The Rise of Market Power and the Macroeconomic Implications: Comment *

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1 Introduction

De Loecker et al. (2020) (henceforth, DEU) seeks to estimate how markups—a possible proxy for market power—have evolved in the United States economy between 1955 and 2016. The article's headline result is that the average markup increased from 1.21 in 1980 to 1.61 in 2016 (DEU Figure I). DEU indicates that "...the increase in market power occurs in all sectors and industries," and that this holds under many alternative specifications. The results have been widely cited in both academic and popular settings, and are a leading piece of evidence supporting the hypothesis that market power increased in the United States over recent decades.[1]

Based on the published supplementary materials and additional necessary replication code provided by one of the DEU authors, we have identified that these results were obtained using sample restrictions that are not stated in the article or its online appendix, that excluded an additional 27% of the observations.[2] In this comment, we

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[1]Syverson (2019); Philippon (2019); Berry et al. (2019); U.S. Department of the Treasury (2022); Council of Economic Advisers (2022); Shapiro (2021)

[2]The sample restrictions do appear in the code included in the supplementary materials.

apply the methodology of DEU, as it is described in the article and implemented in the replication code, to the "full" data sample without the unstated restrictions, and examine whether the results of DEU still hold.

We provide two main results (see Figure 1). First, using the full sample, the estimated average markup follows a very different path.[3] While DEU finds that the average markup increased rapidly throughout the 1980s and 1990s, in the full sample, the average markup increases more gradually through 2008. It then sharply increases in the last few years of the sample, ending at a similar level as in the DEU sample.

Second, unlike the results in DEU, which are robust to the exclusion of individual sectors, in the full sample, the increase in markups at the end of the sample is driven almost entirely by a single sector: Finance and Insurance (F&I).[4] When the F&I sector is excluded from the full sample, the average markup increases only modestly, from just below 1.30 in the mid-1980s to about 1.35 in 2016. Furthermore, even when F&I is included in the full sample, the increase in the estimated average markup arises mainly from an artifact of the accounting data used by DEU: interest income is counted as revenue, but interest expenses typically are excluded from Cost of Goods Sold.

We conclude that the results from the full sample do not appear to support DEU's conclusions that "there has been a steady rise [in markups] since 1980" and that "the increase in market power occurs in all sectors and industries."

In the remainder of the comment, we explain our results and examine why they differ from DEU. For completeness, we document additional discrepancies between the DEU article and the code used to generate the results. As these additional discrepancies do not meaningfully change the results, we relegate them to an appendix.

2 Methods and Data Requirements

DEU recovers markups using the "production approach." For completeness, we describe the estimation in detail in Appendix A. In step one of the approach, DEU estimates a production function in which Sales is specified as a function of Cost of Goods Sold (COGS), Capital, and unobserved productivity. In step two of the approach, DEU obtains markups from a first order condition. Cost minimization and other assumptions imply that the markup equals the output elasticity of the production function with respect to a

[3] Throughout this comment, we use the term "full sample" to refer to the data sample after applying the sample restrictions that are stated in the article. Precise details are provided in Section 3.

[4] Although the DEU sample results are robust to excluding F&I, this is because the unstated sample restrictions have the effect of excluding 89% (sales-weighted) of the F&I observations.

freely adjustable variable input multiplied by the ratio of gross revenue to expenditure on the freely-adjustable variable input. DEU uses COGS as the freely-adjustable variable input. Thus, the DEU markup estimate of firm i in period t is given by

$$\mu_{it} \equiv \frac{P_{it}}{MC_{it}} = \theta_{it} \times \frac{\text{Sales}_{it}}{\text{COGS}_{it}} \tag{1}$$

where P_{it} and MC_{it} are price and marginal cost, respectively, and θ_{it} is the output elasticity with respect to COGS from the production function. DEU allows the output elasticity to vary across years and 2-digit sectors, and calculates the average markup as a sales-weighted mean across firms.

DEU uses variables for Sales, COGS, Capital, and Investment (which enters a control function) to estimate the production functions. It uses variables for Sales and COGS, along with the output elasticities from the first step, to obtain markups.[5] DEU states that, to recover markups, "a firm-year observation requires information on both sales and COGS."

3 Main Results

We focus on two discrepancies between the data sample described in the DEU article and that created by the replication code provided by the authors: (i) the code drops observations that have missing values for Capital, and (ii) the code drops observations that have missing values for Selling, General, and Administrative (SG&A) expenses. Neither of these two restrictions is reported in the article, but they are each substantial. If applied in order, the restriction on Capital drops 33,422 observations, and the restriction on SG&A drops a further 63,572 observations. Together, the two restrictions reduce the sample size by 27.4%. The two sample restrictions also have a large effect on the main results in DEU.

3.1 Results: The Rise of Markups

Figure 1 plots three estimates of the average markup over time. The solid red line is the estimate provided in DEU. The dashed green line is what we obtain from the full sample—i.e., without dropping missing values for Capital or SG&A. Finally, the dash-dot black line is what we obtain with the full sample excluding the Finance & Insurance

[5] Thus, the data requirements of the second step are lighter, and DEU calculates markups for some firms that have valid Sales and COGS data, but have missing values for Investment.

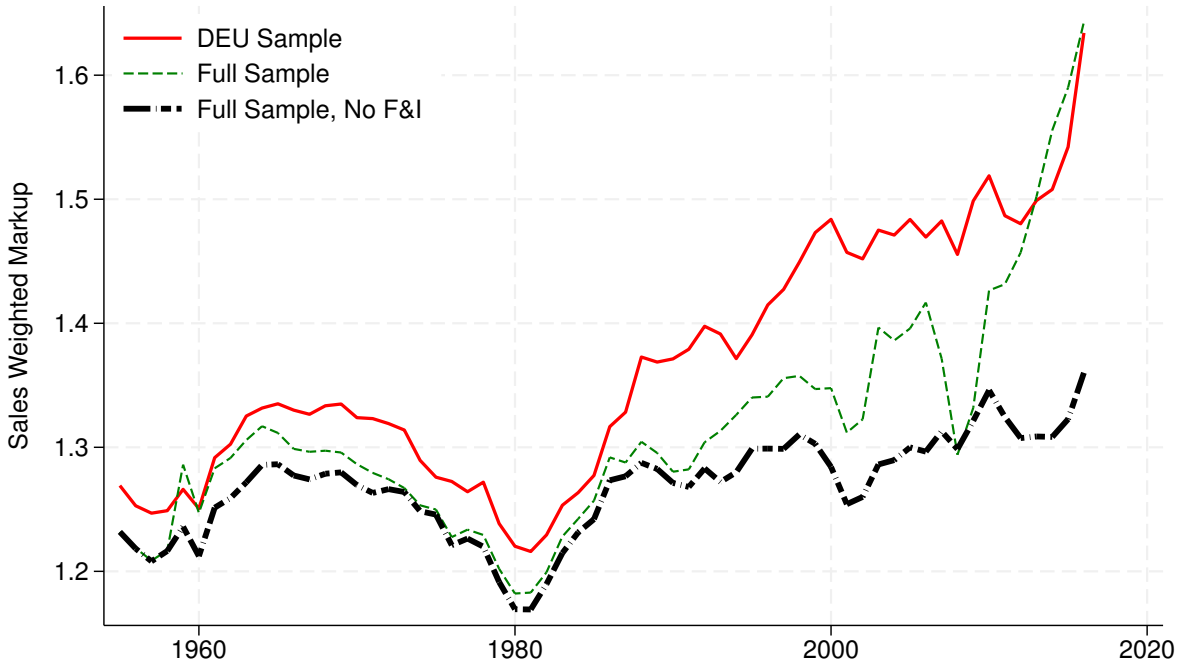

Figure 1: Markups Obtained with the DEU Sample and the Full Sample

Notes: The figure plots estimates of the sales-weighted average markup over time. The solid red line is a replication of Figure I of DEU, which uses a restricted sample. The dashed green line uses the full sample. The black dash - dot line uses the full sample except for the F&I sector.

sector. Using the DEU sample, the average markup increases rapidly throughout the 1980s and 1990s, pauses in the 2000s, then increases rapidly again in the final few years of the sample. In the full sample, the average markup increases more gradually through 2008. It then sharply increases in the last few years of the sample, ending at a similar level as in the DEU sample.

Moreover, unlike the DEU results, which are robust to the exclusion of individual sectors, in the full sample the increase in markups at the end of the sample is driven almost entirely by a single sector: Finance & Insurance. Excluding F&I, the average markup increases only modestly, from just below 1.30 in the mid-1980s to about 1.35 in 2016.

3.1.1 Selection on Missing SG&A

Of the two unstated sample restrictions, it is the omission of observations with missing SG&A values that causes the results to change. Table C.1 shows regressions of log(Sales) and log(COGS) on an indicator for a missing SG&A value, the same indica-

tor interacted with a de-meaned time trend, and industry and time fixed effects (first and third columns). The second and fourth columns repeat the analysis adding firm fixed effects. The regressions show that observations with missing SG&A tend to have lower Sales, and higher COGS, and hence higher markups than other observations. These relationships are statistically significant both across firms and within firms over time. They also strengthen over the sample period. Omitting observations with missing SG&A therefore leads to a trended upward bias in the markups estimates.

Given the large impact of the sample restrictions on the markup estimates, one might reasonably wonder whether there are good reasons for excluding observations with missing SG&A values from the analysis. We have not been able to identify any. SG&A is not needed to estimate markups, and does not otherwise factor into the main results of the article, so there is no practical reason to drop these observations from the analysis. There is also no reason to believe that observations where SG&A is not reported are of low quality. SG&A are not required to be reported as a separate line item under U.S. GAAP. Companies are required to report Operating Expenses, but the precise breakdown is discretionary.[6] A close inspection of SG&A reporting in the Compustat data also does not reveal any systematic data quality issues with firm-year observations where SG&A is not reported. SG&A reporting is much higher in some sectors than others[7] but, since 1970, the fraction of public firms reporting SG&A has held steady at around 80% (see Figure C.1). Many large well-known firms have not consistently reported SG&A, including Aetna Inc, Citigroup, Delta Airlines, Ford Motor Co, HCA Healthcare, and United Parcel Service (UPS). On the other hand, if we are interested in learning what happened to average markups across the whole US economy, then it would seem important to include all of the data in this calculation.

3.1.2 Finance & Insurance Accounting

Figure 1 shows that, for the full sample, the inclusion of finance firms has a large impact on the average markup, particularly after 2010. This result stands in contrast to DEU's Appendix 10, which shows that in their sample excluding the F&I sector does not change the results[8], and Appendix 15, which shows the results by sector.

There are two reasons for the differences in the full sample. One is that 89% (sales-

[6]The same is also true under International Financial Reporting Standards (IFRS).

[7]Weighted by Sales, Utilities(94%), Transportation and Warehousing (54%,/79%) and Finance and Insurance (50%) have the most missing values for SG&A – see Table C.2

[8]Appendix 10 also excludes the Real Estate sector but in the full sample excluding Real Estate has very little impact on any results.

weighted) of F&I sector observations in Compustat are missing either Capital or SG&A. Thus, after imposing these two sample restrictions, the F&I sector is *already* largely excluded from DEU's main analysis. This fact helps explain why the DEU results are robust to excluding F&I. It also provides further insight into the differences between the three lines in Figure 1. The dash-dot black line, which shows markups in the full sample excluding all F&I observations, is perhaps better compared to the red DEU sample line, which also excludes 89% of F&I observations. The difference between these two lines shows, approximately, the effect of removing the sample restrictions on the markup estimates for the rest of the economy minus F&I. The dashed green line then shows the effect of adding the F&I observations back into the sample.

In addition, there are accounting issues in the way that Compustat compiles annual reports data that have a large impact on the estimated markups for F&I firms in particular when using DEU's approach. Compustat includes interest income in Sales, but typically does not include interest expense in COGS. Using DEU's approach, this practice produces markup estimates for financial firms that are high and volatile. For example, the estimated markup of the Federal National Mortgage Association (Fannie Mae) rises from 267% in 2011 to 2130% in 2016. In combination with this effect, an increase in overall financial activity can mechanically generate rising markup estimates. The Finance & Insurance sector accounted for only 1% of the sales in Compustat in 1955, but more than 15% in 2016. In the appendix, we reproduce the main results but including interest expense in COGS for F&I firms, and show that, with this change, the increase in the economy-wide average markup is significantly more modest even when the F&I sector is included (see Figure C.2).

3.2 Other Headline Results

In addition to documenting the rise in average markups, DEU contains two other headline findings: it documents long-term changes in the distribution of markups, and it decomposes the changes in the average markup into changes in markups for existing firms, and reallocation of economic activity across firms.

3.2.1 The Distribution of Markups

DEU finds that the median markup has not changed over time. The rise in the estimated average markup is instead driven by an increase in the upper tail of the markup distribution. These results are somewhat conserved in the full sample, at least in spirit.

Figure C.3 replicates Figure III(B) from DEU using the full sample and excluding the F&I sector. In the full sample, it remains true that the upper tail of the markup distribution has fattened, though the magnitude of the increase in the upper decile is approximately halved. The median markup decreases slightly over time in the full sample.

3.2.2 The Reallocation of Economic Activity

DEU decomposes changes in the average markup since 1980 into three forces: within-firm changes in markups, net entry, and reallocation of sales between firms. DEU finds that within-firm markups contribute about one-third of the total increase in average markups, while reallocation between firms contributes the remaining two-thirds of the change. DEU states that the within-firm result is "an indication of the change in pricing power of firms." Figure C.4 replicates DEU's Figure IV using the full sample excluding the F&I sector. In contrast to the DEU findings, in the full sample, within-firm markups are decreasing over time. Under the logic stated in DEU, we obtain the opposite conclusion: the result would indicate a decrease in the pricing power of existing firms over time. In the full sample, there is also a reallocation of sales to higher markup firms that more than offsets the decrease in within-firm markups.

4 Conclusion

The results of DEU are sensitive to unstated data sample restrictions that exclude over 27% of the observations available for use in the analysis. When we modify the DEU code to include these observations, we find that the increase in overall average markups is no longer robust. It is almost entirely driven by a single sector and is likely due mainly to an accounting issue that strongly affects the estimates for firms in that sector, rather than being due to economic forces. Excluding this sector, the estimated average markups obtained using the production method on the Compustat data are modest. We conclude that the DEU methodology and data, as they are described in the article, do not support the conclusion that broad-based increases in market power have occurred in recent decades.

References

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Appendix Materials

A Production Function Estimation

To recover markups, we estimate production functions using the regression model of DEU. The key parameters of interest are the elasticities of output with respect to COGS. The regression model for estimating these parameters is described in the DEU appendix, but the publicly provided replication package does not contain estimation code for this purpose – instead, the public replication package takes as given the estimated output elasticities, which are treated as data. Thus, we also rely on additional code provided to us by one of the authors that estimates these parameters. In this appendix, we describe the model and its implementation.

To start, DEU specify a Cobb-Douglas production function for their baseline specification. For firm i and year t,

$$q_{it} = \theta_t^V v_{it} + \theta_t^K k_{it} + \omega_{it} + \epsilon_{it} \tag{A.1}$$

where q_{it}, v_{it}, and k_{it} are log output, the log quantity of the variable input, and log capital, respectively, ω_{it} is a persistent productivity shock that is known to the firm when it chooses v_{it}, and ϵ_{it} is a productivity shock that is realized after input decisions are made. The parameters, θ_t^V and θ_t^K are output elasticities.

Compustat provides revenue and expenditures, rather than quantities. Adding and subtracting prices obtains the following conversion:

$$p_{it} + q_{it} = \theta_t^V \left(p_{it}^V + v_{it}\right) + \theta_t^K \left(p_{it}^K + k_{it}\right) + \omega_{it} + \epsilon_{it}^* \tag{A.2}$$

where the left-hand side is log revenue ($p_{it} + q_{it}$), the right-hand side depends on log expenditures ($p_{it}^V + v_{it}$ and $p_{it}^K + k_{it}$), and the unobservables include a wedge between the output and input prices, as $\epsilon_{it}^* \equiv \epsilon_{it} + p_{it} - \theta_t^V p_{it}^V - \theta_t^K p_{it}^K$.

DEU maintain the assumption of Markov transitions for the persistent productivity shock: $\omega_{it} = g(\omega_{it-1}) + \xi_{it}$. They also assume that investment is monotonic in productivity and capital, allowing for the expression: $\omega_{it} = h_t(i_{it}, k_{it}, z_{it})$, where $h_t()$ is referred to as the control function, and z_{it} contains control variables that DEU state are intended to control for the wedge between input and output prices.[9] In the code that we were

[9]Appendix A (p. 632) states, for z_{it}, "we consider market share, measured at various levels of aggregation (two, three, and four digit), to take into account additional variation in output and input markets."

supplied, control variables are not used in the baseline specification. We therefore omit z_{it} from the model hereafter. We also omit ϵ^*_{it} in order to better track the DEU regression model though, absent z_{it}, it should still be present.

Placing these restrictions into equation (A.2), and substituting variable names, the model then becomes:

$$\log(Sales_{it}) = \theta_t^V \log(COGS_{it}) + \theta_t^K \log(Capital_{it}) + \beta_{1t} \log(Investment_{it-1}) + \beta_{2t} \log(Capital_{it-1}) + \beta_{3t} \log(Capital_{it-1})^2 + \xi_{it} \quad \text{(A.3)}$$

where the control function is specified as being linear in investment and quadratic in capital. DEU estimate the production function of equation (A.3) using 2SLS, treating COGS as an endogenous regressor. The excluded instrument is lagged COGS. The orthogonality conditions are provided in equation (27) of DEU Appendix A.

As we have specified the model, the coefficients are time-varying, and DEU also let them vary across 2-digit NAICS sectors. Depending on the sector, they impose constant coefficients before either 1972 or 1985. For each subsequent year, they construct regression samples using observations from within two years, i.e., they use 5-year rolling samples. The 2SLS regression is then estimated separately on each of these samples.

B Additional Issues and Discrepancies

B.1 Sample Restrictions

In addition to the two discrepancies described in the main text, we have identified two additional discrepancies between the sample restrictions described in the article and those used in the code. They do not meaningfully affect the results, but we report them for completeness. First, the DEU article states that observations in the top and bottom percentiles of the ratios of COGS to Sales and SG&A to Sales are dropped. Only the former screen appears in the code. We use both screens in our full sample results. Second, the DEU code drops observations in the top and bottom percentiles of the ratios of COGS to variable cost and COGS to total cost, where variable cost is defined as the sum of COGS and Capital and total cost is defined as the sum of COGS, Capital, and SG&A. These screens are not described in the article, and we do not use them for our full sample results.

Even with the replication package and the additional code provided by one of the authors, we are unable to precisely replicate the main results of DEU without relying on

an additional dataset provided by one of the authors that lists explicitly the firm-years included in their analysis. The additional dataset features approximately five thousand fewer firm-year observations than what we obtain using the code that ostensibly creates the dataset. Specifically, the replication code generates a dataset with 248,390 observations, while the article claims 247,644 observations (Table B.1 in DEU), and the dataset provided by the authors contains 242,645 observations.

B.2 Figures in DEU

We identified two mistakes in the code used to generate figures. First, Figure A.1 in DEU reports that the OP and ACF output elasticities are similar. However, the line labeled "ACF" erroneously provides the baseline OP output elasticities and the line labeled "OP" provides output elasticities using the same OP approach, but with a more flexible control function. While the ACF code we were provided does not provide reasonable estimates for a few years, the overall pattern across the years is similar to the baseline model.

Second, Figure XVIa in DEU examines COGS-weighted average markups. The code that generates the figure contains an error. Specifically, the code averages the cost-share based markup estimate rather than the baseline estimate. The dashed purple line in Figure C.5 contains the corrected COGS-weighted average markup for the DEU sample. It increases by about five percentage points less than what is reported in DEU.

C Additional Figures and Tables

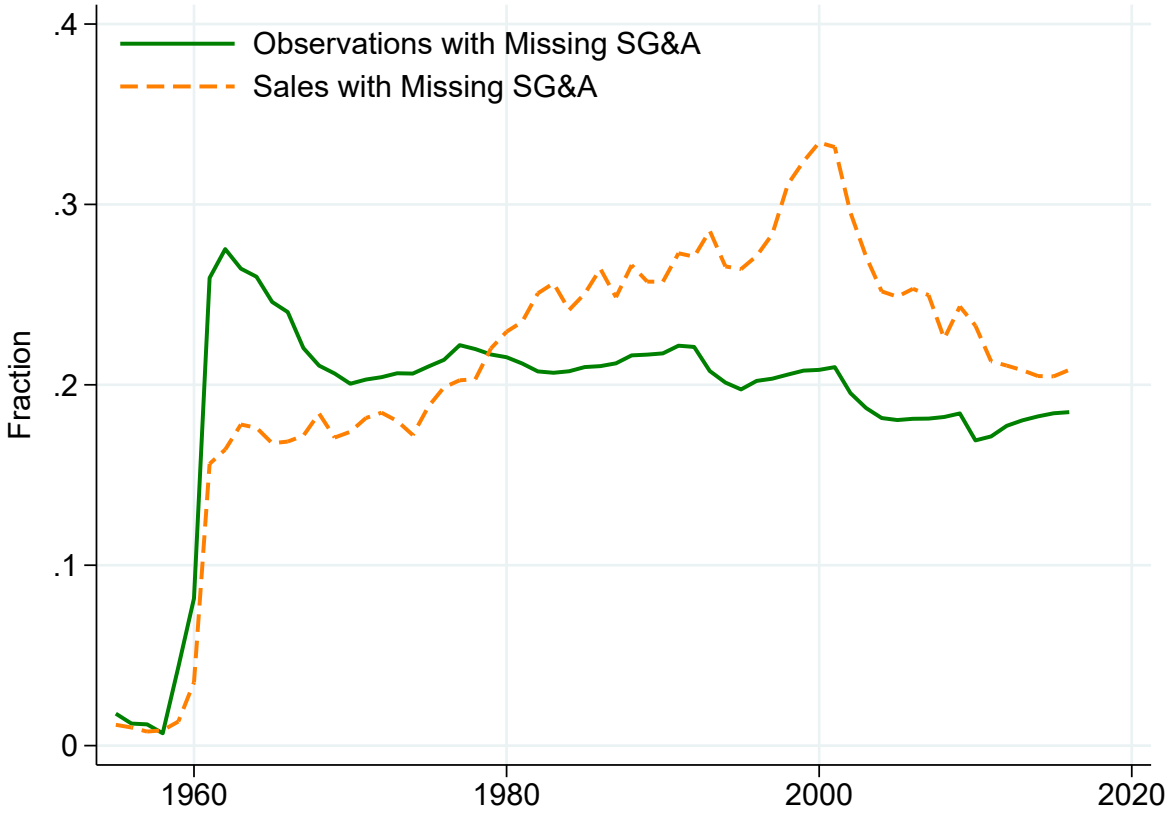

Figure C.1: Summary of Missing SG&A Values over Time

Notes: The figure plots the fraction of otherwise usable observations have missing values for SG&A over the sample period, both unweighted (solid green line) and weighted by sales (dashed orange line).

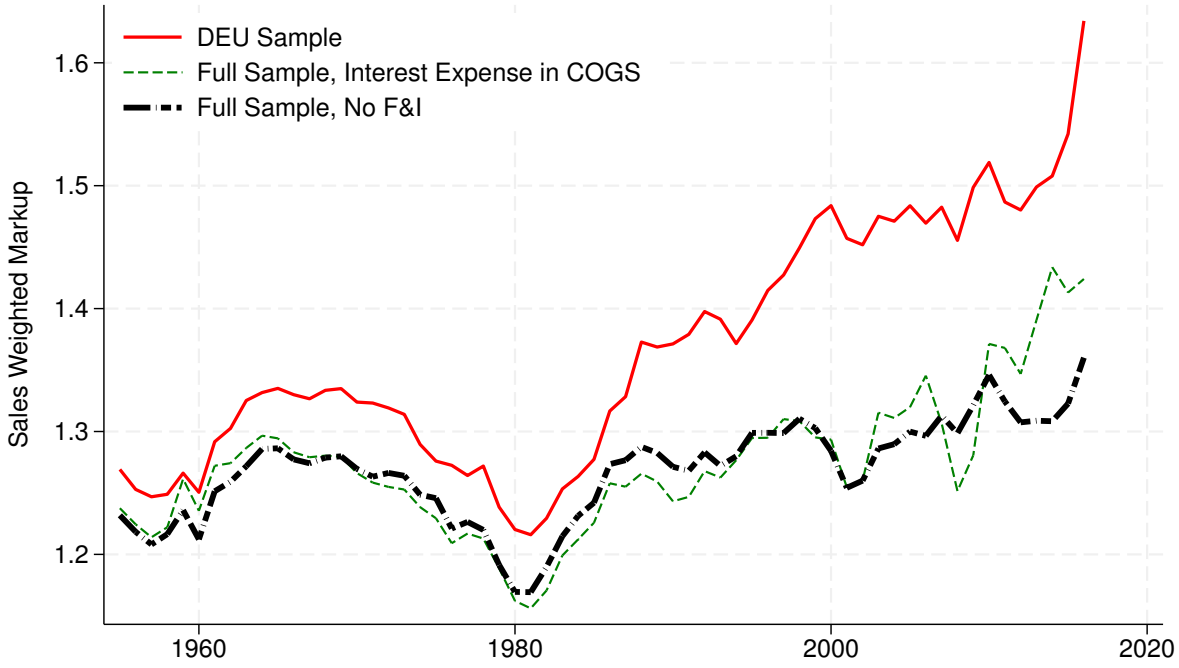

Figure C.2: Markups Estimates that Incorporate Interest Expense in COGS

Notes: The figure plots estimates of the sales-weighted average markup over time. The solid red line is a replication of Figure I of DEU, which uses a restricted sample. The black dash - dot line uses the full sample except for the F&I sector. The dashed green line uses the full sample, including F&I, but incorporates a data correction that adds interest expense to COGS.

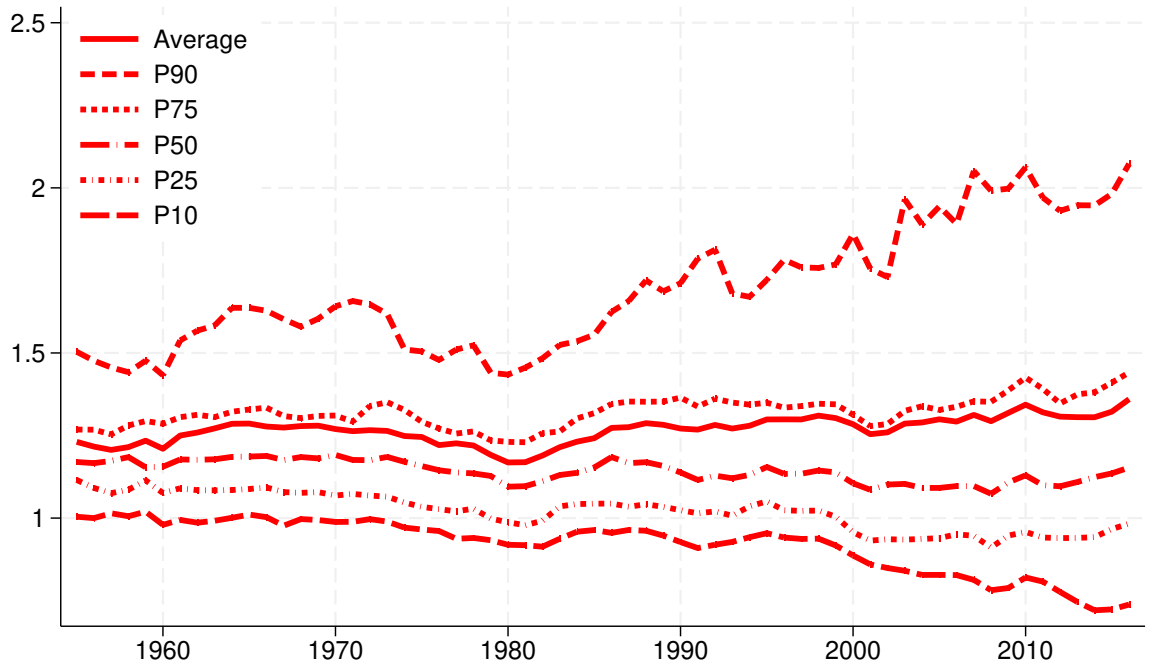

Figure C.3: Markup Percentiles

Notes: The solid line is the sales-weighted average from Figure 1. Each of the dashed lines corresponds to a sales-weighted percentile.

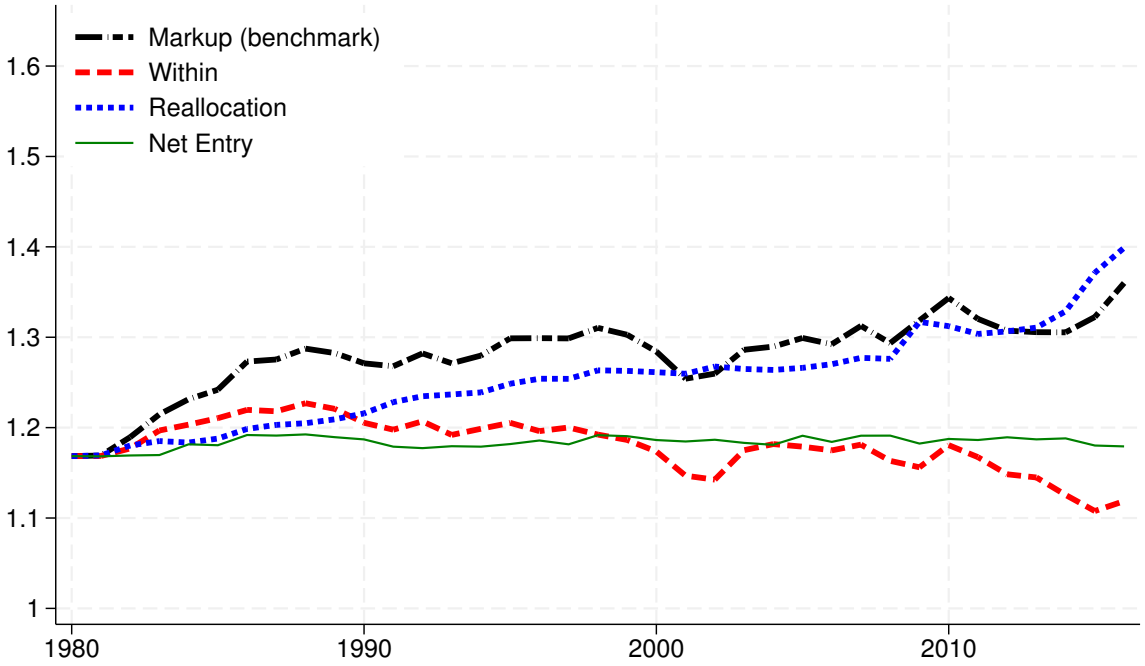

Figure C.4: Decomposition of Estimated Markup Growth

Notes: The figure recreates Figure IV of DEU using the full sample excluding the F&I sector. The black dot-dash line shows the sales-weighted average markup from our main results. The red dashed line represents the contribution of within-firm markup changes, the green solid line represents the contribution of entry and exit, and the blue dotted line represents the contribution of reallocation.

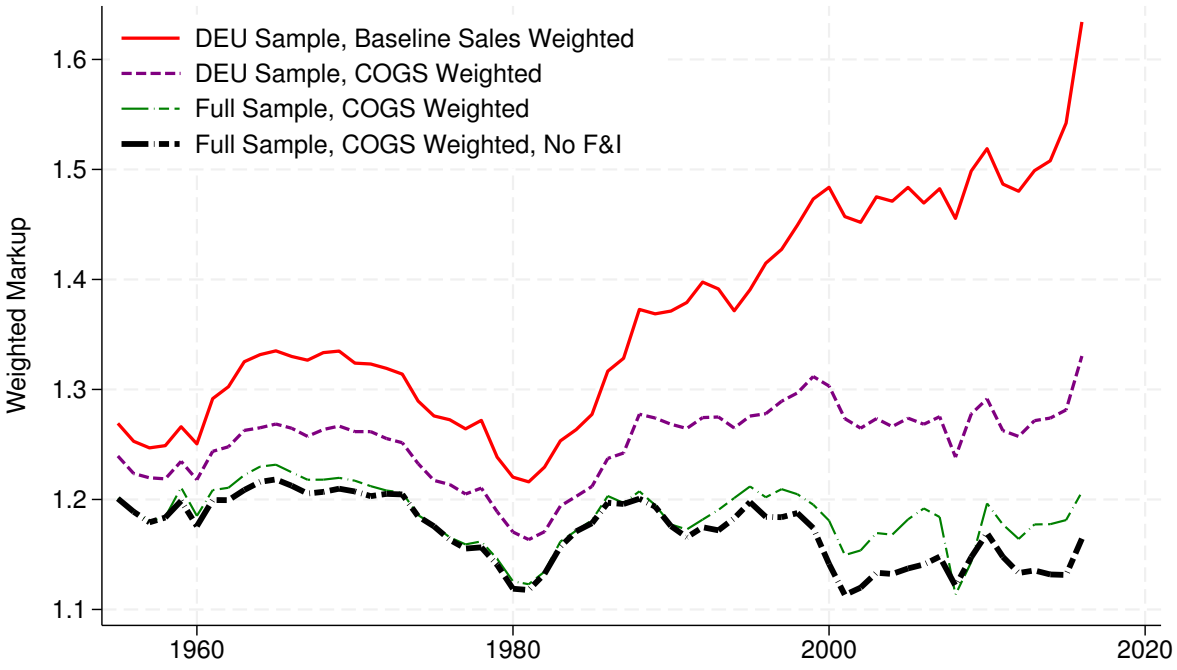

Figure C.5: COGS-Weighted Average Markups

Notes: The figure plots estimates of the sales-weighted and COGS-weighted average markup over time. The solid red line is a replication of Figure I of DEU, which uses a restricted sample. The dashed purple line is the DEU sample with COGS weighting (corrected version of Figure XVI(A) of DEU). The green dash - dot line uses the full sample with COGS weighting. The black dash - dot line is the full sample excluding F&I, with COGS weighting.

Table C.1: Regression Analysis of Observations with Missing SG&A Values

	Dependent Variable			
	log(Sales)	log(Sales)	log(COGS)	log(COGS)
SG&A Missing	-0.142	-0.445	0.442	0.211
	(0.050)	(0.029)	(0.048)	(0.030)
SG&A Missing $\times$ Trend	-0.006	-0.007	0.009	0.004
	(0.002)	(0.001)	(0.002)	(0.001)
Firm Fixed Effects	no	yes	no	yes
R^2	0.094	0.907	0.108	0.903

Notes: This table reports the results of OLS regressions of log Sales and log COGS on an indicator for missing SG&A and its interaction with a demeaned time trend. All regressions include year and industry fixed effects. The industry fixed effects are at the 2-digit NAICS level. There are 348,176 firm-year observations. Standard errors are in parentheses.

Table C.2: Summary of Missing SG&A Values by 2-Digit NAICS Code

NAICS	Definition	Share of Sales (%)	Missing SG&A (%)	
			Observations	Sales
11	Agriculture, Forestry, Fishing and Hunting	0.15	12.19	1.83
21	Mining, Quarrying, and Oil and Gas Extraction	3.56	9.09	23.27
22	Utilities	5.65	90.82	94.37
23	Construction	0.55	10.93	7.77
31	Manufacturing	4.97	4.97	8.42
32	Manufacturing	18.13	15.50	7.32
33	Manufacturing	20.22	4.27	8.44
42	Wholesale Trade	4.06	7.38	5.82
44	Retail Trade	3.95	8.45	9.74
45	Retail Trade	4.91	5.33	6.50
48	Transportation and Warehousing	3.07	41.40	54.35
49	Transportation and Warehousing	0.66	31.78	79.06
51	Information	8.69	19.61	32.60
52	Finance and Insurance	15.23	38.85	50.40
53	Real Estate and Rental and Leasing	0.70	41.60	34.05
54	Professional, Scientific, and Technical Services	1.34	11.53	8.94
56	Administrative and Support and Waste Management and Remediation Services	0.61	11.12	7.64
61	Educational Services	0.08	5.63	2.14
62	Health Care and Social Assistance	0.83	24.20	28.64
71	Arts, Entertainment, and Recreation	0.11	26.36	9.61
72	Accommodation and Food Services	0.81	14.75	21.89
81	Other Services (except Public Administration)	0.08	6.74	2.93
99	Unclassified	1.63	17.75	18.20

Notes: Compustat assigns each firm-year observation to a 2-digit NAICS code. The table provides, for each code, (1) the share of total Compustat sales accounted for by firm-year observations assigned to the code, (2) the fraction of firm-year observations assigned to the code for which SG&A is missing, (2) and the proportion of all sales of firm-year observations assigned to the code that are due to firms-year observations for which SG&A is missing.