A Census of Superstar Sectors

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Introduction

Inequality has become a pressing social concern in at least the past decade, if not longer. Much political rhetoric has been expended on the topic, and pundits have questioned what can be done to curb rising inequality—or whether anything should be done at all. For their part, economists have sought to understand the causes and effects of inequality

Most of the discussion on inequality focuses on individual income inequality, and to a lesser extent, individual wealth inequality. However, inequality among businesses is an important topic that can have downstream effects on individual inequality as well. Small business ownership is a significant component of wealth, especially for middle-income families, and gains from increasing returns to large corporations are unevenly distributed to high-income individuals.

Inequality among businesses resulting in more market concentration also has a double effect on consumers, since it can impact both cost and quality of life as well. More concentration means that businesses hold more power, which can lead to oligopoly and rent extraction. However, if concentration among firms is due to the better product outcompeting other offerings—especially as the result of technological innovation that enables broader market access and more consumer choice—then consumers may still end up with a better quality of life in the end. Therefore, it is vitally important to understand the consequences of technological progress and to be able to distinguish the causes of market concentration in order to create successful policy that addresses inequality.

Literature Review

It is practically impossible to discuss the effect that technology has on income distribution without first considering the foundational paper that first proposed the question, "The Economics of Superstars" by Sherwin Rosen, first published in 1981. Rosen makes the observation that in many fields, including entertainment, sports, and art, "there is concentration of output among a few individuals, marked skewness in the associated distributions of income and very large rewards at the top" (p. 845). To explain these examples, whom Rosen terms "Superstars", he cites two stylized facts: Imperfect substitution among sellers (some sellers are more talented than others, and thus their products are preferred to an outsized degree, which leads to convexity of returns), and joint consumption enabled by technology (technology makes it possible for one individual to serve a large portion of the market with little change in effort). Combined with the observation that technological progress expands access to markets (thereby increasing market size) and makes possible new forms of mass distribution in new markets, Rosen's theory predicts that inequality will continue to rise—as indeed it has since his paper was written—and proposes a hypothesis for why it continues to do so.

The paper "The Macroeconomics of Superstars" by Korinek and Ng (2017) extends Rosen's theory to the macroeconomic scale. They develop a macroeconomic model in which firms can replace part of the labor involved in production through digitization and information technology. This can have the effect of increasing profits through markup (if the cost reduction over competitors is relatively small) and of decreasing prices for consumers (once the optimal markup for consumers is reached).

Autor et al. ("The Fall of the Labor Share and the Rise of Superstar Firms", 2017) explore a related phenomenon: the fall in labor share of value added in recent decades as a result of superstar firms. They explore micro-level firm data from the Economic Census to find that labor share declines most in industries where concentration rises most, and that this decline is largely due to reallocation of sales towards a small number of firms, rather than a trend in labor share across all firms. They also find that industries that are becoming the most concentrated also exhibit faster growth of productivity, lending support to the theory that advances in digital technology are enabling joint consumption. Finally, Autor et al. examine international datasets to confirm that these findings hold true not only for the United States, but also for other OECD countries.

Ideal Research Design

One of the difficulties in conducting a study about the impact that technological improvements have on competition and market concentration is that the necessary data is often highly sensitive and closely guarded by the companies involved—an observation made by Sherwin Rosen himself in the opening remarks of his paper. Indeed, if a company gains market share from its competitors as a result of a new technology, then it has an interest in keeping the details as secret as possible, lest its competitors attempt to copy it and reduce its newfound advantage.

An ideal research design would have access to longitudinal data from individual firms, to compare changes in the entire distribution of income over time (like Autor et al., 2017). Necessary data includes information about income and expenses, including payroll, from which market and income concentration can be derived, as well as firm size, to distinguish growth enabled by technology from growth due to labor supply. Some knowledge of the introduction of

a potentially superstar-enabling technology into each industry and firm would also be helpful in determining exact causality.

Ideally, a long enough time period of data would be available with consistent companies to allow for numerically stable estimates of a trend, both before and after the introduction of a new technology that reduces marginal production cost and enables joint consumption. An empirical measure of product quality, to test Rosen's original hypothesis about imperfect substitution, would be hard to obtain.

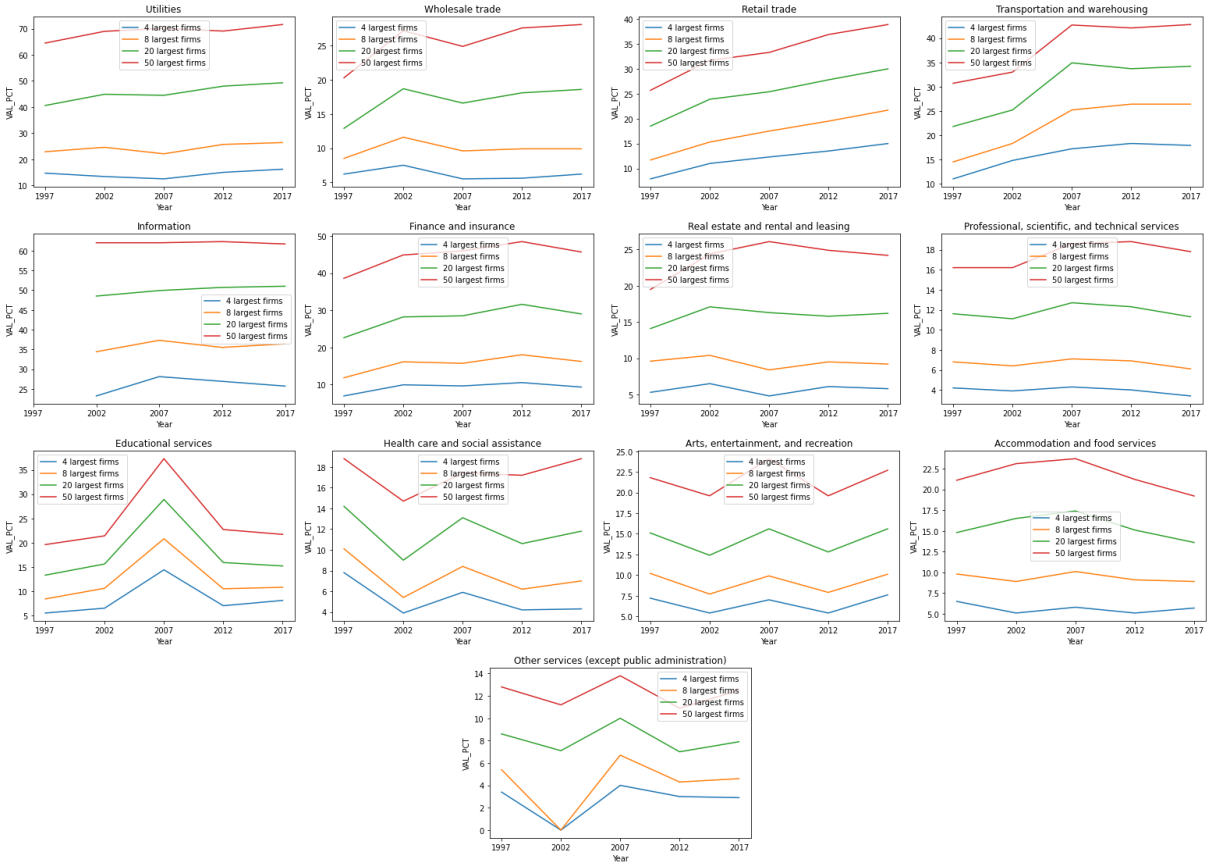
Finally, the collection of a control group—firms in a similar industry unaffected by technological change—would permit a difference in differences analysis to control for other factors that may influence market concentration (e.g. government regulation, changes in productivity, other returns to scale).

Findings

We examined data from the U.S. Economic Census, which is conducted every five years. Data on market concentration—4 largest firms, 8 largest firms, 20 largest firms, and 50 largest firms—is available at the NAICS sector, subsector, and industry level for the 1997, 2002, 2007, 2012, and 2017 censuses at time of writing. Data before 1997 is available using SIC codes, which poses some difficulties to using a consistent definition of a market over time. We examined data at the 2-digit sector level for thirteen sectors: Utilities; Wholesale trade; Retail trade; Transportation and warehousing; Information; Finance and insurance; Real estate and rental and leasing; Professional, scientific, and technical services; Educational services, Health care and social assistance; Arts, entertainment, and recreation; Accommodation and food services; and Other services.

Figure 1

Value-added Across Sectors



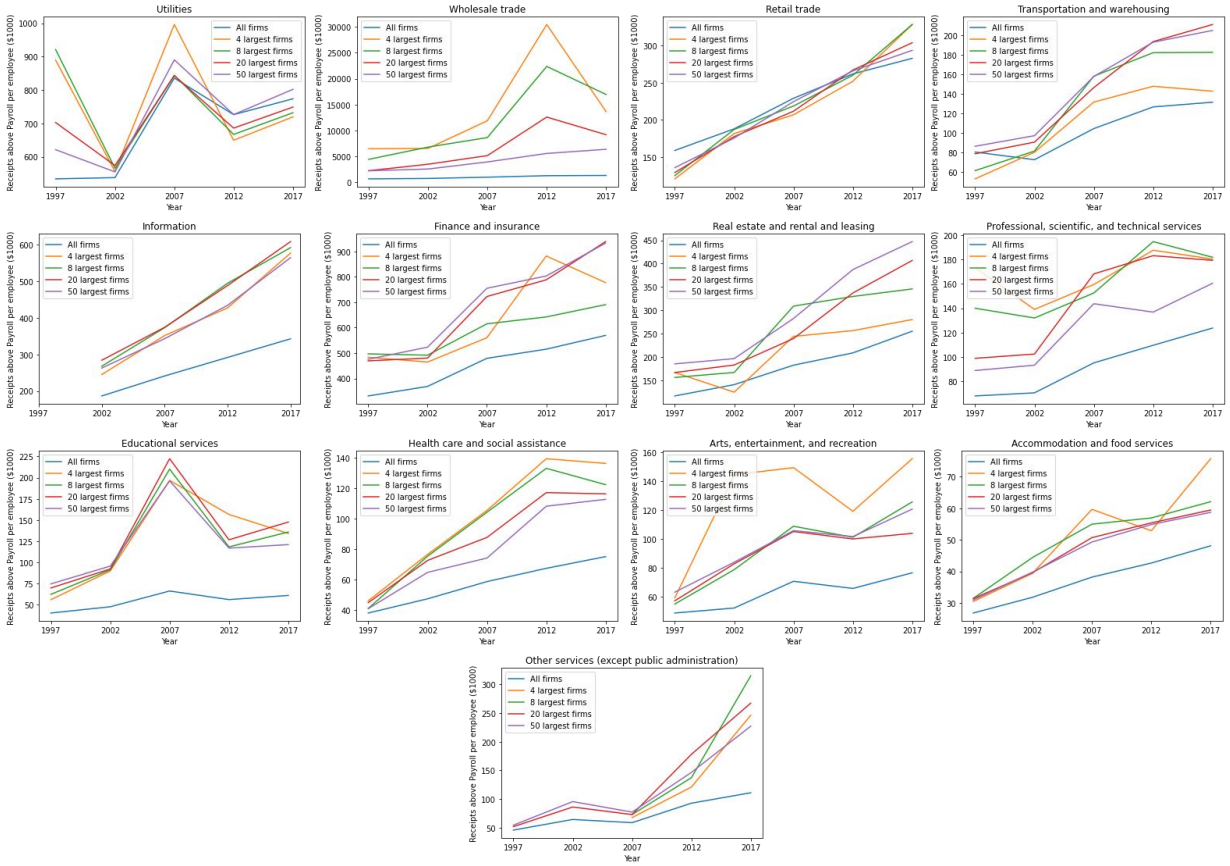
Initial exploratory data analysis shows that the level of market concentration varies widely between sectors, as does the rate of change of concentration. Concentration, as measured by the percentage of value-added accruing to the 4 or 8 largest firms, is noticeably increasing in Retail trade, Transportation and warehousing, and to a lesser extent, Educational services (Figure 1). The Information sector, possibly the most likely candidate for superstar firms, exhibits weak to no change. However, the Information sector exhibits the highest level of absolute concentration, with the 4 largest firms capturing approximately 25% of the total value-added,

more than the 50 largest firms combined in seven other sectors (Real estate and rental and leasing; Professional, scientific, and technical services; Educational services; Health care and social assistance; Arts, entertainment, and recreation; Accommodation and food services; and Other services).

We then consider receipts above payroll, or the total annual value of sales, receipts, and shipments, minus the total annual payroll. We use this as an approximation for profits, but it is not a true measure since information on inputs besides labor is lacking in the data. Receipts above payroll per employee in the Information sector is rising much faster for the largest firms in the sector than for all firms (Figure 2). The absolute level of receipts above payroll per employee is also higher in Information than in most other sectors. We cite this as possible evidence of superstar firms, especially since Information sector firms probably have lower non-payroll expenses than firms in other sectors. Thus, the largest firms in the Information sector are generating much more profit per employee than all other firms, possibly due to the technological advantages available to them. A similar disparate upward trend can be seen in Educational services, Health care and social assistance, and Other services (Figure 2). These sectors include many firms with significant marginal cost to providing services, e.g. schools, hospitals, repair shops, so we are unsure if the trend in profit per employee for the largest firms is the result of superstar effects or not. Further inquiry is required to differentiate between these sectors and Information.

Figure 2

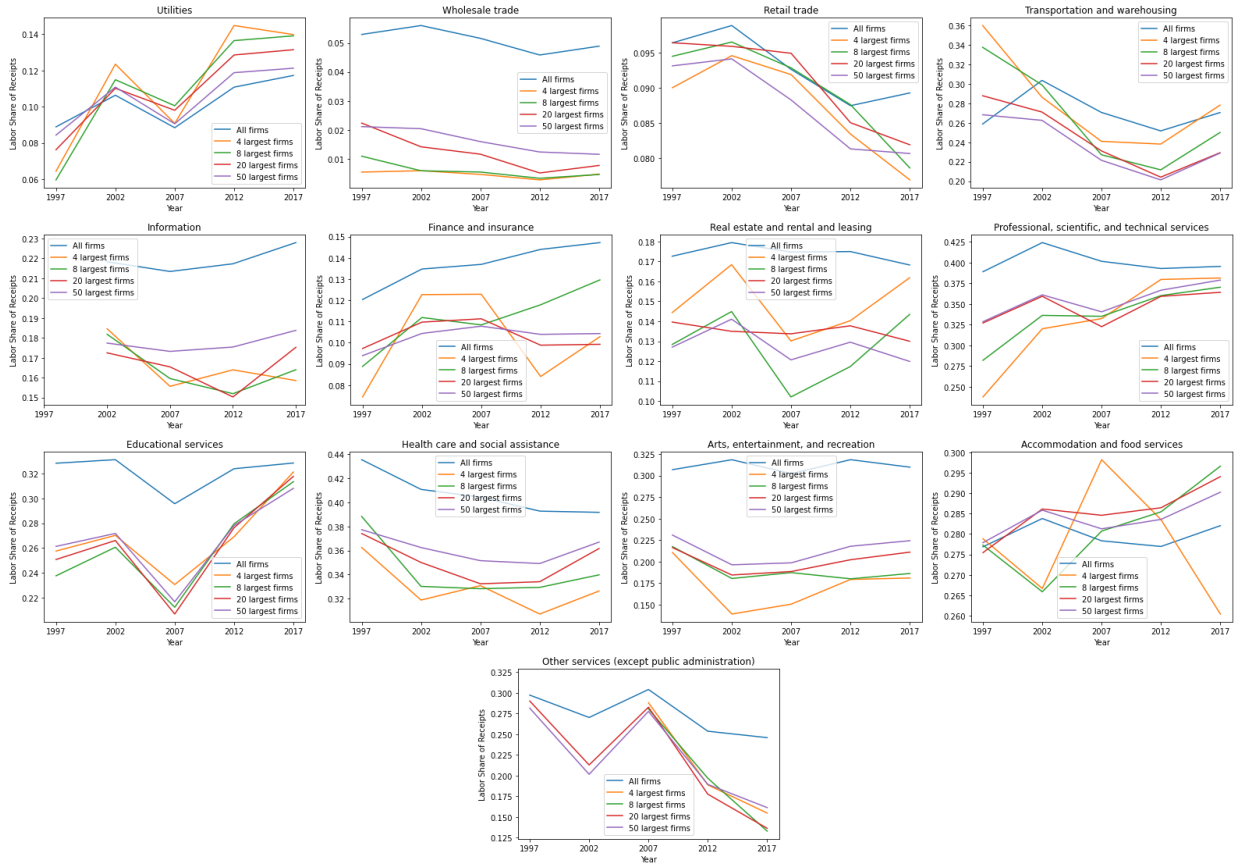
Receipts Above Payroll Per Employee Across Sectors



We also consider labor share of receipts, which is the percentage of total receipts made up by annual payroll. We find a significantly lower labor share among the largest firms in many sectors, including Wholesale trade; Information; Educational services; Health care and social assistance; and Arts, entertainment, and recreation (Figure 3). We would expect superstar firms to have much lower labor share than their overall sectors, since they can distribute their products to a large audience with little additional labor due to technology. The overall trend in labor share varies between sectors, about evenly split between increasing and decreasing.

Figure 3

Labor Share of Payroll Across Sectors



Finally, we attempted to quantify some of the qualitative results discussed here using ordinary least squares regression. However, we found that with only five data points for a single series, the numerical estimates were simply not useful (results omitted here). Even for data with a strong trend, the variance due to a low number of samples results in a 95% confidence interval that always includes zero, so no statistically significant conclusions could be drawn from the quantitative analysis.

Reflection

The questions we posed at the beginning of this paper are very complex and broad in scope, and by no means does this paper answer them. One difficulty regarding major technological advances is defining a specific point in time at which the technological advancement becomes impactful. In evaluating the impact of the Internet, should one start from the development of networking protocols in the 1970s and 1980s, the initial popularity of online messaging and the World Wide Web in the 1990s and 2000s, or the widespread adoption of mobile computing and the rise of social networking in the 2010s and into the modern day? This example highlights that technological advancements are often incremental, with a time-varying effect, such that a concept as broad as the Internet may be better discussed as a sequence of technological advancements. Often, businesses change as technology improves, adapting their strategy based on an initially successful experiment.

One particular difficulty with the data we used was the short timescale and coarse granularity of easily available data. The Economic Census is conducted every five years, and electronically available datasets are only available for the previous five surveys. Such a low sample size leads to high variance in numerical estimates of trends. A single anomalous year that coincides with a survey year can completely neuter or reverse a trend in the data. With so few survey years, it is also difficult to identify enough data points before and after a new technological innovation to draw conclusions about its introduction.

Additionally, we had no control over the metric used to decide the largest firms. The metric used by the Census Bureau is employment size, but as discussed, superstar firms may be characterized by their smaller employment relative to their share of sales. Ranking firms by sales

would allow us to possibly see that trend more clearly, especially in our analysis of receipts above payroll per employee.

Without access to individual firm-level data (like Autor et al. used) and insight into the decision-making process of firms, it is difficult to identify which firms adopted a specific technological advancement and when. This makes it nearly impossible to identify a control group to compare against. We could reduce our exploration to very broad technological advancements (like the advent of “e-commerce” or “the internet” in general), but this confounds the problem of time-varying treatments, and makes it even more difficult to identify a control group which has not adopted the technology. As a result, we are left to speculate which sectors have been impacted most by technological advancements that improve market access.

With additional time, we would have liked to analyze 3-digit subsector or individual 4-digit industries, most of which have the same reported statistics for largest firms. A single superstar firm may stand out much more in an industry than in the sector overall. Assumptions about a subsector or industry may be more applicable than for an entire sector, and a more detailed analysis might allow us to determine the components that contribute to the broader trends seen within each sector. By examining industries, we may have been able to incorporate a longer history of data, as some SIC industries remained largely unchanged under the new 1997 NAICS definitions.

It may never be possible to determine for certain precisely how technology impacts the existence of superstar firms, for the reasons outlined above. However, research into the topic can give some insight into the causes of economic growth, and inform policy aimed at promoting the general welfare of the nation.