Online Appendix:
Growing Oligopolies, Prices, Output, and Productivity

Sharat Ganapati

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A Simple Theoretical Models

I present two simple oligopoly models, first with Cournot competition and second with monopolistic competition under Bertrand pricing. Both models produce relationships that (a) provide a simple tractable framework and (b) allow for straightforward comparative statics.

A.1 Cournot Competition

Assume there are N identical firms indexed by i competing by setting quantity, with constant marginal costs:

$$c(q_i) = cq_i.$$

Assume market demand takes the form:

$$p(Q) = p\left(\sum_{i=1}^{N} q_i\right) = a - bQ$$

In a Cournot equilibrium, each firm produces output q_i at price p:

$$q_i = \frac{a-c}{b(N+1)}, \quad p = \frac{a+Nc}{N+1} \tag{1}$$

This produces total market output Q :

$$Q = \sum_{i}^{n} q_i = \frac{(a-c)N}{b(N+1)}. \tag{2}$$

The last two equations are those that can be tested directly[1]. As N decreases, p increases and total output Q falls, controlling for supply and demand shifters.

Now let us assume that there is a per-period fixed cost F that allow a firm to produce at marginal cost c. Then the number of firms in equilibrium is:[2]

$$N^* = \frac{a-c}{\sqrt{Fb}} - 1.$$

Suppose, due to some exogenous innovation, a new technology $c' < c$ become available. This simulates the rise of productivity. What is this technology? Is it some freely available new general purpose technology that may reduce/hold constant fixed cost F or is it a new technology that increases fixed costs? In terms of market power, market power will increase if the fixed cost of the new technology F' satisfies the following condition:

$$\frac{a-c}{a-c'} < \sqrt{\frac{F}{F'}}.$$

Furthermore, there exists a continuum of (F', c'), such that innovation is welfare improving. [3]

Implicitly, the empirical specifications testing for the correlation between productivity (whose theoretical analog is $1/c$) and market concentration (whose theoretical analog is $1/N$) answer this question. In light of the empirical results, this model implies that higher fixed costs have simultaneous led to lower marginal costs and fewer market competitors.

There is a further question, is labor a larger component of the fixed costs or the operating costs (marginal cost)? The classic answer is rooted in the simultaneity issue in estimating production functions in Marschak and Andrews (1944); Griliches (1957). As operationalized by Olley and Pakes (1992), labor is more variable than capital. One interpretation of their framework is that fixed costs are equivalent to capital expenditures and that operating costs subsist of labor and materials.

Under this framework, total fixed costs (TF) paid by all firms are simply the product of the number of firms and each firm's fixed cost:

$$N \cdot F = F\left(\frac{a-c}{\sqrt{Fb}} - 1\right).$$

[1]Simple log-linear transforms can provide the following testable equations:

$$\begin{aligned} \log Q &= \log(a-c) + \log\frac{N}{N+1} - \log b \\ \log p &= \log(a+Nc) - \log(N+1). \end{aligned}$$

[2]In reality, N^* is an integer, but I abstract away from that for analytic tractability.

[3]I can run a similar exercise if fixed costs can be used to create a larger market $a' > a$. For example, if Apple pays a fixed cost $F' > F$ to acquire intellectual property to add a better camera to their phone, then $a' > a$. Similarly, there exists a continuum of (F', a'), such that innovation is welfare improving.

Labor's share of revenues are:

$$\frac{c}{p} = \frac{c}{\frac{a+Nc}{N+1}}.$$

Furthermore if both $N' < N$ and $Q' > Q$, then $c'/p' < c/p$, thus labor's share of income decreases.

A.2 Discrete Choice

Following Berry (1994), assume there are N identical firms indexed by i that face symmetric competition and compete by setting price, with constant marginal costs as before. Consumer j chooses the firm that maximizes utility U_{ij}:

$$U_{ij} = \beta - \alpha p_i + \epsilon_{ij},$$

where ϵ_{ij} is an i.i.d shock drawn from a standard Gumbel distribution and $\alpha > 0$.

Market share for firm i is:

$$s_i\left(p\right) = \frac{\exp\left(\beta - \alpha p_i\right)}{\sum_{i=1}^{N} \exp\left(\beta - \alpha p_i\right)}.$$

Suppose that total market size is a function of the average utility level:

$$Q\left(p\right) = A\left(\sum_{i=1}^{N} \exp\left(\beta - \alpha p_i\right)\right)^{\epsilon}.$$

Where $3A > 0$ is a choke market size and $\epsilon > 0$ is the elasticity. Firms maximize profits Π_i:

$$\Pi_i = \max_{p_i} s_i\left(p\right) \cdot Q\left(p\right) \cdot \left(p - c\right).$$

Profit maximization by identical firms implies that:

$$p = \frac{1}{\alpha\left(1 + \left(\epsilon - 1\right)\frac{1}{N}\right)} + c, \quad Q = A\left(N \exp\left(\beta - \alpha p_i\right)\right)^{\epsilon}. \tag{3}$$

As in the Cournot example, as the number of competitors increases, price falls and quantity sold increases, controlling for supply and demand shifters. Most common formulations of supply and demand will provide similar results. These examples also point to mechanisms where competition could fall, but prices fall and quantities increase. For example if a decrease is N is consistent with a high fixed cost technology that reduces marginal cost (mechanization, efficiency) or stimulates demand (advertising), it may break the linkage between market concentration, prices, and quantities.

B Data Appendix

For data from 1972-1992, the US Census does not publish statistics using a unified SIC system (the exception being in the Manufacturing sector, where in 1992 the Census published a retrospective tabulation unifying past SIC codes). There are two regimes, a 1972 system and a redefinition in 1987, with minor modification in between. Similarly, from 1997-2012 the US Census does not publish statistics using a unified NAICS system, with each of the 1997, 2002, 2007 and 2012 EC using a slightly different variation of NAICS codes. As this paper uses this Census data,[4] I do not merge or alter the Census defined markets and base the analysis on consistently defined SIC/NAICS codes (U.S. Census Bureau, 1990-2015, 1997, 2002, 2007, 2012, 1987, 1992, 1997, 1976*b*,*a*,*c*, 1981*b*,*a*,*c*, 1985*b*,*a*,*c*).[5] Market shares cannot be computed in real units of output, so they are computed using the revenue share of all the facilities a given firm operates within a SIC/NAICS category within the United States. the U.S. Bureau of Economic Analysis (BEA) provides price index and output volume data from 1977 to 2012 .[6]

Price indices and supply side controls for manufacturing data are drawn from the NBER-CES database in 4-digit SIC basis before 1997 and in 6-digit NAICS basis after 1997.[7] Price indices for non-manufacturing data come from BEA tables at the most disaggregate level of aggregation provided. As prices and quantities also reflect overall macroeconomic inflation and growth, the analysis in the next section will include year fixed effects and sectoral trends. All of these measured prices are derived from underlying data collected primary by the Bureau of Labor Statistics for the creation of producer and consumer price indices.(Becker, Gray and Marvakov, 2016; Bartelsman and Gray, 1996)

Table B.2 shows the coverage of the data used from 1972 through 2012. There is continuous coverage for the manufacturing sector over the entire time period at an high level of detail. Coverage is at the 4-digit SIC and 6-digit NAICS levels. Coverage for non-manufacturing sectors is spottier. For wholesale and retail trade, coverage is from 1977 through 2012. However, this is at a higher level of aggregation than the manufacturing sector. From 1982 through 1992, this is at the 3-4 digit SIC level. From 1997 through 2012, this is at the 4-6 digit NAICS level. This level of aggregation is due to the limited availability of consistent price indices at finer levels of aggregation. Service data exists from 1977 through 2012. For 1977 and 1982, the data only covers personal (as opposed to business services) at the 3-4 digit SIC level. For 1982 and 1993,

[4]See Ganapati and Greaney (2017) for analysis using a harmonized NAICS codes as published by Fort and Klimek (2016); results are stable to NAICS codes changes. In general, releasing additional, harmonized market share data from Census and administrative US sources is difficult, as disclosure would likely reveal confidential sales and revenue data for the largest firms.

[5]For example, from 1997-2007, the Census published statistics for NAICS industries "311222 Soybean processing" and "311223 Other oilseed processing" separately. In 2012, the Census combined these two industries into a new industry "311224 Soybean and other oilseed processing". I do not merge market share statistics for these two industries and treat them separately. This has the practical effect of decreasing the number of usable observations and increasing the number of industry fixed effects.

[6]This data is not originally collected by the BEA; rather, the BEA aggregates Census and Bureau of Labor Statistics data to produce aggregated and consistent statistics. Prices are simply official government statistics, based on weighed prices, observed and collected by the Bureau of Labor Statistics. This is in contrast with the exact price indices in macroeconomic, international trade, and industrial organization models that can directly measure welfare under sets of modeling assumptions.

[7]The NBER-CES data is currently only updated through 2011. I use values from 2011 NBER-CES database to correspond to the 2012 EC. Result are robust to the omission of 2012 data.

the data covers both personal and business services at the 3-digit level. From 1997 onwards, the data covers all services at the 4, 5 or 6-digit NAICS level. From 1977 through 1992, some transportation sectors (such as those related to automotive transport) and communication sector (such as mass media) data are included in the Service Economic Censuses at the 3-digit SIC level. From 1997 onwards, these sectors, joined by the Utilities and Finance are included at the 3- or 4-digit NAICS levels.

For the manufacturing sector under both SIC and NAICS codes, I add import and export data using concordances from Feenstra (1996, 1997*b*,*a*); Pierce and Schott (2009); Schott (2008) to better understand the role of import competition. To further consider this role, I directly use the timing of the normalization of trade with china (PNTR) from Pierce and Schott (2016) to look at a exogenous supply shock. To better decompose the difference between the number of hours worked and the number of employees, I add in number of worker hours by industry from the Bureau of Labor Statistics. Lastly for regulation, I use the RegData 3.0 database that quantifies the number of federal regulations pertaining to a NAICS sector by year. The database runs a machine learning algorithm on the entire corpus of federal regulation appearing the the Federal Register from 1970-2016. I consider the change in the number of "Industry Relevant Regulations" at the 6-digit NAICS level (McLaughlin et al., 2017).

Table B.1: Summary statistics

Variable	**Mean**	**(Std. Dev.)**	**N**
4-Firm Concentration	34.8	(21.9)	4720
log(4-firm Concentration)	3.3	(0.8)	4720
log(Output)	10.8	(1.6)	4720
log(Price)	4.7	(0.3)	4720
log(Revenue)	15.5	(1.6)	4720
log(Labor Productivity)	0.4	(0.9)	4720
log(Mean Wage)	3.3	(0.6)	4720
log(Employees)	10.4	(1.4)	4720
log(Payroll)	13.7	(1.5)	4720
log(Labor Share)	-1.8	(0.7)	4720
4-factor TFP index 1997=1.000	1	(0.3)	2739
8-Firm Concentration	45.4	(25.1)	4696
50-Firm HHI	756	(688.5)	1234
log(Mean Wage)	3.3	(0.6)	4720
log(Capital Price)	1.3	(2.1)	3905
Hourly Labor Productivity	6.9	(0.8)	3040
log(Hourly Pay)	9.8	(0.6)	3040
log(Labor Hours)	3.5	(1.3)	3040
Import Penetration	0.2	(0.3)	2444
Federal Industry Regulations	23207.9	(41074.2)	2201

Table B.2: Industry Coverage for both Price Indices and Concentration Statistics

Classification	1972	1977	1982	1987	1992	1997	2002	2007	2012	2-Digit Sector	Top Level Sector
	SIC					NAICS					
Agriculture and related										11	Resources + Construction
Mining										21	
Utilities						Part	Part	Part	Part	22	
Construction										23	
Manufacturing	X	X	X	X	X	X	X	X	X	31-33	Manufacturing
Wholesale trade	Part	X	X	X	X	X	X	X	X	42	Trade + Transport
Retail Trade	Part	X	X	X	X	X	X	X	X	44-45	
Transportation						Part	Part	Part	Part	48-49	
Information		Part	Part	Part	Part	X	X	X	X	51	Skilled Tradable Services
Finance, Insurance and Real Estate						X	X	X	X	52	
Real Estate		Part	Part	Part	Part	Part	Part	Part	Part	53	
Professional Services		Part	Part	Part	Part	X	X	X	X	54	
Enterprise Management										55	
Administrative and Waste		Part	Part	Part	Part	X	X	X	X	58	Other Services
Educational Services										61	
Health Care and Assistance			Part	Part	Part	Part	Part	Part	Part	62	Health Care
Arts, Entertainment, and Recreation		Part	Part	X	X	X	X	X	X	71	Arts + Hospitality
Accommodation and Food Services		Part	Part	X	X	X	X	X	X	72	
Other Services		Part	Part	Part	Part	Part	Part	Part	Part	81	Other Services

B.1 Discussion of Price Index Data

The price index data for both manufacturing and non-manufacturing data is largely originally sourced from the Bureau of Labor Statistics' Producer Price Indices (PPI). These indices measure changes in producer prices over time using a Laspeyres index, reindexing the purchasing weights (with each industry) ever five years. The Laspeyres index uses weights from an initial year and tends to overstate price increases, as buyer tend to substitute away from high priced items. In the context of this project, this will have a minimal effect as long as the degree of substitution within an industry is similar across industries, after controlling for year-sector fixed effects. (Boskin et al., 1997; Gordon, 2006; Bureau of Labor Statistics, 2018)

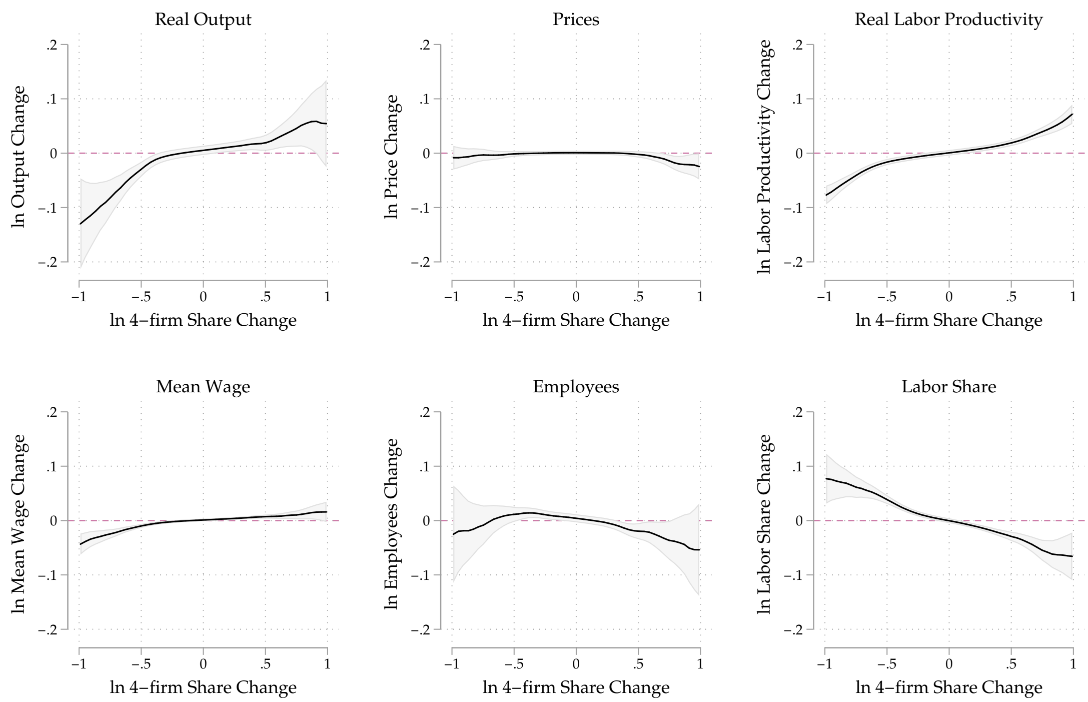
There has been an related debate over the consumer price index and the measurement of new product entry, as well as consumer substitution patterns. Much of this debate has to do with the role of the price of physical goods that are sold online, a sector of the economy that has exhibited substantial growth (Goolsbee and Klenow, 2018). This project is a bit different, while some of the products are used by final consumers, many of the services are intermediate inputs. It is still unclear what role e-commerce plays in the pricing of these intermediate goods. Furthermore, new work is needed to document if the set of products within an industry increases or decreases with market concentration.

A related critique with the BLS PPI data has to do with the use of hedonic adjustments to account for both new products and quality changes. Aghion et al. (2019) find that creative destruction, which occurs when new products are better than old ones, will systematically lead to a upward bias in prices (thus understating real growth). However, the BLS has begun responding positively to this critique, introducing quality adjustments for a variety of high tech and services industries, getting better underlying quantity data to correct weights, as well as cross validating this data. It is unclear if these issues are systematically related to trends in market concentration and/or productivity. Results is either direction will systematically bias results and further access to price micro-data may shed light on these issues.

C Replication with Local Polynomial Regressions and Levels

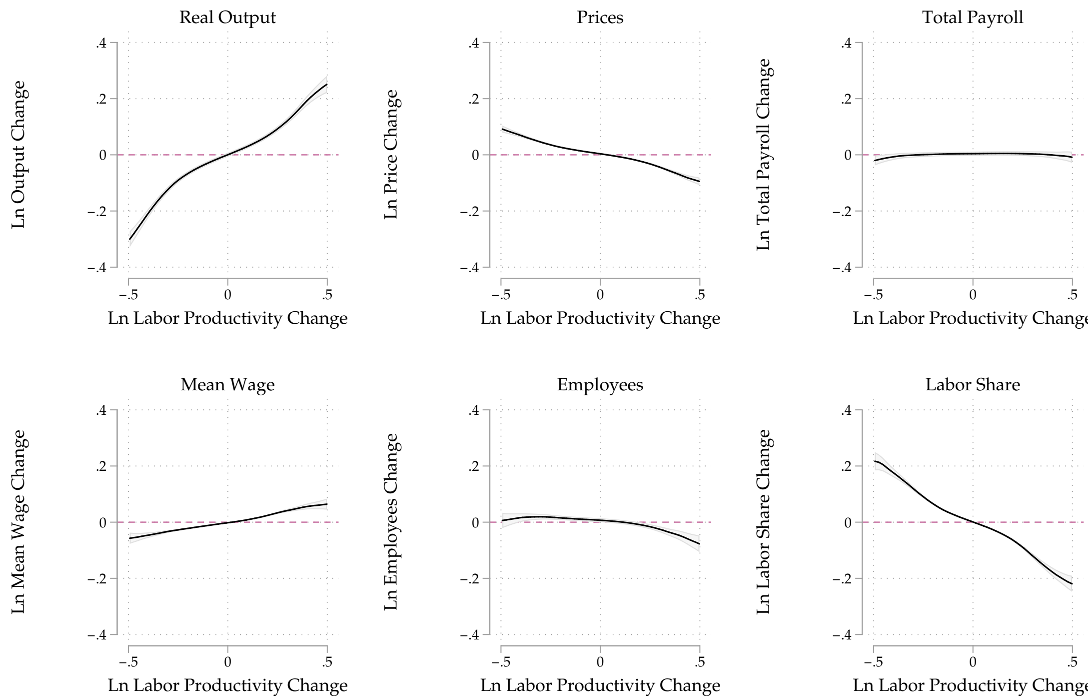
Figures C.1 and C.2 replicate Figures **??** and **??** using of non-parametric regressions instead of bin-scatter plots. Figure C.3 replicates Figure C.1 using the levels of 4-firm changes instead of logarithms.

Figure C.1: Correlation of Economic Outcomes to Market Concentration



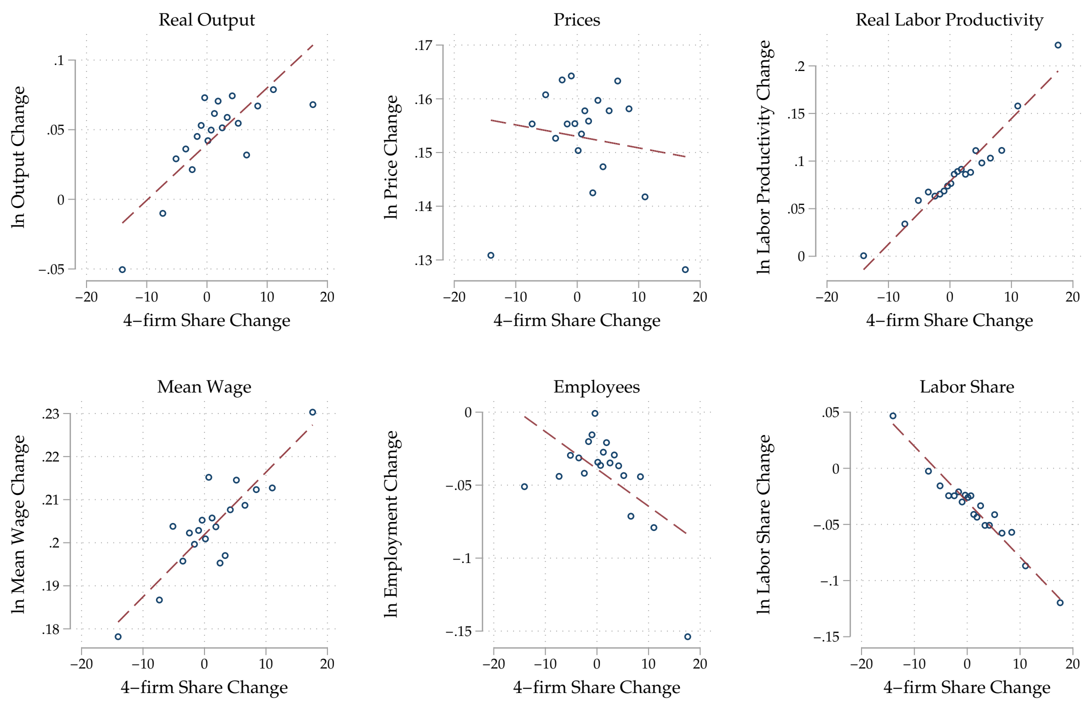
Notes: Results from a non-parametric regression of 5-year changes change in the combined market share of the four largest firms by time period using standardized residuals after demeaning for year-sector means. Sectors computed using two-digit sector codes according to Table B.2. For example, the first panel roughly implies that a 1 standard deviation increase in market concentration is correlated with to 0.1 standard deviation increase in real output. From 1972-1992, data uses 4-digit SIC codes for manufacturing industries and lowest levels of aggregation for non-manufacturing industries (A mixture of 3 and 4 digit SIC codes). From 1997 onwards, 6-digit NAICS codes for all industries. Data from 1992 and 1997 are from non-comparable industrial classification systems.

Figure C.2: Correlation of Economic Outcomes to Labor Productivity



Notes: Results from a non-parametric regression of standardized 5-year changes in labor productivity using residuals after controlling for year-sector means. Sectors computed using two-digit sector codes according to Table B.2. For example, the first panel roughly implies that a 1 standard deviation increase in productivity is correlated with to 0.8 standard deviation increase in real output. From 1972-1992, data uses 4-digit SIC codes for manufacturing industries and lowest levels of aggregation for non-manufacturing industries (A mixture of 3 and 4 digit SIC codes). From 1997 onwards, 6-digit NAICS codes for all industries. Data for non-manufacturing firms in 1972 is incomplete. Data from 1992 and 1997 are from non-comparable industrial classification systems.

Figure C.3: Correlation of Economic Outcomes to Market Concentration (Levels)



Notes: Results from a bin-scatter regression of 5-year changes change in the combined market share of the four largest firms by time period using residuals after demeaning for year-sector means. Sectors computed using two-digit sector codes according to Table B.2. From 1972-1992, data uses 4-digit SIC codes for manufacturing industries and lowest levels of aggregation for non-manufacturing industries (A mixture of 3 and 4 digit SIC codes). From 1997 onwards, 6-digit NAICS codes for all industries. Data from 1992 and 1997 are from non-comparable industrial classification systems.

D Results Robustness Appendix

D.1 Baseline Results

Table D.1 replicates the baseline results from the main paper.

D.2 Weighted Results

To consider the economy-wide effect, I consider two forms of weighted results. One, weighting by the share of gross output and the other by the share of employment. Both of these weighting measures are imperfect, however they are internally consistent; one for the final consumption basket and the other for labor input factors. See See Table D.2 for a replication of the baseline tables weighting by BEA gross output shares and Table D.3 weighting by total industry employment. In the baseline, a one standard deviation increase in the concentration rise is correlated with a 3% increase in output. When results are weighted by gross output, the same concentration correlates to a 4% increase in output. When results are weighted by employment, the same concentration correlates to a 3% increase in output

D.3 Long-Run Relationships

This paper considers short run relationships due to the nature of the underlying data; industry classifications change from year to year, making it difficult to consider long run changes. To partially mitigate this issue, I consider 15-year trends in non-manufacturing (1977-1992 and 1997-2012) and 40-year trends in manufacturing. The break in non-manufacturing is due to changes in industry classification systems. See Tables D.4 and D.5 for a the 15-year non-manufacturing and 40-year manufacturing trends respectively. In the non-manufacturing sectors, a one standard deviation increase in market power echoes the baseline results, reflecting a 8% increase in output, no price effect, 25% increase in productivity and a 7% decrease in labor's share of output. As before, controlling for productivity mitigates these effects and highlights the role played by the strong relationship between productivity and market concentration.

In manufacturing, I am left with just 76 out of 471 NAICS industries with a useable experimental bridge from SIC to NAICS industry codes (covering 1992-1997). This is a small and highly selected sample of industries accounting for just 13% of manufacturing sales (using 2012 sales). Within this small set, I only obtain imprecise results correlating market share changes to prices, output, or productivity. However, when I control for productivity, I see that increases in market concentration are related to weak increases in prices and decreases in output. These results are all relatively weak, likely attenuated by the long time-spans and likelihood of data mis-specification.

D.4 Manufacturing vs Non-Manufacturing

Manufacturing makes up only around 10% of US GDP. However, Census data on manufacturing is widely available at fine levels of detail and make up nearly half of all observations. As a robustness check, I drop all manufacturing industries from the baseline data set. Results are largely the same. Increases in market concentration are positively correlated with output, revenue, and productivity. I do not find significant changes in wages, employment, or payroll, but confirm the negative correlation between output and labor's share of revenue. As in the baseline, when controlling for productivity, I find the relationship between market concentration and output/revenue insignificant.

See Table D.7 for a replication of the baseline tables, subset to only non-manufacturing firms. Manufacturing data may be contaminated by import data (see table D.12 for a comparison) and is therefore hard to directly compare. As before, an increase in the 4-firm concentration share is positively related to increases in output and productivity, while being negatively related to labor's share of revenue. As before, controlling for productivity mutes concentration's relationship to output and labor shares.

D.5 Homogenous Manufacturing Industries

These relationships rely on accurate price and output indices. Homogenous manufacturing industries may have more accurately measured price and output data. As before, I subset the data to just include the 76 homogenous manufacturing industries with consistent data (again accounting for 13% of 2012 manufacturing sales). These are the same industries used to consider long run changes in the manufacturing data. See Table D.6 for a replication of the baseline tables. I do not find any correlation of market concentration to output or prices. However, I do find a strong relationships with productivity and labor's share of revenue. A one standard deviation in market concentration leads to 14% higher productivity and a 2% decrease in labor's share of revenue. When controlling for productivity, there is a small positive correlation between price changes and market concentration growth, but this is completely offset by the negative relationship between price changes and productivity growth.

D.6 Levels vs Logarithms

The logarithm of market shares compresses differences under large level changes. An alternative specification would consider level changes in the market shares. Thus a change from 10% to 20% would be roughly equivalent to the change from 30% to 40%.

See Table D.9 for a replication of the baseline tables, using the level of 4-firm market concentration (as opposed to the logarithm of the 4-firm market concentration).

D.7 Herfindahl-Hirschman Index

This analysis considers four-firm market shares, as this data is widely available. However a four-firm market share is a crude instrument. Under certain forms of competition (Cournot), a classic Herfindahl-Hirschman Index (HHI) index is a more reliable indicator of market power. Substituting an HHI index for the four-firm market shares, where available within manufacturing, finds results broadly consistent with the baseline estimates. See Table D.9 for a replication of the baseline tables, using the Herfindahl-Hirschman index (HHI) computed using the 50 largest firms.

D.8 Factor Price Inputs

Baseline estimates consider output, prices, and revenues without considering the role of input factor prices, such as for materials or capital goods. There may be co-movement in upstream markets, biasing results. For a subset of industries, I directly consider the prices of material and capital inputs. While these factors are quantitatively important, the positive relationship between changes in output, productivity, and concentration remains. See Table D.10 for a replication of the baseline tables, controlling for input price indices in both materials and capital.

D.9 Total Factor Productivity

The baseline estimation considered labor productivity, as opposed to total factor productivity. As production becomes more capital intensive (Bureau of Labor Statistics, 2018), the baseline estimates could suffer from mis-measurement. Total factor productivity estimates would allow for better estimates. For a sample of manufacturing industries, substituting total factor productivity for labor productivity results in nearly identical results. See Table D.11 for a replication of the baseline tables using total factor productivity instead of labor productivity.

D.10 Hourly Labor Productivity

The baseline results measured labor productivity by considering the total number of workers. However there are long term trends in full-time versus part-time workers (Nardone, 1995). To account for this, in a subset of industries, I consider labor productivity by considering the number of hours worked. See Table D.12 for a replication of the baseline tables using hourly employee productivity instead of labor productivity.

D.11 Import Penetration in Manufacturing

Manufactured goods imports have significantly increased over the sample period (Bernard, Jensen and Schott, 2006). While the price indices consider only domestically manufactured goods, imports change the market power available to the largest domestic producers. If this trend is monotonic across time, yearly fixed effects will account for imports, but if there are differential trends across industries, market power will be mis-measured. In response I directly control for import penetration in manufacturing. The positive relationship between changes in output, productivity, and concentration remains.

See Table D.13 for a replication of the baseline tables controlling for import shares and exogenous changes in PNTR status. Import share is computed as $\frac{imports}{domestic+imports}$. PNTR status comes from Pierce and Schott (2016). It is important to note here that the output prices and market concentrations are for domestic production only.

D.12 Regulation

Regulation is one possible source of scale economies (See (Nelson and Wohar, 1983) for a classic example). To control for regulation, I use data from "Regdata" database that considers US Federal industry-level regulation measures derived from textual analysis of federal laws (McLaughlin et al., 2017). While I find that regulation is quantitatively important, the positive relationship between changes in output, productivity, and concentration remains. See Table D.14 for a replication of the baseline tables controlling observed federal regulations.

D.13 Demand Controls

As mentioned earlier, the baseline results lack a true demand instrument. I control for pre-trends in demand by including lagged output and a one-period change in lagged output. The positive relationship between changes in output, productivity, and concentration remains. See Table D.15 for a replication of the baseline tables controlling for both lagged production and lagged production growth rates.

Table D.1: Baseline Results

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0337	-0.000807	0.0329	0.208
	(0.00603)	(0.00171)	(0.00608)	(0.0197)
r2	0.136	0.501	0.247	0.189

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.01000	-0.00765	0.00235	-0.0306
	(0.00156)	(0.00449)	(0.00480)	(0.00348)
r2	0.549	0.189	0.281	0.219
Observations	4720	4720	4720	4720

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.000660	0.0128	0.0121	0.208
	(0.00462)	(0.00196)	(0.00535)	(0.0197)
Std Δ Ln Productivity	0.165	-0.0653	0.100	
	(0.00698)	(0.00630)	(0.00896)	
r2	0.360	0.614	0.318	0.189

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00450	-0.000660	0.00384	-0.00826
	(0.00146)	(0.00462)	(0.00496)	(0.00210)
Std Δ Ln Productivity	0.0265	-0.0336	-0.00715	-0.107
	(0.00301)	(0.00698)	(0.00756)	(0.00561)
r2	0.590	0.201	0.281	0.547
Observations	4720	4720	4720	4720

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors.
Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.2: Weighted - Gross Output Shares

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0414	-0.00101	0.0404	0.297
	(0.00931)	(0.00110)	(0.00949)	(0.0319)
r2	0.160	0.450	0.230	0.194

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00751	-0.0176	-0.0101	-0.0505
	(0.00351)	(0.00827)	(0.00947)	(0.00728)
r2	0.212	0.160	0.229	0.284
Observations	1372	1372	1372	1372

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.00326	0.00352	0.000254	0.297
	(0.00970)	(0.00130)	(0.00974)	(0.0319)
Std Δ Ln Productivity	0.151	-0.0153	0.135	
	(0.0242)	(0.00345)	(0.0234)	
r2	0.388	0.480	0.405	0.194

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	-0.00262	-0.00326	-0.00588	-0.00613
	(0.00335)	(0.00970)	(0.0115)	(0.00395)
Std Δ Ln Productivity	0.0341	-0.0485	-0.0143	-0.150
	(0.00659)	(0.0242)	(0.0222)	(0.00747)
r2	0.319	0.191	0.231	0.779
Observations	1372	1372	1372	1372

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.3: Weighted - Employment Shares

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0277	0.00176	0.0295	0.108
	(0.00864)	(0.00356)	(0.00778)	(0.0336)
r2	0.206	0.588	0.369	0.254

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00518	0.00620	0.0114	-0.0181
	(0.00213)	(0.00650)	(0.00718)	(0.00473)
r2	0.660	0.297	0.386	0.277
Observations	4720	4720	4720	4720

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0116	0.0106	0.0222	0.108
	(0.00658)	(0.00266)	(0.00726)	(0.0336)
Std Δ Ln Productivity	0.149	-0.0818	0.0676	
	(0.0120)	(0.0106)	(0.0124)	
r2	0.438	0.730	0.412	0.254

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00258	0.0116	0.0141	-0.00802
	(0.00202)	(0.00658)	(0.00737)	(0.00265)
Std Δ Ln Productivity	0.0241	-0.0497	-0.0256	-0.0932
	(0.00475)	(0.0120)	(0.0125)	(0.00951)
r2	0.690	0.328	0.393	0.579
Observations	4720	4720	4720	4720

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.4: 15-year relationship - Non-manufacturing Industries

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0707	-0.0142	0.0566	0.257
	(0.0291)	(0.00822)	(0.0284)	(0.0436)
r2	0.156	0.471	0.188	0.258

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0220	-0.0233	-0.00131	-0.0579
	(0.00627)	(0.0228)	(0.0233)	(0.0164)
r2	0.488	0.137	0.227	0.119
Obs	557	557	557	557

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.0106	0.0107	0.0000594	0.257
	(0.0256)	(0.00858)	(0.0260)	(0.0436)
Std Δ Ln Productivity	0.316	-0.0965	0.220	
	(0.0372)	(0.0132)	(0.0369)	
r2	0.342	0.589	0.285	0.258

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00515	-0.0106	-0.00547	-0.00553
	(0.00628)	(0.0256)	(0.0255)	(0.00945)
Std Δ Ln Productivity	0.0656	-0.0494	0.0162	-0.203
	(0.0105)	(0.0372)	(0.0376)	(0.0151)
r2	0.564	0.143	0.228	0.568
Obs	557	557	557	557

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.5: 40-year relationship - Manufacturing Industries

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.218	0.0946	-0.124	0.0284
	(0.141)	(0.101)	(0.0884)	(0.141)
r2	0.0435	0.0151	0.0319	0.000805

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0123	-0.245	-0.232	-0.109
	(0.0193)	(0.0883)	(0.0868)	(0.0370)
r2	0.00634	0.149	0.124	0.114
Obs	76	76	76	76

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.242	0.115	-0.128	0.0284
	(0.0867)	(0.0341)	(0.0876)	(0.141)
Std Δ Ln Productivity	0.844	-0.703	0.141	
	(0.0911)	(0.0491)	(0.0652)	
r2	0.694	0.848	0.0733	0.000805

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0105	-0.242	-0.232	-0.104
	(0.0162)	(0.0867)	(0.0869)	(0.0268)
Std Δ Ln Productivity	0.0628	-0.0943	-0.0314	-0.172
	(0.0151)	(0.0911)	(0.0830)	(0.0364)
r2	0.171	0.171	0.126	0.399
Obs	76	76	76	76

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.6: Homogenous Industries - Manufacturing Industries

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.000393	-0.00130	-0.000908	0.137
	(0.0135)	(0.00477)	(0.0144)	(0.0435)
r2	0.102	0.539	0.358	0.123

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00447	-0.0275	-0.0230	-0.0221
	(0.00242)	(0.0125)	(0.0132)	(0.00753)
r2	0.770	0.119	0.356	0.209
Obs	532	532	532	532

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.0261	0.0125	-0.0136	0.137
	(0.0125)	(0.00495)	(0.0143)	(0.0435)
Std Δ Ln Productivity	0.193	-0.101	0.0927	
	(0.0124)	(0.0211)	(0.0268)	
r2	0.463	0.712	0.419	0.123

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00294	-0.0261	-0.0231	-0.00955
	(0.00239)	(0.0125)	(0.0133)	(0.00485)
Std Δ Ln Productivity	0.0112	-0.0103	0.000838	-0.0919
	(0.00436)	(0.0124)	(0.0147)	(0.0195)
r2	0.777	0.120	0.356	0.475
Obs	532	532	532	532

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors.
Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.7: Only Non-Manufacturing Firms

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0517	-0.00387	0.0479	0.239
	(0.00953)	(0.00233)	(0.00930)	(0.0303)
r2	0.160	0.449	0.225	0.219

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0124	-0.000943	0.0114	-0.0365
	(0.00264)	(0.00626)	(0.00671)	(0.00613)
r2	0.335	0.174	0.260	0.197
Observations	1981	1981	1981	1981

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0104	0.00789	0.0183	0.239
	(0.00672)	(0.00238)	(0.00712)	(0.0303)
Std Δ Ln Productivity	0.173	-0.0493	0.124	
	(0.0127)	(0.00601)	(0.0124)	
r2	0.385	0.561	0.345	0.219

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00266	0.0104	0.0131	-0.00523
	(0.00240)	(0.00672)	(0.00718)	(0.00306)
Std Δ Ln Productivity	0.0406	-0.0477	-0.00703	-0.131
	(0.00561)	(0.0127)	(0.0136)	(0.00769)
r2	0.432	0.196	0.260	0.637
Observations	1981	1981	1981	1981

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.8: 4-Firm Market Shares - In Levels

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Δ 4-Firm Share	0.00521	-0.000179	0.00503	0.0361
	(0.00107)	(0.000300)	(0.00108)	(0.00307)
r2	0.139	0.501	0.249	0.216

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Δ 4-Firm Share	0.00156	-0.00197	-0.000414	-0.00544
	(0.000251)	(0.000744)	(0.000796)	(0.000549)
r2	0.551	0.191	0.281	0.243
Observations	4720	4720	4720	4720

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Δ 4-Firm Share	-0.000818	0.00225	0.00143	0.0361
	(0.000790)	(0.000320)	(0.000943)	(0.00307)
Std Δ Ln Productivity	0.167	-0.0673	0.0998	
	(0.00704)	(0.00639)	(0.00900)	
r2	0.360	0.617	0.318	0.216

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Δ 4-Firm Share	0.000615	-0.000818	-0.000202	-0.00163
	(0.000248)	(0.000790)	(0.000827)	(0.000359)
Std Δ Ln Productivity	0.0262	-0.0320	-0.00585	-0.106
	(0.00306)	(0.00704)	(0.00763)	(0.00568)
r2	0.590	0.201	0.281	0.549
Observations	4720	4720	4720	4720

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.9: Using 50-Firm Herfindahl-Hirschman index (HHI) Concentration Measures

(a) 50-Firm HHI

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 50-Firm HHI	0.00980	0.00613	0.0159	0.152
	(0.0116)	(0.00544)	(0.0127)	(0.0345)
r2	0.0377	0.154	0.0852	0.0635

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 50-Firm HHI	0.00881	-0.0205	-0.0117	-0.0276
	(0.00298)	(0.0107)	(0.0118)	(0.00534)
r2	0.0422	0.0168	0.0195	0.206
Observations	1150	1150	1150	1150

(b) 50-Firm HHI & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 50-Firm HHI	-0.0172	0.0177	0.000476	0.152
	(0.0107)	(0.00412)	(0.0129)	(0.0345)
Std Δ Ln Productivity	0.178	-0.0761	0.102	
	(0.0125)	(0.0157)	(0.0212)	
r2	0.257	0.329	0.144	0.0635

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 50-Firm HHI	0.00581	-0.0172	-0.0114	-0.0119
	(0.00307)	(0.0107)	(0.0120)	(0.00436)
Std Δ Ln Productivity	0.0197	-0.0215	-0.00175	-0.103
	(0.00380)	(0.0125)	(0.0141)	(0.0138)
r2	0.0941	0.0210	0.0196	0.451
Observations	1150	1150	1150	1150

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.10: Controlling for Factor Input Prices

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0357	0.000772	0.0364	0.232
	(0.00734)	(0.00153)	(0.00733)	(0.0229)
S.log(Material Price)	0.0139	0.731	0.744	-1.592
	(0.0917)	(0.0732)	(0.117)	(0.342)
S.log(Capital Price)	-0.0203	0.0695	0.0492	-0.890
	(0.120)	(0.0558)	(0.106)	(0.597)
r2	0.119	0.641	0.265	0.197

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0123	-0.0106	0.00172	-0.0347
	(0.00184)	(0.00540)	(0.00564)	(0.00398)
S.log(Material Price)	0.0410	0.331	0.372	-0.373
	(0.0153)	(0.0923)	(0.0946)	(0.0437)
S.log(Capital Price)	0.0502	0.157	0.207	0.158
	(0.0365)	(0.115)	(0.104)	(0.0709)
r2	0.556	0.171	0.258	0.247
Observations	3905	3905	3905	3905

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.00191	0.0126	0.0107	0.232
	(0.00561)	(0.00190)	(0.00609)	(0.0229)
Std Δ Ln Productivity	0.162	-0.0508	0.111	
	(0.00860)	(0.00574)	(0.00917)	
S.log(Material Price)	0.272	0.650	0.921	-1.592
	(0.0914)	(0.0585)	(0.132)	(0.342)
S.log(Capital Price)	0.124	0.0243	0.148	-0.890
	(0.107)	(0.0405)	(0.110)	(0.597)
r2	0.318	0.705	0.343	0.197

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00559	-0.00191	0.00368	-0.00698
	(0.00167)	(0.00561)	(0.00586)	(0.00220)
Std Δ Ln Productivity	0.0288	-0.0373	-0.00846	-0.119
	(0.00361)	(0.00860)	(0.00924)	(0.00548)
S.log(Material Price)	0.0868	0.272	0.358	-0.563
	(0.0167)	(0.0914)	(0.0972)	(0.0527)
S.log(Capital Price)	0.0758	0.124	0.199	0.0515
	(0.0277)	(0.107)	(0.104)	(0.0470)
r2	0.599	0.183	0.259	0.614
Observations	3905	3905	3905	3905

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.11: Controlling for Total Factor Productivity (Manufacturing Only)

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0337	-0.000807	0.0329	0.0830
	(0.00603)	(0.00171)	(0.00608)	(0.0395)
r2	0.136	0.501	0.247	0.0401

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0101	-0.0203	-0.0103	-0.0326
	(0.00212)	(0.00873)	(0.00937)	(0.00410)
r2	0.677	0.0787	0.252	0.189
Observations	2739	2739	2739	2739

(b) 4-Firm Market Shares & Total Factor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.00605	0.00921	0.0153	0.0830
	(0.00836)	(0.00336)	(0.00987)	(0.0395)
Std Δ Ln TFP	0.153	-0.0686	0.0848	
	(0.0433)	(0.00982)	(0.0347)	
r2	0.327	0.623	0.308	0.0401

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00993	-0.0244	-0.0144	-0.0297
	(0.00212)	(0.00863)	(0.00926)	(0.00375)
Std Δ Ln TFP	0.00142	0.0487	0.0502	-0.0346
	(0.00263)	(0.0257)	(0.0279)	(0.00772)
r2	0.677	0.112	0.278	0.234
Observations	2739	2739	2739	2739

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.12: Use Hourly Measures of Productivity

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0337***	-0.000807	0.0329***	0.195***
	(0.00603)	(0.00171)	(0.00608)	(0.0286)
r2	0.136	0.501	0.247	0.0918

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00791**	-0.0153	-0.00739	-0.0317***
	(0.00301)	(0.00799)	(0.00785)	(0.00369)
SectorYearFE	X	X	X	X
N	3039	3039	3039	3039
r2	0.496	0.114	0.259	0.216

(b) 4-Firm Market Shares & Hourly Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.00431	0.0165***	0.0122	0.195***
	(0.00772)	(0.00280)	(0.00879)	(0.0286)
Std Δ Ln Productivity	0.131***	-0.0685***	0.0620***	
	(0.00706)	(0.00782)	(0.0102)	
r2	0.273	0.630	0.287	0.0918

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	-0.00226	-0.00431	-0.00657	-0.0188***
	(0.00264)	(0.00772)	(0.00793)	(0.00305)
Std Δ Ln Productivity	0.0521***	-0.0563***	-0.00419	-0.0662***
	(0.00502)	(0.00706)	(0.00805)	(0.00541)
SectorYearFE	X	X	X	X
N	3039	3039	3039	3039
r2	0.594	0.152	0.259	0.368

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2.Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data

Table D.13: Controlling for Import Penetration (Manufacturing Only)

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.00398	0.00833	0.00435	0.200
	(0.0171)	(0.00716)	(0.0180)	(0.0531)
S.log(Import Penetration)	-3.074	-0.326	-3.400	-2.270
	(0.473)	(0.247)	(0.495)	(1.154)
PNTR Status x Post 1999	-0.238	-0.0946	-0.332	0.538
	(0.0827)	(0.0335)	(0.0913)	(0.195)
r2	0.242	0.152	0.302	0.0726

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0116	-0.0437	-0.0322	-0.0365
	(0.00433)	(0.0139)	(0.0150)	(0.00829)
S.log(Import Penetration)	-0.205	-2.622	-2.827	0.573
	(0.0724)	(0.409)	(0.416)	(0.163)
PNTR Status x Post 1999	0.0569	-0.345	-0.288	0.0443
	(0.0156)	(0.0755)	(0.0760)	(0.0361)
r2	0.0642	0.260	0.259	0.201
Observations	1002	1002	1002	1002

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.0390	0.0236	-0.0154	0.200
	(0.0142)	(0.00639)	(0.0179)	(0.0531)
Std Δ Ln Productivity	0.175	-0.0763	0.0991	
	(0.00999)	(0.0189)	(0.0209)	
S.log(Import Penetration)	-2.675	-0.500	-3.175	-2.270
	(0.406)	(0.212)	(0.497)	(1.154)
PNTR Status x Post 1999	-0.332	-0.0536	-0.385	0.538
	(0.0749)	(0.0329)	(0.0889)	(0.195)
r2	0.478	0.330	0.363	0.0726

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00861	-0.0390	-0.0304	-0.0149
	(0.00437)	(0.0142)	(0.0155)	(0.00651)
Std Δ Ln Productivity	0.0149	-0.0237	-0.00884	-0.108
	(0.00430)	(0.00999)	(0.0108)	(0.0164)
S.log(Import Penetration)	-0.171	-2.675	-2.847	0.328
	(0.0670)	(0.406)	(0.412)	(0.217)
PNTR Status x Post 1999	0.0489	-0.332	-0.283	0.102
	(0.0146)	(0.0749)	(0.0756)	(0.0329)
r2	0.0960	0.266	0.260	0.465
Observations	1002	1002	1002	1002

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data, Pierce and Schott (2016, 2009); Feenstra (1996)

Table D.14: Controlling for Measures of Federal Industry Regulation

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0425	0.00244	0.0450	0.267
	(0.00945)	(0.00206)	(0.00953)	(0.0320)
S.log(Regulations)	0.0983	0.0269	0.125	0.136
	(0.0397)	(0.0181)	(0.0407)	(0.135)
r2	0.140	0.192	0.196	0.193

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0127	-0.0106	0.00213	-0.0428
	(0.00265)	(0.00686)	(0.00735)	(0.00574)
S.log(Regulations)	0.0134	0.0711	0.0846	-0.0406
	(0.00908)	(0.0304)	(0.0308)	(0.0247)
r2	0.154	0.225	0.251	0.258
Observations	2201	2201	2201	2201

(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.000313	0.0149	0.0152	0.267
	(0.00705)	(0.00327)	(0.00831)	(0.0320)
Std Δ Ln Productivity	0.158	-0.0469	0.111	
	(0.0104)	(0.0104)	(0.0141)	
S.log(Regulations)	0.0767	0.0333	0.110	0.136
	(0.0304)	(0.0175)	(0.0355)	(0.135)
r2	0.341	0.305	0.283	0.193

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00466	0.000313	0.00497	-0.0103
	(0.00246)	(0.00705)	(0.00774)	(0.00352)
Std Δ Ln Productivity	0.0301	-0.0408	-0.0107	-0.122
	(0.00502)	(0.0104)	(0.0113)	(0.00917)
S.log(Regulations)	0.00934	0.0767	0.0860	-0.0239
	(0.00865)	(0.0304)	(0.0307)	(0.0170)
r2	0.238	0.240	0.252	0.598
Observations	2201	2201	2201	2201

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data, Mercatus Center

Table D.15: Controlling for Lagged Demand and Pre-trends

(a) 4-Firm Market Shares

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	0.0375	0.00188	0.0394	0.222
	(0.00805)	(0.00202)	(0.00831)	(0.0232)
L.log(Output)	0.00864	-0.00108	0.00756	0.00997
	(0.00444)	(0.00305)	(0.00516)	(0.0190)
LS.log(Output)	0.102	-0.0164	0.0852	-0.0757
	(0.0370)	(0.0111)	(0.0367)	(0.0795)
r2	0.152	0.400	0.165	0.175

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.0107	-0.00667	0.00404	-0.0353
	(0.00232)	(0.00588)	(0.00623)	(0.00441)
L.log(Output)	-0.0000600	0.00666	0.00660	-0.000961
	(0.00171)	(0.00416)	(0.00422)	(0.00248)
LS.log(Output)	0.00190	0.117	0.119	0.0334
	(0.00677)	(0.0362)	(0.0365)	(0.0120)
r2	0.531	0.169	0.236	0.160
Observations	2982	2982	2982	2982

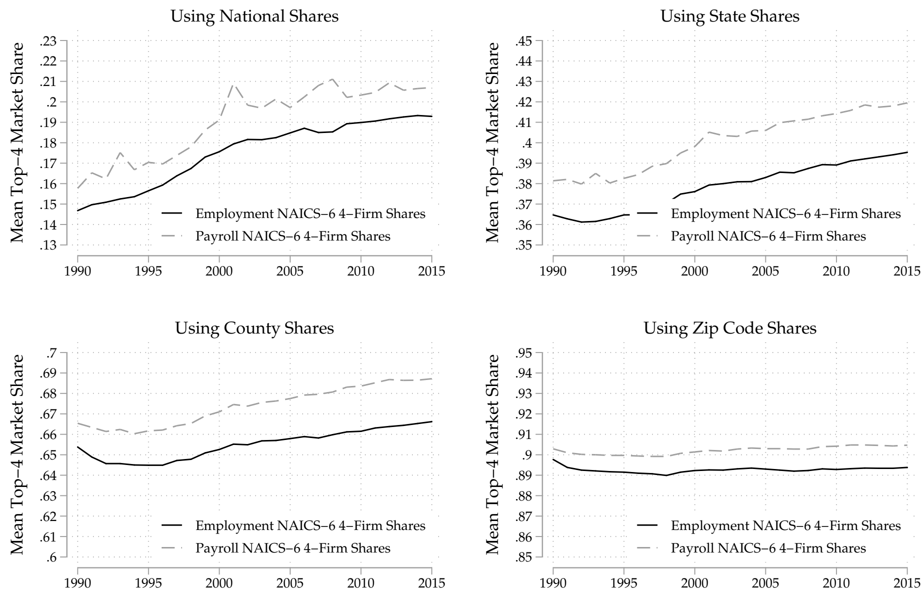
(b) 4-Firm Market Shares & Labor Productivity

	Δ Ln Output	Δ Ln Price	Δ Ln Revenue	Δ Ln Labor Productivity
Std Δ Ln 4-Firm Share	-0.000857	0.0143	0.0134	0.222
	(0.00619)	(0.00237)	(0.00714)	(0.0232)
Std Δ Ln Productivity	0.173	-0.0559	0.117	
	(0.00830)	(0.00585)	(0.0103)	
L.log(Output)	0.00692	-0.000527	0.00639	0.00997
	(0.00400)	(0.00254)	(0.00544)	(0.0190)
LS.log(Output)	0.115	-0.0206	0.0941	-0.0757
	(0.0360)	(0.00965)	(0.0371)	(0.0795)
r2	0.384	0.506	0.263	0.175

	Δ Ln Mean Wage	Δ Ln Employees	Δ Ln Payroll	Δ Ln Labor Share
Std Δ Ln 4-Firm Share	0.00386	-0.000857	0.00300	-0.0104
	(0.00218)	(0.00619)	(0.00654)	(0.00269)
Std Δ Ln Productivity	0.0309	-0.0262	0.00470	-0.112
	(0.00389)	(0.00830)	(0.00883)	(0.00520)
L.log(Output)	-0.000368	0.00692	0.00655	0.000159
	(0.00151)	(0.00400)	(0.00423)	(0.00245)
LS.log(Output)	0.00424	0.115	0.119	0.0249
	(0.00625)	(0.0360)	(0.0366)	(0.00967)
r2	0.583	0.176	0.236	0.524
Observations	2982	2982	2982	2982

Notes: Robust standard errors clustered on BEA industry codes. Regressions include year-sector fixed effects. Sectors computed using two-digit sector codes according to Table B.2. Observations at the NAICS 6-digit level for 1997-2012 and at the SIC 3 and 4-digit level for 1972-1992. Data from 1992 and 1997 are from non-comparable industrial classification systems. Market shares and productivity changes are standardized by subtracting means and dividing by standard errors. Sources: Author's Calculations based on US BEA, BLS, Census, NBER-CES data,

Figure E.1: Market Share by Employment and Payroll, 1990-2015 - Balanced Panel



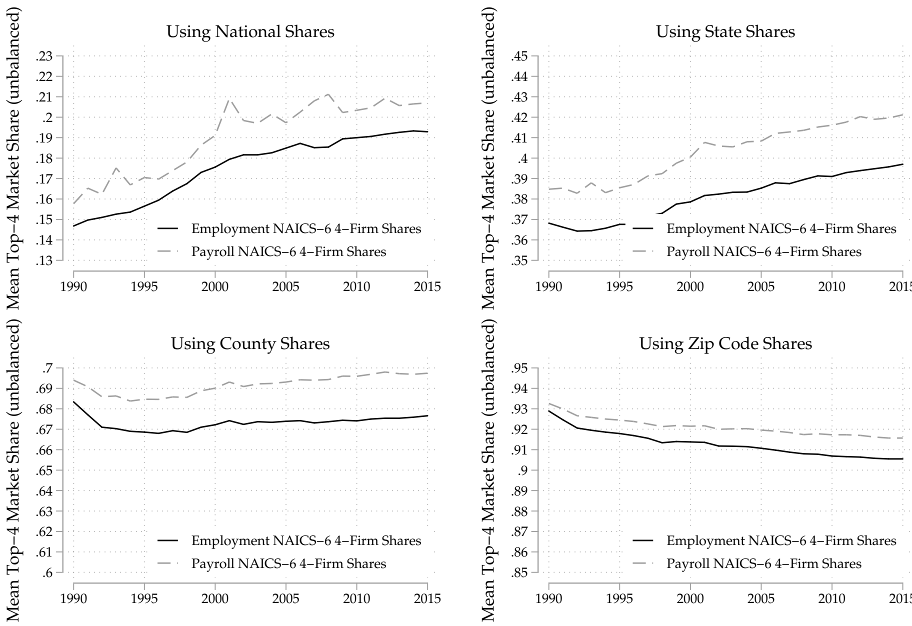
Notes: These four graphs plot changes in the average market share of the top four firms across 6-digit NAICS codes. Data drawn from a balanced panel from 1990 through 2015, with data weighted using employment levels in 1990. Counterclockwise from the top left, I use national market definitions, state market definitions, county market definitions, and finally 5-digit Zip code market definitions. The solid trend-line plots market shares computed using payroll. The dotted trend-line plots market share computed using employment. Data aligned from 1990-2005 to 2012 NAICS codings from the Longitudinal Business Database for all firms with either payroll or employment (U.S. Census Bureau, 1990-2015) .

E Market Concentration Robustness

Rinz (2018) and Rossi-Hansberg, Sarte and Trachter (2018) find that local market concentration has decreased, while I find that market concentration at the Zip code level is relative constant. I broadly replicate their findings and show that this is simply due to disappearing markets and extremely small markets. Suppose a world has two locations, a city and small town. For simplicity, assume that the underlying population stays constant. The city has many highly competitive firms. The small town has a set of firms that operates as an oligopoly. Suppose that some time passes and the firms in the city become more concentrated and all the firms in the small town become bankrupt. Has the average level of market concentration gone up or down? This depends on how you aggregate markets without any firms. See this Table E.1.

If we use a balanced sample, we only consider the market share in the city - where we have a continuous sample. And market shares then increase - entirely due to the effect in the city. On the other hand if we use an unbalanced sample, then market share decreases, as the highly concentrated town drops out of the sample, completely masking the increased market share in the city. With an unbalanced panel, if an area loses a monopolist, aggregate concentration decreases.

Figure E.2: Market Share by Employment and Payroll, 1990-2015 - Unbalanced Panel



Notes: These four graphs plot changes in the average market share of the top four firms across 6-digit NAICS codes. Data drawn from a *unbalanced* panel from 1990 through 2015, with data weighted using employment levels in 1990. I use national market definitions, state market definitions, county market definitions, and finally 5-digit Zip code market definitions. The solid trend-line plots market shares computed using payroll. The dotted trend-line plots market share computed using employment. Data aligned from 1990-2005 to 2012 NAICS codings from the Longitudinal Business Database for all firms with either payroll or employment.

Table E.1: Hypothetical Concentration Scenarios

Market	Market Weight	HHI by Year	
		1990	2010
City	0.9	1000	1200
Town	0.1	5000	

HHI Statistic	HHI by Year	
	1990	2010
Unbalanced Panel	1400	1200
Balanced Panel	1000	1200

This does not occur with a balanced panel.

For example a grocery store may go out of business. This is extremely common in our data at the Zip Code - 6-digit NAICS level. There are approximately 42,000 5-digit zip codes and 1,000 6-digit NAICS industries. Combined, there are 42 million possible markets. In 1999, there were only 5,408,174 active establishments. In 2015, there were 6,786,097 active establishments.[8] Zero market shares are extremely common.[9]

Figures E.1 and E.2 compare these two approaches, first using a balanced panel and the second using an unbalanced panel.[10] Data at the National and State level look largely identical. Results start diverging at the County or Zip code level. The balanced panel finds small increases in market concentration at the county level and nearly no change in market concentration at the zip code level. The unbalanced panel finds slight decreases at both the county and zip code level. For example, the 4-firm payroll concentration at the zip-code level decreases from 93% to 92%. While there is a slight decrease, this also obscures a related point. If bins are drawn extremely narrowly (such as at the zip code level), concentration will mechanically be extremely high.

Extremely local market concentrations can be misleading. Furthermore, this approach assumes that markets are *mutually exclusive*, without spillovers. Consumers may switch to a store in a neighboring zip code, or buy products from a superstore that combines both groceries and consumer durables. To illustrate this point, consider Hudson County, which includes Hoboken and West New York. It is part of New Jersey, and part of the New York MSA and commuting zone 19600. New York County is across the Hudson river and consists of Manhattan. It is part of New York State, part of the New York City MSA, but part of commuting zone 19400.

If we use national markets or MSAs, these counties are part of the same market. If we use counties, states, or commuting zone, these counties are part of different markets. The Industrial Organization literature seriously accounts for this, by looking at the cost of distance, in a market-by-market fashion (For an example see Davis, 2006). However this has not been systematically exploited at a macro-economic scale, looking across industries - likely for data availability reasons.

The analysis by Rinz (2018) aims to look at local labor markets finds that as more workers move to dense agglomerations, monopsony power decreases. As a retail worker may switch sectors, but still work within retail, Ritz aggregates data to commuting zones and high-level industry aggregates. The analysis by Rossi-Hansberg, Sarte and Trachter (2018) is a bit different. The authors look at market concentrations at the 8-digit level, using a proprietary dataset that claims to include establishment level revenue counts. As such data is quite imprecise, even when using administrative tax data, more work needs to be done to understand the nature of the underlying data set. For example, what happens to internal firm transfers? How are data validated? How is value-added attributed up and down the supply chain?

[8] See US Census Business Dynamics Statistics at https://www.census.gov/ces/dataproducts/bds/data_firm2015.html.

[9] For example there were 8,721 pawnshops operating in the United States in 2012, but over 42,000 zip codes. Even split between 3,000 counties, many counties will not have a pawn shop.

[10] Results that vary weights by time period show broadly similar results.

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