, especially in recessions or when the capital gains term is large. In these cases, BLS uses an external rate of return to calculate rental prices. The external rate of return is the average rate of return observed in the private business sector, adjusted for differences in the capital gains term.

2007). These well-documented spillovers show that social returns to R&D are much greater than the private returns shown in table 1. It has so far been difficult to assign R&D spillovers to specific industries. However, Martin *et al.* (2022) recently developed a framework that may be able to assign R&D spillovers to each industry.

Figure 1. Panel A: Capital services growth of intangible and tangible assets in the private economy

Average annual growth

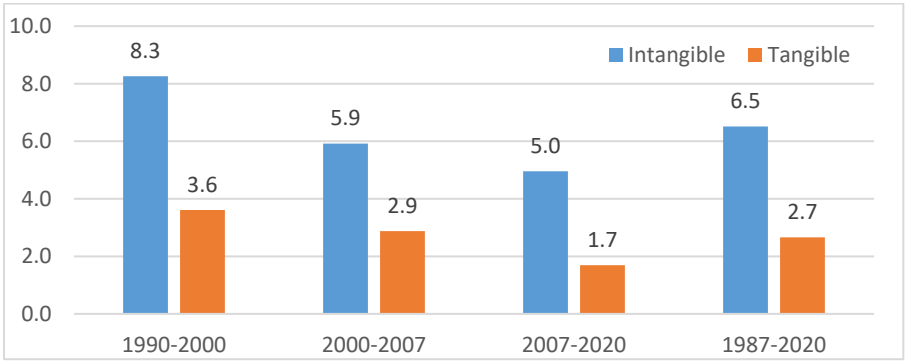
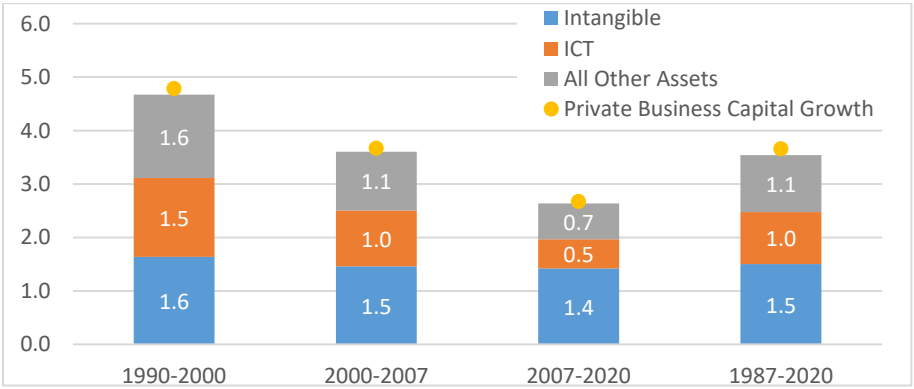


Figure 1. Panel B: Contributions of different types of assets to private capital growth

Percentage point contribution, average annual growth



On software, table 1 shows that pre-packaged software affects growth most strongly. That might seem to contradict Bessen (2020; 2022), who has shown that large firms often dominate their industries by developing highly productive proprietary computer systems; these powerful proprietary systems might seem to be own-account software. However, BEA classifies software-as-a-service (SaaS) as pre-packaged software, and this category has grown rapidly, so U.S. data show that pre-packaged software contributes strongly to growth.[17]

Despite the importance of marketing, inclusion of marketing as an additional intangible does not greatly increase measured economic growth. Table 2 shows that capitalization of purchased and own-account marketing increases output growth by less than 0.1 percent a year. This growth increase is similar to the increase associated with capitalization of R&D (Ribarsky 2022).

[17] BEA specialists mention that some countries prefer to think of software as a purchased service. However, BEA plans to continue classifying SaaS as an investment in pre-packaged software. They also comment that the increased reliance on cloud computing has altered the way that firms pay for software and that counting SaaS as an investment in software helps to describe the new payment patterns.

Table 1. Input and TFP contributions to private business output growth

	1990–2000	2000–2007	2007–2020	1987–2020
Purchased Marketing	0.14	0.16	0.17	0.15
Own Account Marketing	0.03	0.03	0.05	0.03
Entertainment Originals	0.04	0.04	0.02	0.03
Research and Development (R&D)	0.17	0.13	0.14	0.15
Software, Custom	0.07	0.05	0.07	0.06
Software, Own Account	0.03	0.04	0.03	0.03
Software, Prepackaged	0.11	0.10	0.11	0.10
Information and Communication Technology (ICT)	0.54	0.39	0.22	0.37
All Other Assets	0.56	0.41	0.28	0.42
Labor Input	1.43	0.30	0.31	0.75
TFP Residual	0.93	1.10	0.45	0.71
Private Business Output	**3.9**	**2.5**	**1.7**	**2.7**

Table 1 reports our preferred estimates of the role of marketing, and its importance relative to R&D and software, in the United States economy. However, it is also useful to present supplementary tables showing corresponding effects under a variety of different assumptions. Tables C.1 and C.2 of Appendix C report results under several alternative assumptions. These sensitivity tests show that changes in the percentage of marketing expenditures that is investment have a considerable impact on the implied contribution of marketing. Since advertising expenditures are substantial, changes in this investment proportion are particularly influential. In contrast, changes in the rate of depreciation, within the range of values that the literature suggests, have little effect on the implied role of marketing. These results suggest that, as further work on marketing proceeds, researchers could usefully concentrate on measuring the proportion of expenditures that represents long-term investment. Time diaries and interviews and surveys of workers might provide more evidence.

Table 2. Purchased and Own-Account Marketing Long-Run Effects

1987–2020	TFP	Output	Capital	Labor
Private Industry Without Any Marketing	0.752	2.707	3.388	1.174
Private Industry With Only Purchased Marketing	0.703	2.762	3.599	1.174
Private Industry With All Marketing	0.699	2.784	3.655	1.174

Figure 2 shows the relative importance of purchased and own-account marketing over time, as measured by the flow of capital services for marketing as a percentage of nominal value added. Figure A.2 in Appendix A shows that investment in many categories of marketing, as a percentage of gross domestic product (GDP), has turned upwards in recent years.

Figure 2 shows that purchased marketing accounts for a considerably larger proportion of total marketing than own-account marketing does. In part, these patterns arise because our baseline estimates assume that only 30 percent of own-account marketing expenditures represent investment. If we instead assume, as in our alternative set of assumptions, that 60 percent of own-account expenditures is investment, then the lower line in figure 2 would be twice as high and much closer to the top line (purchased marketing).

Figure 2. Nominal Marketing as a Share of Nominal Business Value Added

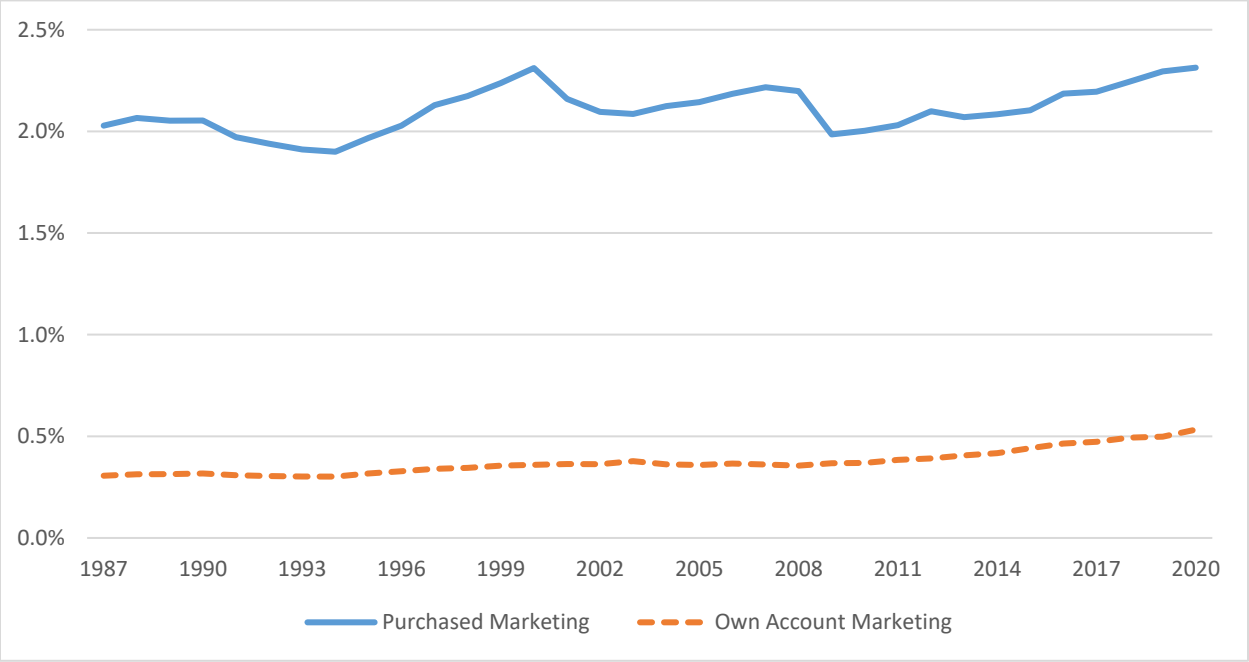


Table 3 shows the rate of growth of investment for various types of capital assets in different time periods. Investment growth slowed over time for most asset categories. Prepackaged software grew rapidly in each time period. It might seem surprising that prepackaged software has grown so quickly (table 3), whereas purchased marketing contributed more to output growth (table 1). Table 4, which shows the annual rates of growth, factor shares, and contributions to output growth for each of these two types of assets, explains these different patterns. Purchased marketing's larger factor share offsets the more rapid growth of pre-packaged software and allows purchased marketing to contribute more to growth.

Table 3. Real Investment Growth by Asset Category

Average annual change	1990–2000	2000–2007	2007–2020	1987–2020
Purchased Advertising	10.7	6.4	4.0	7.3
Own Account Advertising	10.8	7.1	6.8	8.6
Entertainment Originals	4.3	2.5	1.0	2.5
R&D	5.5	2.7	3.6	4.2
Software, Custom	16.2	4.3	6.1	9.3
Software, Own Account	7.4	3.2	4.2	5.3
Software, Prepackaged	24.0	9.8	11.0	17.8
ICT	8.4	6.4	4.5	6.0
All Other Assets	3.2	1.3	0.8	1.7
Private Business All Assets Growth	**4.5**	**2.4**	**2.5**	**3.1**

Table 4. The Effect of Prepackaged Software and Purchased Marketing on Output Growth

	Asset Growth, percent change		Factor Share, percent change		Contribution to Output, percentage point	
	Software, pre-packaged	Purchased Marketing	Software, prepackaged	Purchased marketing	Software, prepackaged	Purchased marketing
2008	6.5%	8.0%	0.9%	3.1%	0.06	0.25
2009	6.2%	2.7%	0.9%	3.4%	0.06	0.09
2010	4.0%	-0.5%	1.0%	3.6%	0.04	-0.02
2011	4.6%	0.9%	0.9%	3.5%	0.04	0.03
2012	9.9%	3.4%	0.9%	3.4%	0.09	0.12
2013	12.3%	5.1%	0.9%	3.5%	0.12	0.18
2014	11.5%	5.4%	1.0%	3.6%	0.11	0.19
2015	10.7%	5.4%	1.1%	3.6%	0.12	0.20
2016	11.2%	5.7%	1.1%	3.7%	0.13	0.21
2017	11.9%	6.0%	1.2%	3.9%	0.14	0.23
2018	12.9%	6.3%	1.2%	3.7%	0.16	0.23
2019	13.3%	6.8%	1.3%	3.5%	0.18	0.24
2020	12.8%	5.6%	1.4%	3.7%	0.19	0.21
1987–2020	17.9%	7.5%	0.8%	2.4%	0.10	0.15
1990–2000	26.9%	9.6%	0.5%	1.5%	0.11	0.14
2000–2007	11.6%	6.7%	0.9%	2.4%	0.10	0.16
2007–2020	10.3%	4.8%	1.1%	3.6%	0.11	0.17

4.B The Flow of Capital Services in Goods and Services

The goods sector consists of agriculture, mining, utilities, construction, and manufacturing. Services are the rest of the private economy. The private economy covered here represents about three-quarters of GDP, and excludes general government, government enterprises, nonprofits, and households.

Figure 3.A shows the flow of capital services to the goods sector and to the services sector over time. We calculate the annual flow of capital services in each industry and add them for all goods and for all services. Capital services were slightly less in goods from 1987 to 1990. However, by 2020 only 30 percent of capital services occurred in goods.

Figure 3.A. Flow of Capital Input to the Production of Goods and Services, 1987–2020

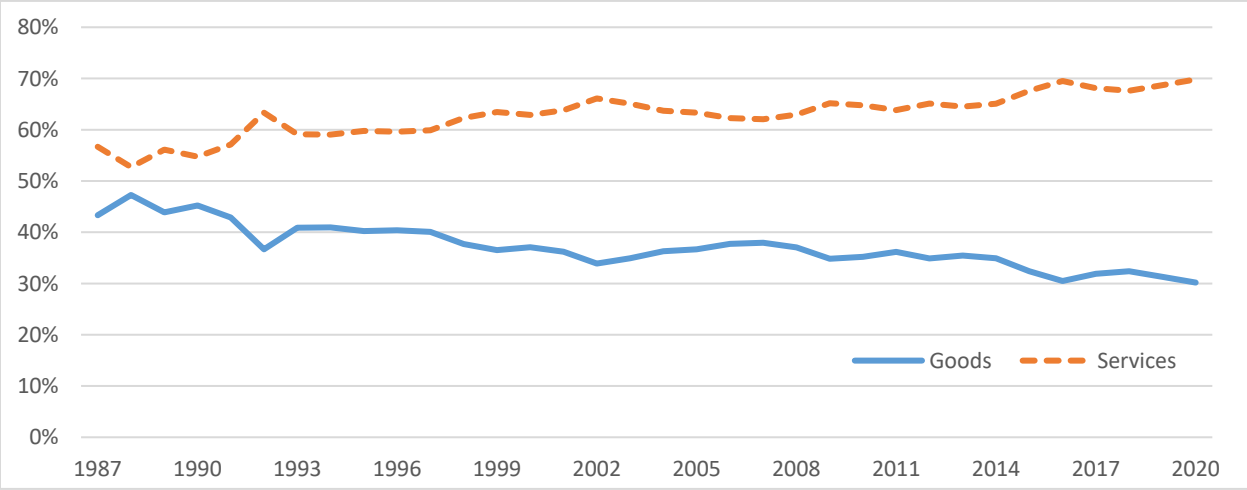
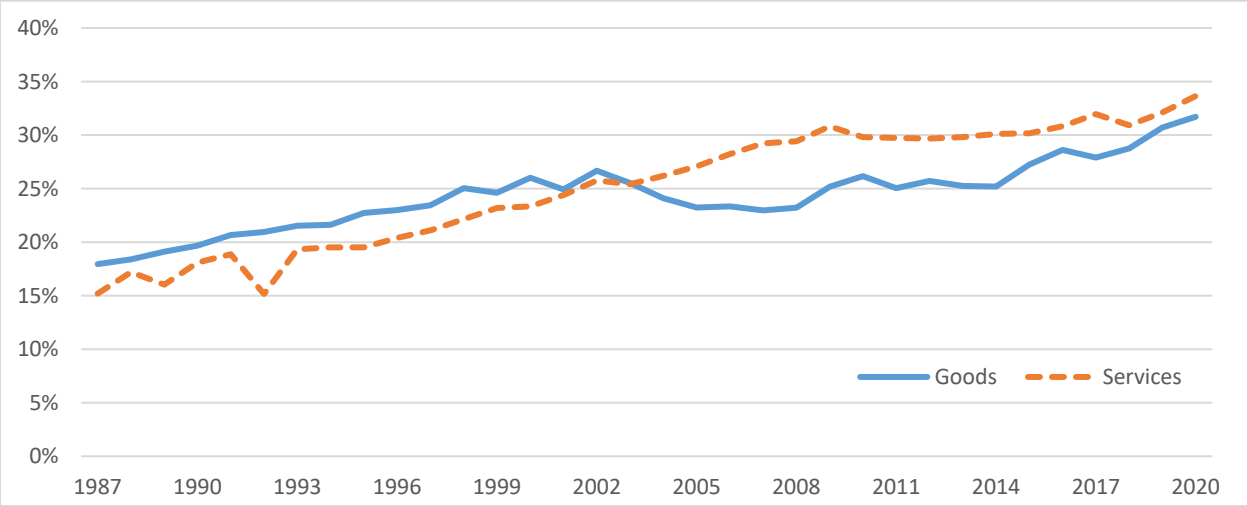


Figure 3.B shows that the intangible share of capital services was originally greater in goods than in services. It was not until about 2001 that the intangible share in services surpassed the share in goods, so that the expanding role of services began to increase the overall amount of intangibles. R&D represents a large portion of the intangibles in manufacturing. Figure 3.B shows that, at the end of the technology boom in 2000, the share of capital payments spent on intangibles began to decline for goods but continued to increase in services.

Figure 3.B. The Intangible Share of Capital Services, in Goods and in Services, 1987–2020



5. Influences on Marketing Assets

5.A The Impact of Consumer or Business Markets on the Level and Growth of Marketing

IO tables provide information on how much output of each commodity is delivered to intermediate products, consumption, or investment. The amounts used in consumption tell us how important the consumer market is, and amounts used in intermediate products and investment show how important the business market is in each of our 61 industries.[18] We use data from BEA's detailed 2012 IO table.

We seek to understand how marketing practices differ between consumer and business-oriented industries. In the cross-section we measure the importance of marketing in each industry by the flow of capital services to marketing as a proportion of that industry's value added. We examine the growth of marketing investment and marketing's influence on labor productivity growth.

We find no evidence that the intensity or rate of growth of marketing activities differs between industries oriented to consumer or business markets. The shares of purchased and own-account marketing similarly do not differ between consumer or business industries. Defining marketing intensity in industry i as the flow of capital services to marketing divided by the value added observed in that industry, we estimate the following regression:

$$Marketing\ Intensity_i = \alpha + \beta Consumer\ Share_i + \gamma Business\ Share_i \qquad (4)$$

[18] Since some output is delivered to government, the shares of consumer and business are not perfectly collinear.

These regressions show no sign that the consumer or business orientation characteristic of an industry affects observed marketing intensity. Similarly, the type of customer does not affect the intensity of purchased and own-account marketing or our measures of time-series effects.

We had expected to find more marketing in consumer-oriented industries. The World Advertising Research Center (WARC) occasionally reports the U.S. industries in which advertising expenditures are the greatest. Their 2022 report lists these industries, in order, as retail, media and publications, business and industrial, financial services, technology and electronics, pharma and healthcare, technology and utilities, automotive, and amusement and leisure.[19] That WARC list appears to be heavily weighted towards consumer goods.

A possible explanation is that national income measures assign a firm's advertising to each of its establishments, which are often classified in different industries. U.S. National Income and Product Accounts data report heavy advertising expenditures in wholesale trade, financial functions, and management of companies. Such measures probably assign advertising to economic functions well. These national income conventions may explain why we cannot establish a relationship between the customer type and observed marketing.

5.B The Effect of the Presence of ICT on the Future Growth of Marketing

We hypothesized that the presence of information and communication technology (ICT) would lead to a more rapid growth of investment in marketing, and that the link between ICT and the subsequent growth of marketing became stronger in more recent years, as digital marketing became more prevalent. We measured the presence of ICT in each industry in any year as the share of ICT assets, including software, in current value added.[20]

We did not find any clear impact of ICT on marketing in our U.S. industry data. With more detailed data, such as information on many firms in the same industry, or data for the same sector in different countries (Chen *et al.*, 2016), the effects of ICT might be clearer.

5.C The Effect of Advertising if Digital Advertising is Substantially More Effective

Mandel (2019) emphasizes that digital advertising, viewed on personal computers or mobile phones, is inherently more effective than print media advertising. Digital advertisers know more about the interests and concerns of potential customers and can target or customize ads towards likely buyers. This is a quality change, in the same sense that cars with more horsepower and houses with more square footage are of higher quality and represent more output. Consistent with that hypothesis, advertisers are shifting to digital advertising very rapidly. The Services Annual Survey shows that the digital share of the advertising market increased from 0.9 percent in 2002 to 38.2 percent in 2015 and 58.3 percent in 2020.[21] Growth of this magnitude suggests that digital advertising offers important

[19] https://www.marketingcharts.com/advertising-trends/spending-and-spenders-227936/7?et_blog.
The website Zippia has a somewhat similar list of the industries, but their list is restricted to digital advertising.

[20] We consider investment in marketing from 1990, 2000, and 2007, the beginning of each our three subperiods. We also consider growth since the expansion of digital marketing in 2012. For each of these four time periods, we cannot establish any effect of ICT intensity on the future growth of marketing investment.

[21] This digital share refers to the industry 5418 only. Purchases of the commodity advertising from other industries, purchases of other marketing services, or own-account marketing may have different digital shares.

advantages to advertisers, most notably the targeting of specific consumers. As Mandel states (2019, page 4) “In the economic sense, digital advertising is more productive than print advertising.” Also (page 12) “The simplest explanation for all these observations is that advertisers are finding that they can get a bigger bang for their buck by spending their money online rather than in print.”

Mandel (2019) suggests that digital advertising is five-thirds as effective as print advertising. That is, every dollar spent on digital advertising brings a bonus of 0.67 cents of extra output due to the greater effectiveness of digital ads. With a 60 percent increase in the digital share over the years, that would imply 60 * 2/3 or a 40 percent increase in the effective amount of advertising just from the switch to the internet. That seems to be a remarkable amount of additional advertising output, even allowing for the overwhelming success of firms like Google, Facebook, and TikTok. Perhaps these magnitudes arise because Mandel was comparing digital advertising with print media, which is a particularly stagnant advertising category.

Even if the quality differences are not so large as Mandel suggests, it is plausible that typical deflators do not adequately adjust for quality improvements in advertising. To examine these possibilities, table 5 considers effectiveness bonuses of 0.10 percent or 0.20 percent for every 1 percent increase in the digital share. In these cases, the long-term 60 percent increase in the digital share would be associated with a 6 or 12 percent gain in the real amount of advertising. These increases in output are strongest since 2015 when the digital share of advertising increased from 38 to 58 percent.

The first column of table 5 shows the digital share of the advertising market from 2002 to 2020, from the SAS. The second and third columns report the extra bonus of advertising output if each additional dollar spent on digital advertising brings a bonus of 10 or 20 cents of additional output.

Table 5 shows that if digital advertising brings even modest productivity advantages, advertising output increases 6 to 12 percent by 2020 solely because of the shift to the internet. Equivalently, the price per unit of advertising output would decline by 6 or 12 percent by 2020 just because of the output expansion due to digital advertising. In 2020, the present official estimate of advertising output price, 103.696 declines as much as 10 percent, to 98.01 (103.696/1.058) or 92.92 (103.696/1.116).

These calculations show that the implied effect on the price of advertising is substantial even if digital ads are only slightly more effective than other forms of advertising. We do not at present know exactly how much more effective digital ads are. However, this exercise has shown that, even if digital ads were only slightly more effective, that is sufficient to lower the implied price of advertising substantially. Lower prices would in turn show that advertising has increased output growth more rapidly. Further research on the productivity advantage of digital advertising would be helpful.[22]

[22] If digital marketing represents unmeasured quality improvement, then marketing prices would have increased less than currently available price indices indicate, so that the amount of output and the productivity gains associated with marketing would be greater than presently measured.

Another crucial question about advertising or marketing is whether expenditures by one firm cancel expenditures by a rival firm, so that the net effect of expenditures is reduced. In our judgment, this topic cannot be understood solely from industry data. As in the analysis of R&D (Bloom, Schankerman, and Van Reenen (2013), this issue requires both firm and industry data, so that it is possible to evaluate the presence of positive or negative spillovers.

Table 5. The Digital Share of the Advertising Market and the Digital Bonus, 2002-2020

Year	(1) Digital share (1)	(2) = 10% of (1) Bonus, model 1	(3) = 20% of (1) Bonus, model 2	(4) BEA price
2002	0.9	0.1	0.2	82.636
2003	1.5	0.2	0.3	83.778
2004	2.5	0.3	0.5	84.609
2005	4.1	0.4	0.8	89.700
2006	7.1	0.7	1.4	95.709
2007	11.4	1.1	2.3	97.537
2008	13.6	1.4	2.7	98.088
2009	16.0	1.6	3.2	97.696
2010	18.5	1.9	3.7	97.612
2011	22.3	2.2	4.4	98.723
2012	26.0	2.6	5.2	100.000
2013	29.1	2.9	5.8	101.210
2014	30.8	3.1	6.2	102.127
2015	38.2	3.8	7.6	102.775
2016	42.1	4.2	8.4	103.337
2017	47.1	4.7	9.4	103.809
2018	50.7	5.1	10.0	103.952
2019	55.1	5.5	11.0	104.915
2020	58.3	5.8	11.6	103.696

6. Distribution of Assets Across Industries and Their Effect on Growth

6.A Stocks of Asset Types in Different Industries

We now consider the importance of asset types at industry level. The sectors considered are manufacturing, other goods, trade, finance, and other services. Table 6 shows the importance of each type of capital as a percentage of total capital stocks in each of these five sectors. Panel A of table 6 reports tangible assets and panel B shows intangible assets for 2012. Equipment accounted for 31 percent of capital stocks in manufacturing. Similarly, inventories were 24 percent of all stocks in trade. In panel B, we see that R&D accounts for 24 percent of all manufacturing capital stocks and entertainment originals are 7 percent of total stocks in other services. Purchased marketing is most important in trade and other services, accounting for 3 percent of total stocks.

Table 6. Panel A: Shares of Tangibles in Total Capital Stock Values by Sector, 2012

	Equipment	Structures	Inventories	Land	Total Tangible
Manufacturing	30.6%	12.4%	5.5%	25.0%	73.5%
Other Goods	16.8%	3.7%	23.8%	54.9%	99.3%
Trade	14.8%	23.9%	22.3%	32.9%	93.8%
Finance, Insurance, Real Estate	14.5%	0.2%	21.0%	61.0%	96.7%
Other Services	22.1%	1.5%	13.2%	44.1%	80.8%

Table 6. Panel B: Shares of Intangibles in Total Capital Stock Values by Sector, 2012

	Purchased Marketing	Own Acct Marketing	Entertainment Originals	R&D	Software, Custom	Software, Own Acct	Software, Prepackaged	Total Intangible
Manufacturing	1.0%	0.2%	0.0%	23.6%	0.9%	0.3%	0.4%	26.5%
Other Goods	0.2%	0.0%	0.0%	0.3%	0.1%	0.0%	0.1%	0.7%
Trade	3.2%	0.4%	0.0%	1.0%	0.8%	0.4%	0.5%	6.2%
FIRE	1.2%	0.2%	0.0%	0.3%	0.7%	0.2%	0.7%	3.3%
Other Services	3.2%	0.7%	6.7%	5.0%	2.0%	1.0%	0.7%	19.2%

6.B Correlations between Sources of Growth

Our breakdown attributes the growth of output to 14 inputs and a TFP residual. We measure these effects for each of our 61 industries. The 14 inputs shown in table 7 are: 7 types of intangibles, 5 types of tangible capital, labor hours, and labor composition. These measures are expressed as average annual contributions over the 1987–2020 period.

Table 7 shows how the average annual contributions to growth are correlated across industries. We highlight correlations of special interest. The high correlations between various forms of software show that industries which use one form of software tend to use others as well. The contributions of the two forms of marketing are highly correlated. Both forms of marketing are also highly correlated with the impact of software. Own-account marketing is largely measured by the presence of computer-oriented occupations, so that a link with software is not surprising. However, purchased marketing, which consists largely of advertising, is also closely linked to the presence of software.

Table 7. Correlations between sources of growth, measured as contributions to annual growth, across 61 industries, 1987–2020

	Equipment		Software			Struc-tures	Land	Inven-tories	R&D	Ent. Originals	Marketing		Labor	
	Except ICT	ICT	Purch-ased	Custom	Own Acct						Purch-ased	Own Acct	Hours	Comp-osition
ICT	0.43													
Purchased Software	0.09	0.58												
Custom Software	-0.02	0.60	0.81											
Own Acct Software	-0.02	0.59	0.71	0.96										
Structures	0.14	0.20	0.17	0.13	0.14									
Land	-0.05	0.31	0.29	0.42	0.49	0.18								
Inventories	0.04	-0.08	-0.03	-0.02	-0.04	-0.10	-0.07							
R&D	-0.04	0.23	0.28	0.42	0.35	-0.04	0.16	0.22						
Ent. Originals	-0.06	0.09	-0.04	-0.03	-0.03	0.35	-0.01	-0.17	-0.04					
Purchased Marketing	0.12	0.64	0.67	0.73	0.71	0.10	0.38	0.10	0.25	0.17				
Own Acct Marketing	-0.04	0.63	0.75	0.94	0.94	0.15	0.50	-0.03	0.36	0.05	0.75			
Labor Hours	0.03	0.14	0.14	0.15	0.17	0.15	0.03	-0.11	-0.04	0.00	0.18	0.16		
Labor Composition	-0.24	-0.09	0.12	0.12	0.08	-0.21	0.14	0.02	0.16	-0.08	0.05	0.13	-0.27	
TFP Residual	-0.25	-0.13	-0.04	0.00	-0.08	-0.11	-0.03	0.14	0.17	-0.04	-0.13	-0.05	-0.20	0.08

We measure each factor's average annual contribution to output growth in every industry from 1987 to 2020. The table reports the correlation between these contributions across the 61 industries, to illustrate patterns in which inputs make contributions together. Certain inputs—R&D, Originals, and Own Account Advertising—have zero measured quantity in certain industries and therefore make no contribution to output there.

There is some support for the well-established connection between R&D and marketing, especially for own-account marketing (Corrado and Hao, 2014). We had thought that potential drivers of economic growth such as ICT, improvements in the composition of labor, or TFP might be associated with a more rapid growth of intangibles. There is some evidence that ICT (which here excludes software) may have some effect on the growth of intangibles, but measures of labor composition and TFP appear to have little connection to intangibles growth. Our estimates of TFP may be subject to measurement error, partially because they are based on value added rather than gross output.[23]

The economics literature, such as Bessen *et al.* (2020), discusses how intangibles have altered the nature of production, based on firm data. This literature typically concentrates on firm data because intangibles frequently affect firms in the same industry differently (De Ridder, forthcoming). However, table 7 shows that differences between industries can also describe some of the connections between intangibles.

6.C Industry Concentration of Intangibles

This subsection provides evidence on the extent to which the use of each intangible is concentrated in a few leading industries. Table 8 reports industry concentration for each intangible in 1987, 2002, and 2020, as measured by the percentage of the total stock of that intangible observed in the top 10 of our 61 industries.

Table 8. Stocks of each intangible in the top 10 Industries, as a percentage of all stocks of that intangible in the private sector, 1987, 2002, and 2020

Intangible	1987 Industry concentration	2002 Industry concentration	2020 Industry concentration
Purchased Marketing	66%	62%	70%
Own Account Marketing	69%	70%	74%
Entertainment Originals	100%	100%	100%
R&D	82%	76%	79%
Software, Custom	66%	67%	80%
Software, Own Account	66%	72%	84%
Software, Prepackaged	63%	63%	70%
Total marketing	63%	62%	69%
Total software	66%	66%	75%

Entertainment originals always have concentration of 100 percent, since only five industries hold this asset. Concentration of R&D declines modestly. However, concentration of software and marketing increases markedly, especially after 2002. Bessen (2022) describes how software has become more proprietary since 2000, as firms develop their own computer systems.

Much of the concentration of software has occurred within industries, as firms with effective digital systems displace their competitors. However, table 8 shows that, since 2002, software also became more concentrated across industries; each type of software also became more concentrated.

[23] Berndt and Wood (1975) suggest that measures of productivity growth based on gross output are preferable to estimates obtained from value added. De Loecker and Scott (2016) and Gandhi *et al.* (2020) show the usefulness of gross output methods and describe how they can be implemented. Connections between TFP and the presence of intangibles might provide some clues about which intangibles have spillover effects. For example, there is a mild positive connection between R&D and TFP. However, industries differ in so many other respects that it is preferable to search for spillovers within data for firms in a single industry.

Both forms of marketing similarly became more concentrated since 2002. The same internal data systems that are known to make software more effective for leading firms are likely to make the same firms' marketing more successful and concentrated.

The second portion of this subsection lists the five industries with the largest stocks of purchased and own-account marketing, in order, in 1987, 2002, and 2020.

The lists of leading industries are generally reasonable. Conventional lists of leading advertisers are likely to emphasize consumer industries, such as retail trade, pharmaceuticals, electronics, automotive, food, and finance. National accounts methods frequently assign advertising expenditures to different functions of a firm, such as retail or wholesale trade, finance, or the management of companies, rather than to the final product eventually sold. That probably explains why relatively few consumer industries appear on the list of the largest advertisers.[24]

Table 9. Industries with the largest stocks of purchased or own-account marketing, 1987, 2002, and 2020

Purchased marketing

1987	2002	2020
Retail trade	Retail trade	Retail trade
Wholesale trade	Wholesale trade	Wholesale trade
Construction	Broadcasting and telecommunications	Federal Reserve banks, credit intermediation, and related activities
Management of companies and enterprises	Food services and drinking places	Miscellaneous professional, scientific, and technical services
Food services and drinking places	Miscellaneous professional, scientific, and technical services	Management of companies and enterprises

Own-account marketing

1987	2002	2020
Broadcasting and telecommunications	Broadcasting and telecommunications	Management of companies and enterprises
Publishing industries, except internet (includes software)	Management of companies and enterprises	Data processing, internet publishing, and other information services
Management of companies and enterprises	Wholesale trade	Wholesale trade
Wholesale trade	Publishing industries, except internet (includes software)	Broadcasting and telecommunications
Computer and electronic products	Computer and electronic products	Publishing industries, except internet (includes software)

[24] It is probably an anomaly that construction is the third largest purchaser of advertising in 1987. Recall that, prior to 1997, we measure advertising from data on "miscellaneous professional, scientific, and technical services." This category includes items such as accounting, architectural, engineering, and design services as well as advertising. Shifts among these categories could overstate advertising in construction in 1987.

7. Conclusions

The IMF report on marketing assets urged examination of the feasibility of incorporating these assets into the national accounts. The summary of the IMF report on marketing assets (2022, page 2) states "As part of the global consultation, it is proposed to enquire to what extent economies still face measurement challenges, which prevent capitalizing marketing assets." This paper shows that, for the United States, building on the approach of Corrado, Hulten, and Sichel (2005; 2009) and Corrado and Hao (2014), this is feasible.

It would be useful to develop an understanding of how sales workers affect the value of marketing assets and to integrate emerging work on the value of trademarks (Dosi *et al.*, 2022) with a more general view of firm assets and capabilities. Two trends emerging in the literature are likely to have a strong impact on how marketing and other intangibles are understood. Mandel (2019) has argued that it is difficult to develop measures of the output price of marketing because recent shifts to digital advertising, such as through the internet or smart phones, make marketing far more productive than prior advertising media. Koh *et al.* (2022) propose that a portion of the added income produced by capitalization of intangibles should be credited to labor rather than to capital. These two lines of thought could have a strong influence on how marketing is eventually understood. In addition, time diaries and other surveys could help estimate what proportion of time advertising and own-account marketing workers devote to long-term investment. Finally, there are also further issues to consider, such as the appropriate treatment of licensing and franchising.

Despite these topics that require further attention, the clear message of our paper is that a remarkable amount can be done to develop a comprehensive treatment of marketing for the United States. It is possible to construct measures of purchased advertising, other purchases of marketing services, and own-account marketing. These measures rest on solid and highly detailed data. Overall, the results of our study strongly suggest that many statistical agencies will be able to include marketing capital in their accounts.

In particular, the summary paragraph of the initial IMF discussion of marketing assets (IMF, 2022) states that "the major reason for not treating marketing assets as fixed assets is due to the difficulty of measuring their value." Note that the procedures developed in this paper provide rental prices as well as stocks of marketing capital, and therefore overcome the main difficulty that the IMF document emphasizes.

Our most central empirical result is that marketing contributes about as much to overall output growth as R&D or software. Table 1 shows that the contribution of marketing to output growth increased over time, whereas the contributions of R&D and software tended to stabilize. Own-account marketing grew more quickly than purchased marketing, steadily over the entire period. Purchases from web design and hosting and from marketing services, together with increased own-account employment of technical and marketing skills, all helped to drive marketing investment. However, capitalization of both forms of marketing has only a modest effect on the growth of output.

These estimates of the impact of marketing largely occur because we have classified certain elements of the revolution in computers and data as contributors to marketing. Investments in web design and hosting are certainly a central element of marketing investment. Similarly, as in Corrado and Hao (2014), own-account investments in computer and marketing occupations are crucial in developing the internal capabilities of the firms that comprise each industry. It will be important to determine how these investments should be allocated between the data revolution and marketing.

References

Bagwell, K., "The Economic Analysis of Advertising," Columbia University Department of Economics, Discussion Paper No. 0506–01, 2005.

Beckhusen, J., "Occupations in Information Technology," American Community Survey Report ACS–35, U.S. Census Bureau, Washington, D.C., 2016.

Berndt, E. and D. Wood, "Technology, Prices, and the Derived Demand for Energy," *Review of Economics and Statistics*, 57, 259–268, 1975.

Bessen, J., "Industry Concentration and Information Technology," *Journal of Law and Economics*, 65, 531–555, 2020.

Bessen, J., *The New Goliaths: How Corporations Use Software to Dominate Industries, Kill Innovation, and Undermine Regulation*, Yale University Press, New Haven, 2022.

Bessen, J., E. Denk, J. Kim, and C. Righi, "Declining Industrial Disruption," Boston University School of Law, Law and Economics Working Paper 20–28, 2020. Also, Social Science Research Network, https://ssrn.com/abstract=3682745.

Bloom, N, M. Schankerman, and J. Van Reenen, "Identifying Technology Spillovers and Product Market Rivalry," *Econometrica*, 81, 1347–1393, 2013.

Bronnenberg, B., J. Dube, and M. Gentzkow, "The Evolution of Brand Preferences: Evidence from Consumer Migration," *American Economic Review*, 102, 2412–2508, 2012.

Bursztyn, L. and D. Cantoni, "A Tear in the Iron Curtain: The Impact of Western Television on Consumption Behavior," *Review of Economics and Statistics*, 98, 25–41, 2016.

Chen, W., T. Niebel, and M. Saam, "Are Intangibles More Productive in ICT-Intensive Industries? Evidence from EU Countries," *Telecommunications Policy*, 40, 471–484, 2016.

Corrado, C. and Hao, J., "Brands as Productive Assets: Concepts, Measurement, and Global Trends," WIPO Economic Research Working Paper No. 13, 2014.

Corrado, C, J. Haskel, C. Jona-Lasinio, and M. Iomma, "Intangible Capital and Modern Economies," *Journal of Economic Perspectives*, 36, 3–28, 2022.

Corrado, C., J. Haskel, C. Jona-Lasinio, M. Iomma, and F. Bontadini, "Data, Intangible Capital, and Productivity," presented at 10th IMF Statistical Forum: Measuring the Tangible Benefits of Intangible Capital, Washington DC, November 2022.

Corrado, C., C. Hulten, and D. Sichel, "Measuring Capital and Technology: An Expanded Framework," in C. Corrado, J. Haltiwanger, and D. Sichel (eds), *Measuring Capital in the New Economy, Studies in Income and Wealth*, Vol. 65, University of Chicago Press, Chicago, 2005, pp. 11–46.

Corrado, C., C. Hulten, and D. Sichel, "Intangible Capital and U.S. Economic Growth," *Review of Income and Wealth,* 55 , 661–685, 2009.

De Loecker, J. and P. Scott, "Estimating Market Power: Evidence from the U.S. Beer Industry," National Bureau of Economic Research Working Paper 22957, 2016.

De Ridder, M., "Market power and innovation in the intangible economy," *American Economic Review*, forthcoming.

Dosi, R., Gavrilova, E., Silva, R., and Soares, M., "The Value of Trademarks," Social Science Research Network, November 2022, https://ssrn.com/abstract=4280505.

Fraumeni, B. and S. Okubo, "R&D in the National Income and Product Accounts: A First Look at the Effect on GDP," in C. Corrado, J. Haltiwanger, and D. Sichel (eds), *Measuring Capital in the New Economy*, *Studies in Income and Wealth*, Vol. 65, University of Chicago Press, Chicago, 2005, pp. 275–322.

Gandhi, A., S. Navarro, and D. Rivers, "On the Identification of Gross Output Production Functions," *Journal of Political Economy*, 128, 2973–3016, 2020.

Heys, R. and E. Fotopoulou, "Delivering Tangible Estimates of non-SNA Intangible Assets", presented at 10th IMF Statistical Forum: Measuring the Tangible Benefits of Intangible Capital, Washington DC, November 2022.

International Monetary Fund, Committee on Balance of Payments Statistics, BPM6/2008/SNA Update, Joint Globalization Task Force (GZTT), Inter-Secretariat Working Group on National Accounts, Section G9, Guidance Note on Marketing Assets, Payments for Nonproduced Knowledge-Based Capital (Marketing Assets). https://unstats.un.org/unsd/nationalaccount/SNAUpdate/GZTT.asp.

International Monetary Fund, SNA/M1.23/7 - Summary of Discussions for the Joint AEG-BOPCOM Meeting, 2023. https://unstats.un.org/unsd/nationalaccount/aeg/2023/M22/M22_7_Summary_of_Discussions.pdf

Koh, D., R. Santaeulalia, and Y. Zheng, "Labor Share Decline and Intellectual Property Products Capital," *Econometrica*, 88, 2609–2628, 2020.

Li, W. and B. Hall, "Depreciation of Business R&D Capital," *Review of Income and Wealth,* 66, 161-180.

Lodish, L., M. Abraham, J. Livelsberger, B. Lubetkin, B. Richardson, and M. Stevens, "A Summary of Fifty-Five In-Market Experimental Estimates of the Long-Term Effect of TV Advertising," *Marketing Science*, 14, G133–G140, 1995.

Lucking, B., N. Bloom, and J. Van Reenen, "Have R&D Spillovers Declined in the 21st Century?" *Fiscal Studies*, 40, 561–590, 2019.

Mandel, M., "The Declining Cost of Advertising: Policy Implications," Progressive Policy Institute, Washington, D.C., July 2019.

Martin, R., P. Mohnen, C. Thomas, C., D. Verhoeven, and C. Guillard, "Efficient Industrial Policy for Innovation: Standing on the Shoulders of Hidden Giants," Social Science Research Network, February 2022, https://ssrn.com/abstract=4026731.

Moyer, B., M. Planting, M. Fahim-Nader, and S. Lum, "Preview of the Comprehensive Revision of the Annual industry Accounts," *Survey of Current Business*, 84, 38–51, 2004.

Nakamura, L., J. Samuels, and R. Soloveichik, "Measuring the "Free" Digital Economy Within the GDP and Productivity Accounts," Federal Reserve Bank of Philadelphia Working Paper 17–37, 2017.

Ribarsky, J., "Intangible Capital in the Update of the International Statistical Standards," presented at 10th IMF International Statistical Forum: Measuring the Tangible Benefits of Intangible Capital, Washington DC, November 2022.

Rogers, R. and R. Tokle, "The Economics of Advertising: Where's the Data?" *Review of Industrial Organization*, 10, 675–687, 1995.

Silk, A. and E. R. Berndt, "Aggregate Advertising Expenditure in the U.S. Economy: What's Up? Is it Real?", National Bureau of Economic Research Working Paper 28161, 2020.

Soloveichik, R., "Long-Lived Television Programs as Capital Assets," unpublished paper, 2013.

Stiroh, K., "Are IT Spillovers Driving the New Economy?" *American Economic Review*, 92, 1559–76, 2002.

Sveikauskas, L., "R&D and Productivity Growth: A Review of the Literature," Bureau of Labor Statistics Working Paper Number 408, 2007.

United Nations Statistics Division, *System of National Accounts 2008,* 2009

U.S. Bureau of Economic Analysis, *NIPA Handbook: Concepts and Methods of the U.S. National Income and Product Accounts*, 2021, online.

Villalonga, B., "Intangible Resources, Tobin's q, and Sustainability of Performance Differences," *Journal of Economic Behavior and Organization,* 54, 205–230, 2004.

Vitorino, M. A., "The Effect of Advertising on Stock Returns and Firm Value: Theory and Evidence from a Structural Model," *Management Science,* 60, 227–245, 2014.

Appendix A. Overview of Investment in Marketing Assets

Appendix A provides a condensed view of our basic data set. The figures below show investment in each form of marketing as a percentage of total investment in marketing in every year. Figure A.1a reports investment shares under our basic assumptions, which treat 60 percent of expenditures on purchased advertising, 80 percent of expenditures on other marketing purchases, and 30 percent of own-account marketing expenditures as investment.

Figure A.1a shows that in 2020 purchases of advertising accounted for 52 percent of total investment in marketing, which represented a sharp decline from 71 percent in 1987.[25] In contrast, web design and hosting did not exist at all in 1987, but by 2020 represented 9 percent of marketing investment. The share of investment in marketing services increased moderately after 1997, and the share of marketing analysis also increased modestly. As a result of changes in these components, especially the decline in advertising, the purchased marketing share of investment declined from 84 percent of investment in 1987 to 78 percent by 2020. Conversely, the own-account share of marketing investment increased from 16 percent in 1987, to 19 percent in 2002, and 22 percent by 2020. Table D.1a, in online Appendix D, lists the specific investment shares that underly Figure A.1a.

Figure A.1b shows the investment share based on our alternative assumptions in which 60 percent of expenditures on advertising, 95 percent of expenditures on other purchased marketing services, and 60 percent of own-account marketing are treated as investment. Since the alternative assumptions weight own-account expenditures more heavily, the own-account share of investment is greater in this scenario. The own-account share of total investment then increases from 27 percent in 1987 to 35 percent in 2020. Table D.1b in online Appendix D reports the actual data used in Figure A.1b.

Throughout Appendix A, “Commodity advertising” refers to NAICS 51, 5418, and a portion of NAICS 3231. “Commodity advertising” includes advertising by ad agencies and large amounts of advertising provided by the print media, radio and TV, and the internet. Web design and hosting refers to NAICS 5415 and 5182. Marketing consulting is NAICS 5416, and marketing surveys refers to NAICS 5419.[26] The own-account share represents own-account investment by all our 61 industries.

The baseline assumption is that 60 percent of advertising expenditures, 80 percent of other marketing expenditures, and 30 percent of own-account expenditures represent investment.

Figure A.1b relies on the same data on expenditures, but this alternative assumes that 60 percent of advertising, 95 percent of other purchased marketing services, and 60 percent of own-account expenditures represent investment. As a consequence, own-account marketing accounts for a substantially larger share of total investment. Table D.1b in Appendix D provides the data that underlie Figure A.1b.

[25] The data on purchased advertising are commodity data, so they reflect the sharp decline in print media.

[26] Our estimates of the marketing consulting and marketing research purchased in 2012 are somewhat greater than the 2007 to 2011 estimates in Corrado and Hao (2014).

Figure A.1a. Sources of Marketing Services, in Percentages, With Base Assumptions

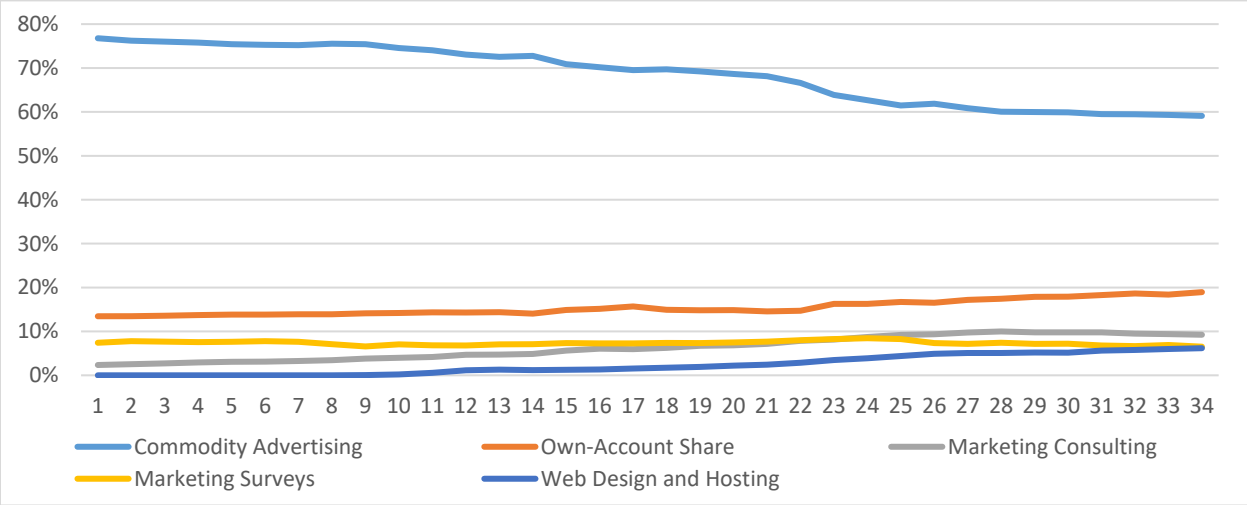


Figure A.1b. Sources of Marketing Services, in Percentages, With Alternative Assumptions

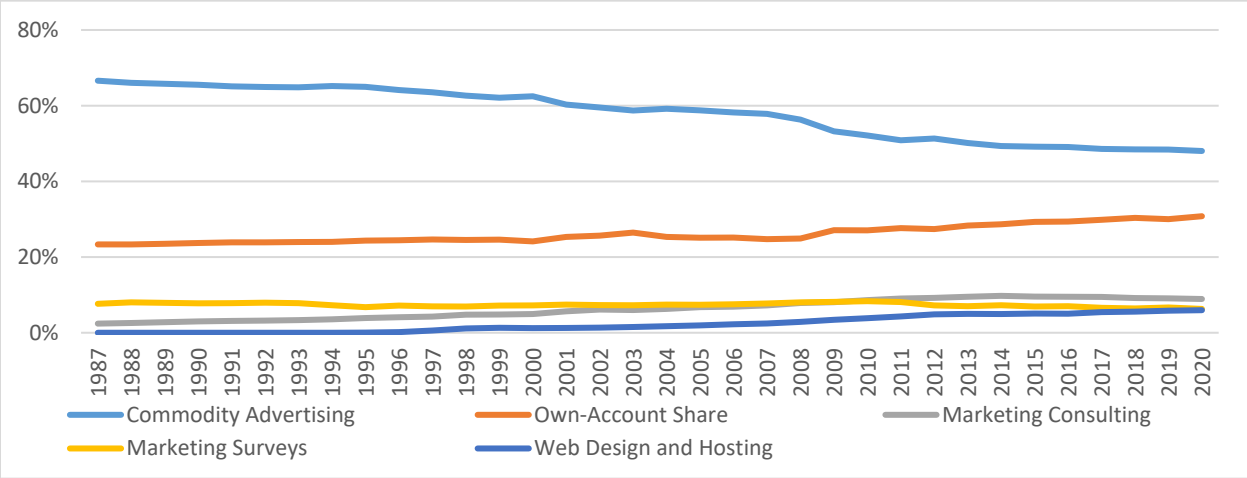
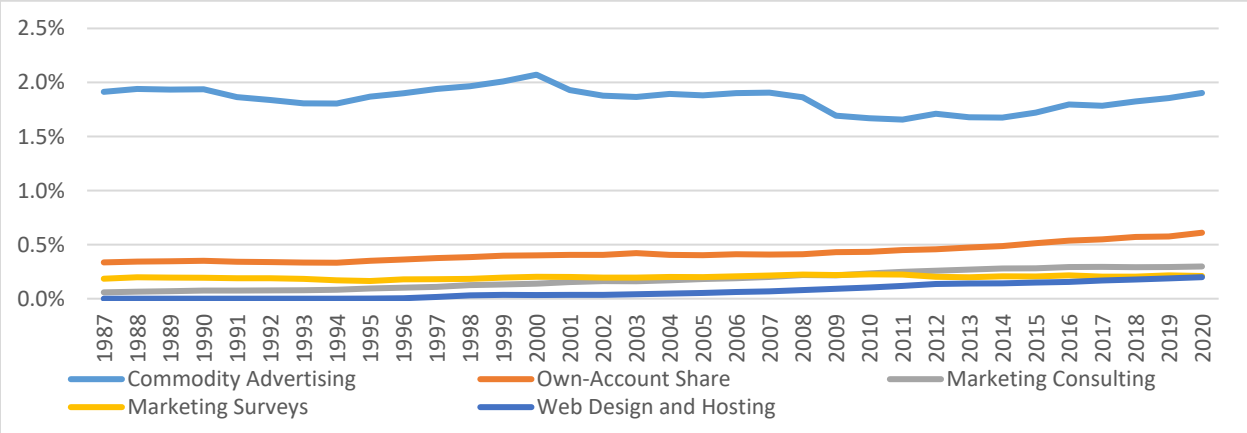


Figure A.2 shows marketing investments from each of the categories of providers as a percentage of GDP. Since 2010, investment in most forms of marketing increased as a percentage of GDP. The shares of GDP devoted to advertising and to own-account marketing increased substantially, but web services and marketing analysis also increased.

Figure A.2. Sources of Marketing Services, as a Percentage of Nominal GDP



Appendix B. Measures of Own-Account Marketing

Table B.1 shows the occupations selected to represent own-account marketing in the United States. For each occupation, we list its Standard Occupational Code (SOC), and 2021 national employment in that occupation in the OEWS data.

Table B.1. Occupations that Produce Own-Account Marketing

Occupation title	SOC occupation code	2021 employment
Advertising and promotion managers	11–2011	22,520
Marketing managers	11–2021	278,690
Public relations managers and fund-raising managers	11–2030	83,040
Market research analysts and marketing specialists	13–1161	727,540
Web developers	15–1254	84,820
Web and digital interface designers	15–1255	82,380
Other computer occupations	15–0000, part	224,375
Survey researchers	19–3022	8,850
Art directors	27–1011	42,080
Merchandise displayers and window trimmers	27–1026	159,790
Public relations specialists	27–3031	242,710
Media and communications workers, all other	27–3099	16,540

These occupational definitions changed over time, and the OEWS is available only for years since the late 1990s. Because less occupation detail is available for earlier years, in certain cases we assume that the distribution of detailed occupations observed in a later year also holds true in earlier years.

We considered including several other occupational categories. We decided not to include advertising sales agents (occupational code 41–3011) because their work is typically sold as purchased advertising. Similarly, we do not include employees working in NAICS industry 541800 because their output is already counted in purchased advertising, so that their inclusion would represent double counting. We exclude editors (27–3041) and writers and authors (27–3043) because, in our judgment, most of these workers are not involved in marketing.

Once we have developed measures of labor compensation for the selected occupations, we estimate total expenditures as twice compensation, following Corrado and Hao (2014). Because the category system changes, the occupations we use are not exactly the same ones that they use. Our primary estimates assume that own-account workers spend 30 percent of their time on long-term investment, following Heys and Fotopoulou (2022). Our alternative measures assume that own-account workers spend 60 percent of their time on investment, a compromise between 80 percent for managers and 50 percent for computer personnel and media workers assumed in Corrado and Hao (2013).

Table B.2 presents the amounts of own-account expenditures developed from the presence of each specific occupation. Marketing analysts, advertising and public relations workers, and web specialists account for most of the observed growth in expenditures. Marketing analysts have grown especially rapidly, probably largely because of the new capabilities permitted by improved methods and tools of data analysis. These three categories of occupations account for 145.9/161.8, or over 90 percent, of the total increase in expenditures observed between 2002 and 2020.

Table B.2. The Contributions of Specific Occupations to Own-Account Marketing Expenditures

Year	Web design and hosting	Marketing analysis	Advertising, public relations, and related	Marketing research	Other computer
	(1)	(2)	(3)	(4)	(5)
2002	4.0	13.2	61.7	0.6	11.5
2012	7.7	44.1	80.7	1.0	18.3
2020	13.8	79.5	131.5	0.7	27.3

Note: SOC codes for each column:
Column (1): 15–1254, 15–1255.
Column (2): 13–1161.
Column (3): 11–2011, 11–2021, 11–2032, 27–1011, 27–1026, 27–3031, and 27–3099.
Column (4): 19–3022. Column (5): 15–0000 other.
Column (5): 15–0000 other, calculated as 5 percent of computer workers outside of web design and hosting

Appendix C. Detailed Information on how Several of Our Main Estimates are Determined

Appendix C discusses several issues that help explain how we obtain the results reported.

Assumptions concerning the investment proportions and depreciation rates used in the baseline and alternative cases: Sensitivity tests

Table C.1 reports the investment proportions used for advertising, other purchased marketing, and own-account marketing under our baseline and alternative sets of assumptions. Table C.2 shows how sensitive our results are to other assumptions concerning the investment proportion or the rate of depreciation.

Tables C.1–C.2. Output Contribution of Marketing Under Alternative Assumptions, 1987–2020

Table C.1. Summary of Assumptions Concerning Construction of Capital Stocks

	Advertising expenditures	Other purchased marketing expenditures	Own-account expenditures	Depreciation Rate
Baseline assumption	60%	80%	30%	45%
Alternative assumption	60%	95%	60%	45%
Sensitivity test for advertising 1	40%	80%	30%	45%
Sensitivity test for advertising 2	80%	80%	30%	45%
Sensitivity test for depreciation 65%	60%	80%	30%	65%

Table C.2. Output Contribution of Marketing Under Different Assumptions, 1987–2020

	Total marketing	Purchased marketing	Own-account marketing	Software effect	R&D effect
Basic assumptions	.18	.15	.03	.19	.15
Alternative assumptions	.23	.16	.07	.19	.15
Advertising 40% investment	.15	.12	.03	.19	.15
Advertising 80% investment	.22	.19	.03	.19	.15
Depreciation rate of 65%	.17	.14	.03	.19	.15

Table C.2 shows how the estimated impact of marketing varies with the percentage of expenditures that is treated as investment. The alternative set of assumptions suggests that the investment percentage is greater for expenditures on purchased marketing and, especially, for own-account marketing, so that their implied effect on output growth is stronger. If the investment percentage of advertising is greater, or lower, the implied impact of advertising on output growth similarly increases or decreases. In

contrast, a change in depreciation, within the range that most estimates say is realistic, has little impact on output growth. The effect of software and of R&D does not vary across these different possibilities, so the relative importance of marketing varies with the specific parameters used to measure the marketing stock, especially the proportion of expenditures that is regarded as investment.

How we measure the impact of capital input on output growth

Tables 1 and 4 of the main text discuss the impact that several types of intangibles have on output growth. This subsection explains how we determine these estimates.

Analysis of the effect of the influence of intangibles begins with measures of the stock and rental price of each asset in each year and industry. The BLS Capital Database currently contains information on 101 assets. We add further information on purchased marketing and own-account marketing, making a total of 103 assets. We remind the reader that in the BLS database most rental prices are designed to exhaust property income. However, for some industry-years, the BLS uses external information to develop more plausible rates of return.

For private business contributions to growth, we first Tornqvist aggregate each asset across the 61 industries for each of the 103 assets in every year. We calculate the share of each asset as the share of (stocks * rental price)/value added. Finally, the contribution of each asset to output growth is calculated from the percentage change in that stock multiplied by that stock's associated share of value added.

The contribution of each intangible to output growth in a particular industry is measured in a very similar way. The percentage increase in the quantity of a specific intangible in that industry is then weighted by that intangible's share of value added in that industry.

Estimates of the price of marketing prior to 1997

We need a price index for advertising for the years 1982 to 1997. Conceptually, the price of marketing reflects both the preparation of a marketing message and its delivery to a viewer. The present study measures the price of marketing from BEA estimates of the price of the commodity advertising from 1997 to 2020. These BEA prices depend largely on PPI data which cover both the costs of preparing marketing messages and delivering them. PPI data provide much less information on the prices of services prior to 1997. Consequently, it is more difficult to price advertising before 1997.

The 1982 to 1997 deflator makes a difference in the sense that different potential deflators can have a considerable effect on the implied growth of marketing. We would have preferred to rely heavily on the available PPIs because they are official BLS series. However, some tests showed that the cost of advertising also influences BEA's official advertising deflator. We therefore selected 1982 to 1997 deflators that assign one-half of the weight to the PPI evidence and one-half to the cost of advertising. We combined these new data with the official BEA series for 1997 to 2020. The cost of advertising is measured by the revenue that advertisers receive for each impression on a viewer, such as the revenue ESPN receives per viewer for an ad during a football game. In recent years, advertisers, such as Coca-Cola, paid about a dollar an hour for time watching television ads.

Data on cost per viewer is largely drawn from Nakamura *et al*. (2017), who studied free content supported by advertising and marketing from 1929 to 2017. This paper uses cost data only for 1982 to 1997. We add estimates of direct mail reading time obtained from the U.S. Postal Service's Household Diary Survey (https://www.prc.gov/docs/119/119244/Final%20HDS%202020%20Annual%20report.pdf).

This method has the advantage that cost per viewer time can be calculated consistently over time. This will be particularly useful when the analysis of advertising is eventually extended to begin in 1929. In addition, like other advertising price indexes, this advertising price index declines when ads are digitally targeted over the internet, and also declines during recessions.

Estimates of each industry's expenditures on web services, marketing consulting services, and purchased marketing services

We prepare annual data on expenditures on web services, on marketing consulting services, and on purchased marketing services from the Census of Services and the SAS. We believe that our estimates of the national totals for each of these categories are reasonably reliable. Unfortunately, these same sources cannot provide reliable information on how much each industry spends on each of these categories, especially since it is difficult to track expenditures on secondary products.

We therefore allocate the national totals for each of these categories to individual industries based on the IO tables. However, the IO tables do not cover the detailed industries that produce these products. For example, the specific industry that provides marketing consulting services is NAICS 541613, but the most detailed input-output industry for which data are available is NAICS 541610, management consulting services in general. Consequently, our allocation of purchased marketing services to individual industries is not precise. Further research on marketing expenditure by each industry would improve national accounts.

Output in Private Business used in BLS Measures of Labor Productivity and TFP Growth and in this Study of Marketing

Table C.3 shows how our definition of output differs from those used in official BLS measures of labor productivity growth and of TFP growth.

Table C.3. Measures of Output in the Private Business Sector Used in Official BLS Measures and this Study

	Labor Productivity Business Output	TFP Private Business Output	This Marketing Study, Private Business Output
Aggregation method	Fisher	Fisher	Tornqvist
Nonprofits and housing	removed	removed	removed
Government enterprises	included	removed	removed
Indirect business taxes	included	included	removed

As Table C.3 indicates, this study measures output by Tornqvist aggregation, while the official measures use a Fisher index. All measures remove nonprofits and housing services. We also remove government enterprises which the BLS measure of labor productivity growth includes. We also remove indirect business taxes because it is difficult to assign these to either capital or labor. These differences are small and should not affect our conclusions.

Online Appendix D. Other Supporting Material

Tables D.1 provide information on the marketing services purchased from each type of supplier.

Table D.1a. Providers of Marketing Services, in Percentages
With baseline investment proportions

Year	Commodity Advertising	Own-Account Share	Marketing Consulting	Marketing Surveys	Web Design and Hosting
1987	76.8%	13.5%	2.3%	7.4%	0.0%
1988	76.2%	13.5%	2.5%	7.8%	0.0%
1989	76.0%	13.6%	2.7%	7.7%	0.0%
1990	75.8%	13.7%	2.9%	7.6%	0.0%
1991	75.4%	13.8%	3.1%	7.6%	0.0%
1992	75.3%	13.8%	3.1%	7.8%	0.0%
1993	75.2%	13.9%	3.3%	7.6%	0.0%
1994	75.5%	13.9%	3.4%	7.1%	0.0%
1995	75.4%	14.1%	3.8%	6.6%	0.0%
1996	74.6%	14.2%	4.0%	7.0%	0.2%
1997	74.0%	14.4%	4.2%	6.9%	0.6%
1998	73.1%	14.3%	4.7%	6.8%	1.1%
1999	72.6%	14.4%	4.7%	7.1%	1.3%
2000	72.8%	14.1%	4.9%	7.1%	1.2%
2001	70.9%	14.9%	5.6%	7.4%	1.3%
2002	70.2%	15.1%	6.1%	7.3%	1.3%
2003	69.5%	15.7%	6.0%	7.3%	1.5%
2004	69.7%	14.9%	6.2%	7.4%	1.7%
2005	69.2%	14.8%	6.7%	7.3%	1.9%
2006	68.6%	14.8%	6.8%	7.5%	2.2%
2007	68.2%	14.6%	7.2%	7.7%	2.4%
2008	66.6%	14.7%	7.8%	8.0%	2.9%
2009	63.9%	16.3%	8.1%	8.3%	3.5%
2010	62.7%	16.3%	8.7%	8.4%	3.9%
2011	61.5%	16.7%	9.2%	8.3%	4.4%
2012	61.9%	16.5%	9.4%	7.3%	4.9%
2013	60.8%	17.2%	9.7%	7.2%	5.1%
2014	60.0%	17.4%	10.0%	7.4%	5.1%
2015	60.0%	17.9%	9.8%	7.1%	5.2%
2016	59.9%	17.9%	9.8%	7.2%	5.2%
2017	59.5%	18.3%	9.8%	6.8%	5.6%
2018	59.5%	18.6%	9.5%	6.6%	5.8%
2019	59.3%	18.4%	9.4%	6.9%	6.0%
2020	59.1%	18.9%	9.2%	6.5%	6.2%

Table D.1b. Providers of Marketing Services, in Percentages
With alternative investment proportions

Year	Commodity Advertising	Own-Account Share	Marketing Consulting	Marketing Surveys	Web Design and Hosting
1987	66.6%	23.3%	2.4%	7.6%	0.0%
1988	66.0%	23.3%	2.6%	8.0%	0.0%
1989	65.8%	23.5%	2.8%	7.9%	0.0%
1990	65.5%	23.7%	3.0%	7.8%	0.0%
1991	65.1%	23.9%	3.1%	7.8%	0.0%
1992	65.0%	23.9%	3.2%	8.0%	0.0%
1993	64.9%	24.0%	3.3%	7.8%	0.0%
1994	65.2%	24.0%	3.5%	7.3%	0.0%
1995	65.0%	24.3%	3.9%	6.7%	0.1%
1996	64.1%	24.4%	4.1%	7.2%	0.2%
1997	63.5%	24.6%	4.3%	7.0%	0.6%
1998	62.6%	24.5%	4.8%	6.9%	1.2%
1999	62.1%	24.6%	4.8%	7.2%	1.3%
2000	62.5%	24.1%	5.0%	7.2%	1.2%

Year	Commodity Advertising	Own-Account Share	Marketing Consulting	Marketing Surveys	Web Design and Hosting
2001	60.3%	25.3%	5.7%	7.4%	1.3%
2002	59.5%	25.7%	6.1%	7.3%	1.3%
2003	58.7%	26.5%	6.0%	7.3%	1.5%
2004	59.2%	25.3%	6.3%	7.4%	1.7%
2005	58.8%	25.1%	6.8%	7.4%	1.9%
2006	58.2%	25.2%	6.9%	7.5%	2.2%
2007	57.9%	24.7%	7.2%	7.7%	2.4%
2008	56.3%	24.9%	7.9%	8.0%	2.9%
2009	53.2%	27.1%	8.1%	8.2%	3.4%
2010	52.1%	27.1%	8.6%	8.3%	3.8%
2011	50.9%	27.7%	9.0%	8.1%	4.3%
2012	51.3%	27.4%	9.2%	7.2%	4.8%
2013	50.2%	28.3%	9.5%	7.0%	5.0%
2014	49.4%	28.7%	9.8%	7.3%	5.0%
2015	49.2%	29.3%	9.5%	7.0%	5.1%
2016	49.1%	29.4%	9.5%	7.0%	5.0%
2017	48.6%	29.9%	9.5%	6.6%	5.5%
2018	48.4%	30.4%	9.2%	6.4%	5.6%
2019	48.4%	30.0%	9.1%	6.7%	5.8%
2020	48.0%	30.8%	8.9%	6.3%	6.0%

In table D.2 we list the 61 industries for which we have estimates of productive inputs. Certain intangible categories do not appear in every industry. Five industries are measured as having Entertainment Originals, and four do not have any measured R&D. Our study does not cover two other categories: the Federal Government and State and Local Governments.

Table D.2. List of 61 industries

Industry	Notes on inputs
Farms	No R&D
Forestry, fishing, and related activities	No R&D, no OA Ads
Oil and gas extraction	
Mining, except oil and gas	
Support activities for mining	
Utilities	
Construction	
Wood products	
Nonmetallic mineral products	
Primary metals	
Fabricated metal products	
Machinery	
Computer and electronic products	
Electrical equipment, appliances, and components	
Motor vehicles, bodies and trailers, and parts	
Other transportation equipment	
Furniture and related products	
Miscellaneous manufacturing	
Food and beverage and tobacco products	
Textile mills and textile product mills	
Apparel and leather and allied products	
Paper products	
Printing and related support activities	
Petroleum and coal products	
Chemical products	
Plastics and rubber products	
Wholesale trade	
Retail trade	
Air transportation	
Rail transportation	

Industry	Notes on inputs
Water transportation	
Truck transportation	
Transit and ground passenger transportation	
Pipeline transportation	
Other transportation and support activities	
Warehousing and storage	
Publishing industries, except internet (includes software)	Includes Entertainment Originals
Motion picture and sound recording industries	Includes Entertainment Originals
Broadcasting and telecommunications	Includes Entertainment Originals
Data processing, internet publishing, and other information services	
Federal Reserve banks, credit intermediation, and related activities	
Securities, commodity contracts, and investments	
Insurance carriers and related activities	
Funds, trusts, and other financial vehicles	
Real estate	
Rental and leasing services and lessors of intangible assets	
Legal services	
Computer systems design and related services	
Miscellaneous professional, scientific, and technical services	Includes Entertainment Originals
Management of companies and enterprises	
Administrative and support services	No R&D
Waste management and remediation services	
Educational services	No R&D
Ambulatory health care services	
Hospitals and nursing and residential care facilities	
Social assistance	
Performing arts, spectator sports, museums, and related activities	Includes Entertainment Originals
Amusements, gambling, and recreation industries	
Accommodation	
Food services and drinking places	
Other services, except government	