

# Online Appendix

## Productivity, Markups, and Reallocation: Evidence from French Manufacturing Firms

### A Data

#### Merging of the data sets FICUS and FARE

For my analysis I merge the two fiscal firm-level datasets FICUS and FARE, covering the periods from 1994 to 2007, and 2008 to 2016, respectively. Both in FICUS and FARE firms are classified by a 4-digit sector nomenclature "NAF" (nomenclature d'activité française). However, from FICUS to FARE this sector nomenclature has significantly changed. In FICUS, the nomenclature was organized according to "NAF 1", while in FARE the nomenclature is organized according to "NAF 2". In this study I treat one single data set, 1994 - 2016, by establishing consistency in the sector nomenclature NAF 2 throughout the whole period. That is, I assign the current 4-digit sector nomenclature NAF 2 retrospectively for all firm observations from FICUS. For firms that are observed either in FICUS and FARE or only in FARE the 4-digit sector according to NAF 2 they belong to is known. However, for firms that have exited the market before 2008 I do not know to which NAF 2 4-digit sector they would have belonged to if they had continued their activity. To also classify these firms by the NAF 2 4-digit nomenclature I use the following methodology. I first only look at firms that are observed in both data sets FICUS and FARE. From these observations I build a transition matrix where each row represents a 4-digit sector according to NAF 1 and each column represents a 4-digit sector according to NAF 2.

Each cell of the transition matrix contains the number of firms transiting from a specific 4-digit sector in FICUS (NAF 1) to the new 4-digit sector in FARE (NAF 2). Table A1 shows an exemplifying transition matrix, where I chose the NAF 1 4-digit sectors 201A - 205C, belonging to the manufacturing sector of wood and products of wood. For instance it can be seen that there are 2060 firms observed that were classified in FICUS in 201A (first row) and in FARE in the sector 1610 (third columns), while there are only 46 observations that were classified in 201A (FICUS) and in 0220 (FARE, first column). From these observed transition frequencies I then calculate the transition probabilities by simply dividing each element of the matrix by the sum of its corresponding row. That is, the NAF 1 - NAF 2 transition probabilities are calculated by

$$p_{ij} = \frac{\sum_{n \in \mathcal{I}, \mathcal{J}}^{N_i} \mathbf{1}_{[n \in \mathcal{I} \text{ and } n \in \mathcal{J}]}}{\sum_{n \in \mathcal{I}}^{N_i} \mathbf{1}_{[n \in \mathcal{I}]}} \tag{1}$$

where  $n$  is a firm observed in both FICUS and FARE,  $\mathcal{I}$  and  $\mathcal{J}$  are specific 4-digit sectors according to NAF 1 and NAF 2, respectively.  $\mathbf{1}$  is an index variable equal to 1 if the condition in parenthesis is fulfilled. Table A2 contains the transition probabilities according to the observed transitions Table A1. It can be seen that those 4-digit transitions between FICUS and FARE that were more frequently observed obtain accordingly higher probabilities. In a second step, firms only observed in FICUS belonging to a specific NAF 1 4-digit sector, are assigned to a NAF 2 4-digit sector, by drawing from a discrete probability distribution, which corresponds to the row in the probability transition matrix, i.e. the NAF 1 4-digit sector a firm belongs to and its potential transition possibilities.

Table A1: FICUS - FARE: Observed transition frequencies

NAF 1	NAF 2																Total			
	0220	1392	1610	1621	1622	1623	1624	1629	2223	2512	3101	3109	3319	4329	4332	4391		4399	5610	9524
201A	46	0	2060	5	6	22	35	12	0	0	0	7	0	0	25	24	9	5	0	2256
201B	0	0	498	0	0	0	0	0	0	0	0	0	0	17	4	36	24	0	0	579
202Z	0	0	0	108	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	112
203Z	0	7	33	0	15	1880	8	8	41	26	0	41	0	6	1005	386	34	0	0	3490
204Z	0	0	17	0	4	857	6	0	0	0	0	0	35	6	0	0	0	0	0	925
205A	4	16	10	4	0	21	5	1215	0	0	12	317	0	0	87	0	4	10	156	1861
205C	0	0	0	0	0	0	0	86	0	0	0	0	0	0	0	0	0	0	0	86

Source: FICUS/FARE database, own calculations.

Table A2: FICUS - FARE: Transitions probabilities

NAF 1	NAF 2																Total			
	0220	1392	1610	1621	1622	1623	1624	1629	2223	2512	3101	3109	3319	4329	4332	4391		4399	5610	9524
201A	0.02	0.00	0.91	0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	1.00
201B	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.01	0.06	0.04	0.00	0.00	1.00
202Z	0.00	0.00	0.00	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	1.00
203Z	0.00	0.00	0.01	0.00	0.00	0.54	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.29	0.11	0.01	0.00	0.00	1.00
204Z	0.00	0.00	0.02	0.00	0.00	0.00	0.93	0.01	0.00	0.00	0.00	0.00	0.04	0.00	0.01	0.00	0.00	0.00	0.00	1.00
205A	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.65	0.00	0.00	0.01	0.17	0.00	0.00	0.05	0.00	0.00	0.01	0.08	1.00
205C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Source: FICUS/FARE database, own calculations.

## B Translog production function estimation

I here present the results from the translog (TL) production function estimation conducted for each 2-digit sector separately. In particular, Table B1 provides the coefficient estimates, which, however, are not easily interpretable. Table B2 shows, the more informative corresponding median output elasticity w.r.t. the inputs capital, labor, and materials, as well as the median returns to scale. Further, the corresponding median average distance (MAD) as well as the share of negative estimates are reported. Figure B1 illustrates the kernel density estimates of output elasticities and returns to scale over all firms and years. It can be seen that the output elasticity w.r.t. capital input is strongly concentrated around 0.1. Instead, the density of the elasticity w.r.t. labor is highest around 0.4. The density of the elasticity w.r.t. materials shows a bi-modal pattern, with a higher concentration between 0.3 and 0.4, as well as between 0.5 and 0.6. Returns to scale are highly concentrated around 1.0 and 1.05. Additionally, Figure B2 illustrates the median output elasticities and returns to scale over time. It can be seen that even though the coefficients of the TL production function are supposed to be fixed over time, the production technology, in terms of the output elasticity for a given input, might change through changes in firms' input mix. The figure shows that the median output elasticity of labor is higher at the beginning of the period and decreases over time, while the median output elasticity w.r.t. materials slightly increases.

The first stage of the production function estimation allows to recover the production function residual  $\hat{\epsilon}_{nt}$  (equation (7) in the paper). It is then further used to recover firm-level productivity (equation (14) in the paper) as well as to estimate the input share of materials to derive firm-level markups (equation (17) and (15) in the paper). Figure B3 shows the kernel density estimate of the residual, with a strong concentration around zero, close to normality.

Table B1: Coefficients estimates of the TL production function (ACF)

Sector	$\alpha_K$	$\alpha_L$	$\alpha_M$	$\alpha_{KK}$	$\alpha_{LL}$	$\alpha_{MM}$	$\alpha_{KL}$	$\alpha_{KM}$	$\alpha_{ML}$	# Obs.	# Firms
Beverages	0.060 (0.0026)	0.368 (0.0192)	0.661 (0.0328)	0.080 (0.0044)	-0.019 (9e-04)	0.100 (0.0048)	0.030 (0.0010)	-0.087 (0.0041)	-0.021 (0.0010)	12743	1330
Textiles	0.138 (0.0070)	0.157 (0.0076)	0.681 (0.0338)	0.047 (0.0024)	0.168 (0.0081)	0.123 (0.0062)	-0.023 (0.0013)	-0.037 (0.0014)	-0.110 (0.0055)	31761	3599
Wearing apparel	0.137 (0.0079)	0.318 (0.0142)	0.721 (0.0364)	0.028 (0.0013)	0.101 (0.0061)	0.155 (0.0078)	-0.013 (0.0012)	-0.022 (0.0010)	-0.124 (0.0063)	33225	5384
Leather/ related products	0.123 (0.0065)	0.100 (0.0025)	0.759 (0.0395)	0.028 (7e-04)	0.189 (0.0109)	0.120 (0.0058)	-0.026 (0.0016)	-0.011 (5e-04)	-0.132 (0.0077)	10553	1337
Wood/products of wood and cork	0.134 (0.0102)	0.196 (0.0107)	0.581 (0.0286)	0.015 (0.0028)	0.103 (0.0090)	-0.034 (0.0024)	-0.083 (0.0053)	0.052 (0.0017)	0.005 (0.0034)	50589	5538
Paper/ paper products	0.078 (0.0030)	0.238 (0.0095)	0.659 (0.0349)	0.059 (0.0031)	0.126 (0.0068)	0.097 (0.0050)	-0.013 (7e-04)	-0.040 (0.0016)	-0.082 (0.0048)	19862	1937
Printing/reprod. of recorded media	0.163 (0.0078)	0.006 (0.0015)	0.735 (0.0362)	0.001 (6e-04)	0.257 (0.0126)	0.074 (0.0049)	-0.039 (0.0024)	0.015 (9e-04)	-0.143 (0.0074)	66497	7911
Chemicals/ chemical products	0.177 (0.0093)	0.130 (0.0056)	0.746 (0.0371)	0.095 (0.0046)	0.168 (0.0082)	0.101 (0.0049)	-0.035 (0.0016)	-0.070 (0.0035)	-0.076 (0.0035)	28717	3043
Pharma. products/ preparations	0.177 (0.0097)	0.024 (0.0012)	0.790 (0.0407)	0.064 (0.0034)	0.123 (0.0075)	0.102 (0.0051)	-0.017 (0.0014)	-0.060 (0.0030)	-0.065 (0.0035)	5902	640
Rubber/ plastic products	0.144 (0.0078)	0.128 (0.0075)	0.637 (0.0314)	-0.010 (0.0012)	0.141 (0.0071)	0.048 (0.0039)	-0.016 (0.0013)	0.009 (3e-04)	-0.069 (0.0041)	55614	5494
Other non-metallic mineral products	-0.011 (1e-04)	0.561 (0.0275)	0.594 (0.0294)	0.048 (0.0014)	0.008 (9e-04)	0.085 (0.0042)	0.017 (7e-04)	-0.038 (0.0013)	-0.063 (0.0031)	42255	4792
Basic metals	0.126 (0.0065)	0.251 (0.0104)	0.622 (0.0318)	0.064 (0.0029)	0.180 (0.0093)	0.107 (0.0052)	-0.037 (0.0021)	-0.028 (9e-04)	-0.109 (0.0056)	12978	1354
Fabricated metal products	0.201 (0.0100)	0.257 (0.0126)	0.496 (0.0246)	0.044 (0.0022)	0.149 (0.0076)	0.067 (0.0043)	-0.034 (0.0023)	-0.030 (6e-04)	-0.065 (0.0039)	191460	19405
Computer/electronic/ optical products	0.100 (0.0056)	-0.024 (6e-04)	0.790 (0.0390)	-0.011 (0.0013)	0.245 (0.0103)	0.096 (0.0057)	-0.003 (8e-04)	0.013 (1e-04)	-0.158 (0.0073)	26831	3423
Electrical equipment	0.193 (0.0098)	0.005 (0.0020)	0.719 (0.0345)	0.043 (0.0022)	0.220 (0.0100)	0.123 (0.0061)	-0.032 (0.0015)	-0.031 (0.0017)	-0.124 (0.0056)	23439	2602
Machinery and equipment	0.182 (0.0102)	-0.093 (0.0050)	0.778 (0.0403)	-0.009 (0.0026)	0.309 (0.0172)	0.083 (0.0054)	-0.058 (0.0036)	0.031 (1e-04)	-0.147 (0.0087)	57187	6446
Motor vehicles/ (semi-) trailers	0.246 (0.0105)	0.083 (0.0054)	0.654 (0.0336)	0.070 (0.0034)	0.214 (0.0101)	0.117 (0.0064)	-0.063 (0.0023)	-0.033 (0.0017)	-0.103 (0.0058)	20532	2191
Other transport equipment	0.166 (0.0090)	-0.094 (0.0054)	0.832 (0.0399)	0.080 (0.0026)	0.323 (0.0164)	0.110 (0.0063)	-0.054 (0.0021)	-0.031 (0.0015)	-0.160 (0.0083)	6656	806
Furniture	0.120 (0.0060)	-0.021 (0.0015)	0.800 (0.0416)	0.014 (0.0012)	0.192 (0.0108)	0.101 (0.0047)	-0.030 (0.0016)	-0.008 (3e-04)	-0.105 (0.0068)	32234	4007

Source: FICUS/FARE database, own calculations. Standard errors are bootstrapped using 400 replications and reported in parenthesis.

Table B2: Translog production function: Median output elasticities w.r.t. inputs and return to scales

Sector	Statistic	Input			
		Capital	Labor	Materials	Return to Scales
All	Elasticity	0.122	0.461	0.474	1.045
	MAD	0.039	0.097	0.113	0.031
	Share $\leq$ 0	3.160	0.190	1.160	0.000
Beverages	Elasticity	0.159	0.361	0.606	1.124
	MAD	0.059	0.020	0.065	0.013
	Share $\leq$ 0	5.010	0.000	0.330	0.000
Textiles	Elasticity	0.124	0.435	0.455	1.011
	MAD	0.038	0.109	0.092	0.053
	Share $\leq$ 0	2.490	0.620	1.000	0.000
Wearing apparel	Elasticity	0.104	0.471	0.528	1.104
	MAD	0.046	0.202	0.253	0.024
	Share $\leq$ 0	0.910	0.140	14.230	0.000
Leather/ related products	Elasticity	0.083	0.441	0.521	1.039
	MAD	0.013	0.097	0.070	0.031
	Share $\leq$ 0	0.330	0.410	1.180	0.000
Wood/products of wood and cork	Elasticity	0.101	0.390	0.555	1.044
	MAD	0.031	0.068	0.036	0.015
	Share $\leq$ 0	5.810	0.030	0.000	0.000
Paper/ paper products	Elasticity	0.097	0.404	0.532	1.032
	MAD	0.037	0.048	0.050	0.016
	Share $\leq$ 0	5.760	0.000	0.230	0.000
Printing/reprod. of recorded media	Elasticity	0.130	0.480	0.431	1.042
	MAD	0.008	0.084	0.049	0.038
	Share $\leq$ 0	0.000	0.130	0.150	0.000
Chemicals/ chemical products	Elasticity	0.130	0.371	0.594	1.087
	MAD	0.063	0.074	0.081	0.033
	Share $\leq$ 0	8.790	0.620	0.590	0.000
Pharma. products/ preparations	Elasticity	0.148	0.265	0.626	1.034
	MAD	0.052	0.058	0.082	0.019
	Share $\leq$ 0	7.110	1.190	0.260	0.000
Rubber/ plastic products	Elasticity	0.111	0.395	0.551	1.050
	MAD	0.012	0.064	0.043	0.022
	Share $\leq$ 0	0.000	0.020	0.020	0.000
Other non-metallic mineral products	Elasticity	0.100	0.464	0.496	1.070
	MAD	0.034	0.059	0.054	0.026
	Share $\leq$ 0	0.630	0.000	0.090	0.000
Basic metals	Elasticity	0.113	0.484	0.448	1.039
	MAD	0.037	0.089	0.068	0.022
	Share $\leq$ 0	4.970	0.330	0.340	0.000
Fabricated metal products	Elasticity	0.178	0.545	0.312	1.035
	MAD	0.029	0.054	0.046	0.027
	Share $\leq$ 0	0.070	0.000	0.200	0.000
Computer/electronic/ optical products	Elasticity	0.119	0.446	0.481	1.048
	MAD	0.026	0.131	0.079	0.045
	Share $\leq$ 0	2.510	0.880	2.350	0.000
Electrical equipment	Elasticity	0.095	0.389	0.541	1.023
	MAD	0.031	0.089	0.078	0.026
	Share $\leq$ 0	2.480	0.370	1.600	0.000
Machinery and equipment	Elasticity	0.048	0.454	0.554	1.046
	MAD	0.029	0.121	0.065	0.049
	Share $\leq$ 0	17.660	0.400	0.610	0.000
Motor vehicles/ (semi-) trailers	Elasticity	0.101	0.392	0.558	1.045
	MAD	0.046	0.077	0.064	0.020
	Share $\leq$ 0	6.820	0.340	1.420	0.000
Other transport equipment	Elasticity	0.107	0.580	0.429	1.103
	MAD	0.041	0.168	0.126	0.069
	Share $\leq$ 0	5.850	0.950	5.330	0.000
Furniture	Elasticity	0.085	0.339	0.611	1.029
	MAD	0.012	0.067	0.049	0.020
	Share $\leq$ 0	0.240	0.100	0.060	0.000

Source: FICUS/FARE database, own calculations. MAD denotes the Median Average Deviation.

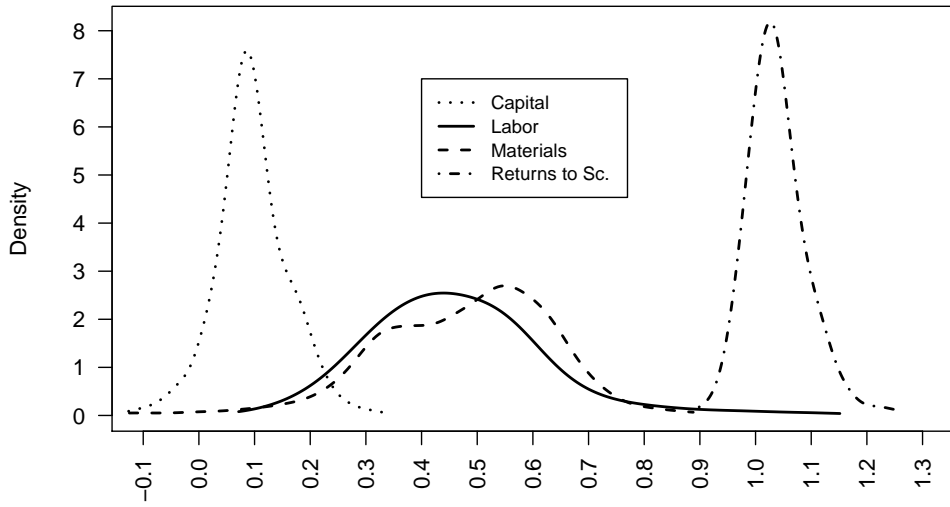


Figure B1: Kernel density estimates of output elasticities and returns to scale. Source: FICUS/FARE database, own calculations.

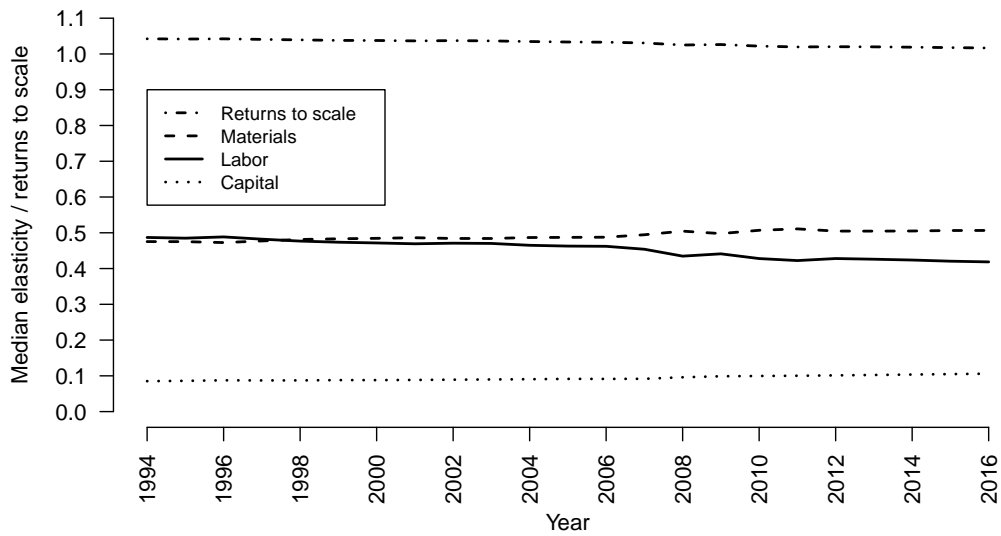


Figure B2: Median output elasticities and returns to scale over time. Source: FICUS/FARE database, own calculations.

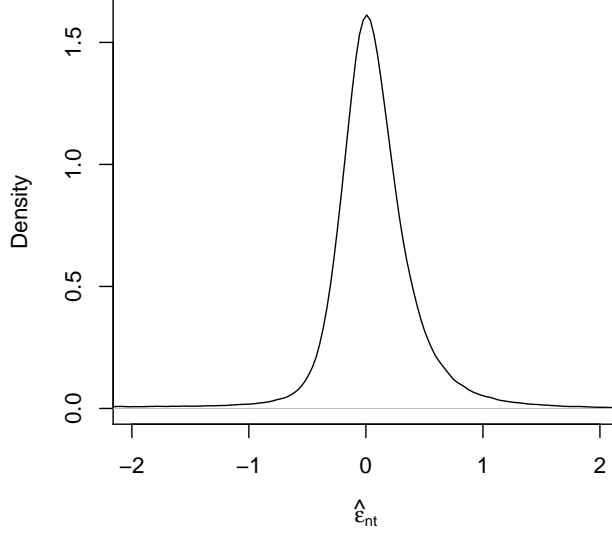


Figure B3: Distribution of residual: production function first stage regression. Source: FICUS/FARE database, own calculations.

## C Decomposition analysis

### C.1 Derivation of the DOPD approach

In the framework of the DOPD approach, aggregate productivity/markup is decomposed in the following way: Let  $S_{Gt} = \sum_{n \in G} s_{nt}$  denote the aggregate sales share of a group  $G$ , where  $G = (E, S, X)$  indexes the group of entrants, survivors, and exitors. A group's aggregate productivity is then defined by  $\Phi_{Gt} = \sum_{n \in G} (s_{nt}/S_{Gt}) \phi_{nt}$ , where  $\phi_{nt}$  denotes the firm-level measure of either TFP or markup. Consider two periods,  $t-k$  and  $t$ , where firms from  $t-k$  to  $t$  either survive or exit the market. That is, the set of active firms at  $t-k$  is composed of those firms that will survive and those that will finally exit the market at some period  $s$  with  $t-k \leq s < t$ . At  $t$  the set of active firms is composed of those firms that have survived from  $t-k$  and new firms that have entered the market at some period  $s$  with  $t-k < s \leq t$ . According to the DOPD approach presented by [Melitz and Polanec \(2015\)](#), the aggregate measure at  $t-k$  and  $t$  is described by

$$\Phi_{t-k} = S_{S,t-k} \Phi_{S,t-k} + S_{X,t-k} \Phi_{X,t-k} = \Phi_{S,t-k} + S_{X,t-k} (\Phi_{X,t-k} - \Phi_{S,t-k}) \quad (2)$$

$$\Phi_t = S_{S,t} \Phi_{S,t} + S_{E,t} \Phi_{E,t} = \Phi_{S,t} + S_{E,t} (\Phi_{E,t} - \Phi_{S,t}). \quad (3)$$

Adding to the first equality of the first and second line  $S_{X,t-k} \Phi_{S,t-k} - S_{X,t-k} \Phi_{S,t-k}$  and  $S_{E,t} \Phi_{S,t} - S_{E,t} \Phi_{S,t}$ , respectively, and recognizing that  $S_{S,t-k} + S_{X,t-k} = 1$  and  $S_{S,t} + S_{E,t} = 1$  yields the second equality.

Hence, the aggregate's growth between  $t - k$  and  $t$  can be expressed by

$$\Phi_t - \Phi_{t-k} = \underbrace{\Phi_{S,t} - \Phi_{S,t-k}}_{\text{Contr. survivors}} + \underbrace{S_{E,t}(\Phi_{E,t} - \Phi_{S,t}) + S_{X,t-k}(\Phi_{S,t-k} - \Phi_{X,t-k})}_{\text{Contr. Net-entry}}. \quad (4)$$

As shown in the main text, the contribution of survivors can be further decomposed into its within and between contribution.

## C.2 Decomposition tables for aggregate productivity

Table C1 shows aggregate measures for the group of survivors, entrants, and exitors, both those of sales shares and productivity. Panel A shows the respective measures at the respective first year ( $t - k$ ), corresponding to equation (2) and Panel B shows the respective measures at the second year ( $t$ ), corresponding to equation (3) (see Online Appendix Section C).

Table C1: Aggregate productivity and sales shares

Panel A: Measures at $t - k$							
$t - k$	$t$	$\Phi_{S,t-k}$	$S_{S,t-k}$	$\Phi_{X,t-k}$	$S_{X,t-k}$	No. Surv.	No. Exitors
1994	1998	0.57	90.76	0.49	9.24	27871	4145
1998	2002	0.67	87.95	0.57	12.05	30842	6575
2002	2006	0.72	79.76	0.73	20.24	30362	6347
2006	2010	0.79	88.42	0.78	11.58	26196	5988
2010	2014	0.89	81.73	0.79	18.27	24276	3860
2012	2016	0.88	93.04	0.90	6.96	23771	2804
Panel B: Measures at $t$							
$t - k$	$t$	$\Phi_{S,t}$	$S_{S,t}$	$\Phi_{E,t}$	$S_{E,t}$	No. Surv.	No. Entrants
1994	1998	0.70	88.54	0.67	11.46	27871	8359
1998	2002	0.72	82.84	0.74	17.16	30842	6212
2002	2006	0.79	76.39	0.79	23.61	30362	4556
2006	2010	0.87	92.30	0.93	7.70	26196	3352
2010	2014	0.92	79.12	0.81	20.88	24276	2905
2012	2016	0.90	84.93	0.90	15.07	23771	1791

Source: FICUS/FARE database, own calculations. The columns  $\Phi_{G,j}$  and  $S_{G,j}$  with  $G = \{S, X, E\}$  and  $j = \{1, 2\}$ , denote the aggregate productivity and the aggregate sales share of the firm groups survivors, exitors, and entrants - measured for the initial year (Year 1) and the last year of the period (Year 2). All sales shares  $S_{G,j}$  are given in %.

Table C2 presents the aggregate measures, graphically shown in the main text. That is, the tables contain of aggregate productivity/markup (and aggregate sales shares) of the group of survivors, entrants, and exitors as well as these groups' contribution to the aggregate. Note that the index  $t$  corresponds to the respective year (column 1), whereas the index  $t - k$  always corresponds to the measure at the initial year 1994. This means

that contributions to the aggregate measure are always cumulatively w.r.t. 1994.

Table C2: DOPD: Aggregate productivity 1994-2016

Year ( $t$ )	$\Phi_t$	$\Phi_{S,t}$	$S_{S,t}$	$\Phi_{S,t-k}$	$S_{S,t-k}$	Contr. Surv.	Contr. Within	Contr. Between	$\Phi_{E,t}$	$S_{E,t}$	Contr. Entry.	$\Phi_{X,t-k}$	$S_{X,t-k}$	Contr. Exit.	Contr. Net-E
1994	0.556	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	0.576	0.578	96.32	0.556	100.00	0.021	-0.000	0.021	0.543	0.04	-0.001	0.000	0.00	0.000	-0.001
1996	0.580	0.578	93.52	0.557	97.48	0.021	-0.004	0.025	0.600	0.06	0.001	0.546	0.03	0.000	0.002
1997	0.655	0.649	90.16	0.562	92.99	0.092	0.032	0.060	0.661	0.10	0.001	0.489	0.07	0.005	0.006
1998	0.696	0.692	88.54	0.564	90.76	0.135	0.053	0.083	0.673	0.11	-0.003	0.492	0.09	0.007	0.004
1999	0.737	0.732	85.05	0.567	87.58	0.174	0.083	0.092	0.711	0.15	-0.005	0.490	0.12	0.010	0.005
2000	0.775	0.783	81.81	0.559	79.55	0.226	0.076	0.150	0.732	0.18	-0.010	0.551	0.20	0.002	-0.008
2001	0.726	0.734	79.50	0.522	75.33	0.203	0.100	0.103	0.733	0.20	0.002	0.560	0.25	-0.009	-0.008
2002	0.717	0.704	73.04	0.537	78.99	0.172	0.106	0.066	0.737	0.27	0.007	0.511	0.21	0.005	0.013
2003	0.740	0.733	70.04	0.534	74.53	0.202	0.117	0.085	0.750	0.30	0.004	0.524	0.25	0.003	0.007
2004	0.749	0.717	68.33	0.554	70.42	0.186	0.133	0.053	0.769	0.32	0.009	0.475	0.30	0.023	0.032
2005	0.758	0.727	54.58	0.539	61.57	0.197	0.130	0.067	0.783	0.45	0.021	0.515	0.38	0.009	0.030
2006	0.785	0.749	53.90	0.548	59.16	0.218	0.155	0.063	0.806	0.46	0.018	0.503	0.41	0.018	0.036
2007	0.802	0.765	53.20	0.547	57.35	0.235	0.174	0.061	0.824	0.47	0.020	0.507	0.43	0.017	0.037
2008	0.891	0.850	56.34	0.550	55.40	0.319	0.264	0.055	0.919	0.44	0.022	0.507	0.45	0.019	0.041
2009	0.856	0.841	55.27	0.540	51.37	0.312	0.232	0.080	0.861	0.45	0.004	0.516	0.49	0.012	0.016
2010	0.872	0.851	53.27	0.533	49.58	0.323	0.249	0.074	0.892	0.47	0.017	0.523	0.50	0.005	0.022
2011	0.882	0.872	51.64	0.533	46.69	0.345	0.270	0.075	0.886	0.48	0.004	0.523	0.53	0.006	0.009
2012	0.887	0.859	53.86	0.535	47.60	0.330	0.259	0.072	0.912	0.46	0.022	0.522	0.52	0.007	0.028
2013	0.898	0.865	47.89	0.538	46.05	0.337	0.276	0.061	0.919	0.52	0.023	0.519	0.54	0.010	0.033
2014	0.898	0.871	47.02	0.540	45.07	0.344	0.274	0.070	0.911	0.53	0.015	0.517	0.55	0.013	0.027
2015	0.900	0.885	45.35	0.537	44.10	0.358	0.294	0.064	0.905	0.55	0.005	0.520	0.56	0.010	0.015
2016	0.900	0.868	45.15	0.538	42.79	0.341	0.283	0.058	0.916	0.55	0.020	0.518	0.57	0.012	0.032

Source: FICUS/FARE database, own calculations.  $t$  refers to the respective year, while  $t - k$  always refers to the initial year 1994. Contributions of survivors and net entry are, hence, always w.r.t. 1994.  $\Phi_G$  and  $S_G$  with  $G = \{S, E, X\}$  denotes aggregate productivity and sales share of the group of survivors, entrants, and exitors.  $S_G$  are given in percent.

### C.2.1 Annual average growth rates of aggregate productivity

Based on Table C2 (i.e. the second column,  $\Phi_t$ ), Figure C1 shows the average annual growth rate (AAGR) of aggregate productivity. Here, the AAGR for each year is calculated by  $AAGR_{t_0,t} = (\Phi_t - \Phi_{t_0}) / (t - t_0)$ , with  $t > 1994$  and  $t_0 = 1994$ . As also described in the paper, the AAGR exhibits a strong increase until 2000, up to about 3.5%, whereupon the AAGR is decreasing over time with some exceptions between 2005 and 2008. Figure C2 confronts the evolution of aggregate productivity (shown on left  $y$ -axis) with the AAGR for different time periods (shown on the right  $y$ -axis). Here, the AAGR for different periods, i.e. from  $t - k$  to  $t$ , is computed by  $AAGR_{t-k,t} = (\Phi_t - \Phi_{t-k}) / (t - k)$ , given by 1.56% (1994-2016), 3.65% (1994-2000), 0.33% (2000-2007),  $-0.09\%$  (2008-2012), and 0.032% (2012-2016). The purpose of the figure is to compare my results with those of Ben Hassine (2019), who likewise estimates aggregate productivity using French firm-level data. The author finds (for the whole French economy) for 2000-2007 (2008-2012) an AAGR of 0.66% (0.32%), which is, hence, somewhat higher compared to my results for the respective periods.



Figure C1: The average annual growth rate (AAGR) of aggregate productivity. Source: FICUS/FARE database, own calculations.

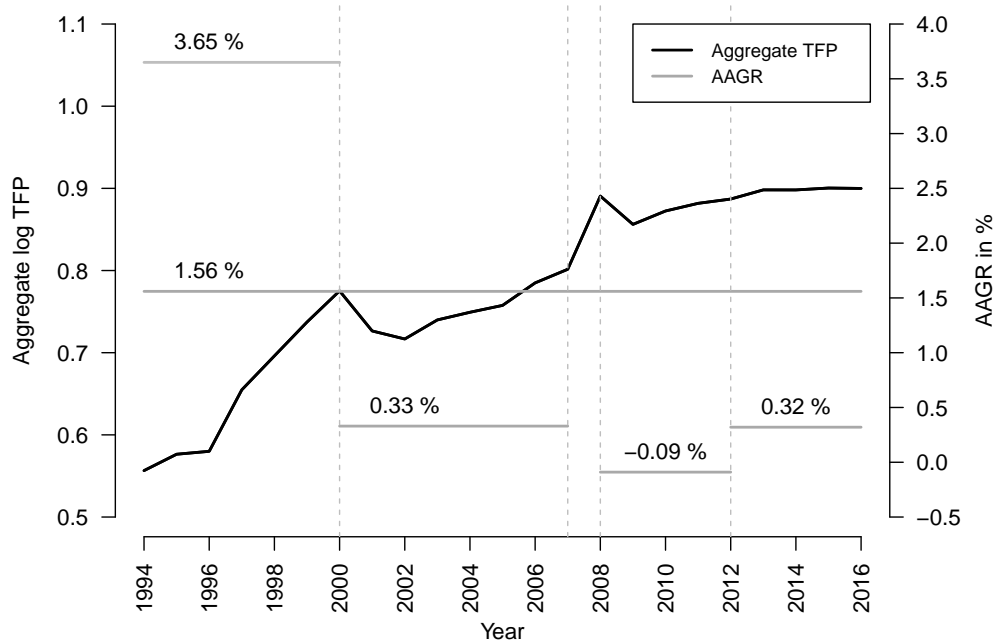


Figure C2: Aggregate productivity and the average annual growth rate (AAGR). Source: FICUS/FARE database, own calculations.

### C.3 Decomposition tables for aggregate markups

Analogously to the case of aggregate productivity, Table C3 shows aggregate measures for the group of survivors, entrants, and exitors, both those of sales shares and markups. Panel A shows the respective measures at the first year ( $t - k$ ), corresponding to equation (2) and Panel B shows the respective measures at the second year ( $t$ ), corresponding to equation (3) (see Appendix C).

Table C3: Aggregate markups and sales shares

Panel A: Measures at $t - k$							
$t - k$	$t$	$\Phi_{S,t-k}$	$S_{S,t-k}$	$\Phi_{X,t-k}$	$S_{X,t-k}$	No. Surv.	No. Exitors
1994	1998	0.14	90.76	0.17	9.24	27871	4145
1998	2002	0.25	87.95	0.19	12.05	30842	6575
2002	2006	0.30	79.76	0.02	20.24	30362	6347
2006	2010	0.16	88.42	0.22	11.58	26196	5988
2010	2014	0.29	81.73	0.02	18.27	24276	3860
2012	2016	0.23	93.04	0.20	6.96	23771	2804
Panel B: Measures at $t$							
$t - k$	$t$	$\Phi_{S,t}$	$S_{S,t}$	$\Phi_{E,t}$	$S_{E,t}$	No. Surv.	No. Entrants
1994	1998	0.23	88.54	0.18	11.46	27871	8359
1998	2002	0.26	82.84	0.14	17.16	30842	6212
2002	2006	0.28	76.39	-0.13	23.61	30362	4556
2006	2010	0.23	92.30	0.14	7.70	26196	3352
2010	2014	0.32	79.12	0.04	20.88	24276	2905
2012	2016	0.30	84.93	0.07	15.07	23771	1791

Source: FICUS/FARE database, own calculations. The columns  $\Phi_{G,j}$  and  $S_{G,j}$  with  $G = \{S, X, E\}$  and  $j = \{1, 2\}$ , denote the aggregate productivity and the aggregate sales share of the firm groups survivors, exitors, and entrants - measured for the initial year (Year 1) and the last year of the period (Year 2). All sales shares  $S_{G,j}$  are given in %.

Table C4 presents the aggregate measures, graphically shown in the main text. That is, the tables contain of aggregate productivity/markup (and aggregate sales shares) of the group of survivors, entrants, and exitors as well as these groups' contribution to the aggregate. Note that the index  $t$  corresponds to the respective year (column 1), whereas the index  $t - k$  always corresponds to the measure at the initial year 1994. This means that contributions to the aggregate measure are always cumulatively w.r.t. 1994.

Table C4: DOPD: Aggregate markup 1994-2016

Year (t)	$\Phi_t$	$\Phi_{S,t}$	$S_{S,t}$	$\Phi_{S,t-k}$	$S_{S,t-k}$	Contr. Surv.	Contr. Within	Contr. Between	$\Phi_{E,t}$	$S_{E,t}$	Contr. Entry.	$\Phi_{X,t-k}$	$S_{X,t-k}$	Contr. Exit.	Contr. Net-E
1994	1.155	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1995	1.162	1.161	96.32	1.155	100.00	0.006	-0.039	0.044	1.195	3.68	0.001	0.000	0.00	0.000	0.001
1996	1.143	1.138	93.52	1.154	97.48	-0.018	-0.027	0.008	1.242	6.48	0.007	1.232	2.52	-0.002	0.005
1997	1.192	1.180	90.16	1.152	92.99	0.027	0.017	0.009	1.310	9.84	0.013	1.159	7.01	-0.001	0.012
1998	1.301	1.308	88.54	1.147	90.76	0.155	0.016	0.137	1.294	11.46	-0.001	1.210	9.24	-0.006	-0.007
1999	1.235	1.233	85.05	1.180	87.58	0.050	0.057	-0.008	1.268	14.95	0.006	1.205	12.42	-0.003	0.003
2000	1.235	1.230	81.81	1.182	79.55	0.064	0.013	0.051	1.186	18.19	-0.011	1.103	20.45	0.016	0.005
2001	1.301	1.296	79.50	1.210	75.33	0.113	0.036	0.080	1.214	20.50	-0.023	1.098	24.67	0.028	0.005
2002	1.220	1.226	73.04	1.200	78.99	0.026	0.092	-0.067	1.204	26.96	-0.006	1.202	21.01	-0.001	-0.006
2003	1.225	1.239	70.04	1.196	74.53	0.038	0.098	-0.062	1.203	29.96	-0.009	1.214	25.47	-0.005	-0.014
2004	1.207	1.211	68.33	1.206	70.42	0.013	0.084	-0.066	1.183	31.67	-0.011	1.178	29.58	0.008	-0.003
2005	1.154	1.219	54.58	1.246	61.57	0.020	0.050	-0.025	1.019	45.42	-0.112	1.123	38.43	0.047	-0.065
2006	1.145	1.211	53.90	1.248	59.16	0.012	0.046	-0.035	1.012	46.10	-0.114	1.128	40.84	0.049	-0.066
2007	1.142	1.214	53.20	1.247	57.35	0.015	0.026	-0.012	1.006	46.80	-0.120	1.135	42.65	0.048	-0.072
2008	1.233	1.260	56.34	1.247	55.40	0.062	0.099	-0.035	1.135	43.66	-0.076	1.138	44.60	0.049	-0.027
2009	1.298	1.346	55.27	1.245	51.37	0.151	0.184	-0.038	1.176	44.73	-0.098	1.143	48.63	0.049	-0.049
2010	1.228	1.282	53.27	1.239	49.58	0.088	0.104	-0.020	1.115	46.73	-0.099	1.151	50.42	0.045	-0.055
2011	1.194	1.260	51.64	1.226	46.69	0.067	0.055	0.010	1.088	48.36	-0.099	1.166	53.31	0.032	-0.067
2012	1.210	1.277	53.86	1.214	47.60	0.086	0.075	0.009	1.106	46.14	-0.090	1.171	52.40	0.023	-0.067
2013	1.218	1.311	47.89	1.221	46.05	0.119	0.126	-0.011	1.106	52.11	-0.122	1.167	53.95	0.029	-0.093
2014	1.217	1.314	47.02	1.216	45.07	0.124	0.119	0.000	1.108	52.98	-0.122	1.171	54.93	0.025	-0.098
2015	1.217	1.335	45.35	1.218	44.10	0.145	0.163	0.006	1.095	54.65	-0.147	1.169	55.90	0.028	-0.119
2016	1.189	1.313	45.15	1.222	42.79	0.121	0.133	0.011	1.062	54.85	-0.154	1.169	57.21	0.030	-0.124

Source: FICUS/FARE database, own calculations.  $t$  refers to the respective year, while  $t - k$  always refers to the initial year 1994. Contributions of survivors and net entry are, hence, always w.r.t. 1994.  $\Phi_G$  and  $S_G$  with  $G = \{S, E, X\}$  denotes aggregate markup and sales share of the group of survivors, entrants, and exitors.  $S_G$  are given in percent.

## D Cobb-Douglas production function specification

Table [D1](#) presents the estimated coefficients of a Cobb-Douglas (CD) production function along with the resulting returns to scale. Analogously to the employed TL production function presented in the paper, the CD production function is estimated for each 2-digit industry separately. As discussed in the paper, the CD specification is estimated for sake of comparison of aggregate productivity and markups w.r.t. results derived from a TL specification.

Table D1: Coefficient estimates of the Cobb-Douglas production function

Sector	$\hat{\alpha}_K$	$\hat{\alpha}_L$	$\hat{\alpha}_M$	Returns to scale
Beverages	0.188 (0.006)	0.408 (0.006)	0.533 (0.006)	1.129
Textiles	0.102 (0.003)	0.474 (0.004)	0.418 (0.002)	0.994
Wearing apparel	0.097 (0.004)	0.550 (0.004)	0.378 (0.002)	1.025
Leather/related products	0.139 (0.005)	0.578 (0.007)	0.337 (0.005)	1.054
Wood/products of wood and cork	0.078 (0.003)	0.464 (0.004)	0.499 (0.004)	1.041
Paper/paper products	0.126 (0.004)	0.452 (0.006)	0.479 (0.006)	1.057
Printing/reprod. of recorded media	0.064 (0.003)	0.581 (0.004)	0.368 (0.003)	1.013
Chemicals/ chemical products	0.203 (0.004)	0.396 (0.005)	0.488 (0.004)	1.087
Pharma. products/ preparations	0.138 (0.009)	0.374 (0.016)	0.545 (0.011)	1.057
Rubber/plastic products	0.139 (0.005)	0.431 (0.005)	0.491 (0.006)	1.061
Other non-metallic mineral products	0.139 (0.004)	0.492 (0.004)	0.474 (0.005)	1.105
Basic metals	0.126 (0.005)	0.392 (0.006)	0.492 (0.005)	1.010
Fabricated metal products	0.124 (0.000)	0.553 (0.002)	0.319 (0.001)	0.996
Computer/electronic/optical products	0.135 (0.009)	0.581 (0.010)	0.408 (0.009)	1.124
Electrical equipment	0.108 (0.003)	0.497 (0.005)	0.414 (0.004)	1.019
Machinery and equipment	0.074 (0.003)	0.623 (0.004)	0.364 (0.003)	1.061
Motor vehicles/(semi-) trailers	0.140 (0.005)	0.516 (0.006)	0.408 (0.005)	1.064
Other transport equipment	0.125 (0.016)	0.684 (0.011)	0.313 (0.008)	1.122
Furniture	0.070 (0.003)	0.421 (0.005)	0.524 (0.005)	1.015

Source: FICUS/FARE database, own calculations. Standard errors are bootstrapped using 400 replications and reported in parenthesis.

## E Distribution of firm-level productivity and markups

## F Heterogeneity in aggregate productivity and markup across sectors

To provide some insight into heterogeneity in the aggregate measures among sectors, I compute both aggregate productivity and markups across years, for each of the 2-digit sector separately. Figure E1 illustrates heterogeneity w.r.t. aggregate productivity and shows that there is substantial variation. Some sectors, such as the manufacturing for wearing apparel, reveal an aggregate log productivity of only 0.28, whereas others, such as the manufacturing of other transport equipment, reveals a high productivity, given by 1.20, which is a dramatic difference. Similarly, Figure E2 shows the aggregate markup across sectors. Most sectors are above an aggregate productivity of one, i.e., on average prices are higher compared to marginal costs. Sector 24 (basic metals) and 29 (motor vehicles etc.) show an aggregate markup of somewhat below one. More drastically, sector 30 (other transport equipment) shows an aggregate markup far below one. This is induced by a relatively low (high) estimated output elasticity (output share) w.r.t. materials and a higher share of measured markdowns (share of firms reporting a markup  $< 1$ ), probably weighted by larger sales shares. Caselli et al. (2018) measure for the French manufacturing that about 14% of firms reveal markdowns. I find somewhat smaller share of about 10%.<sup>1</sup>

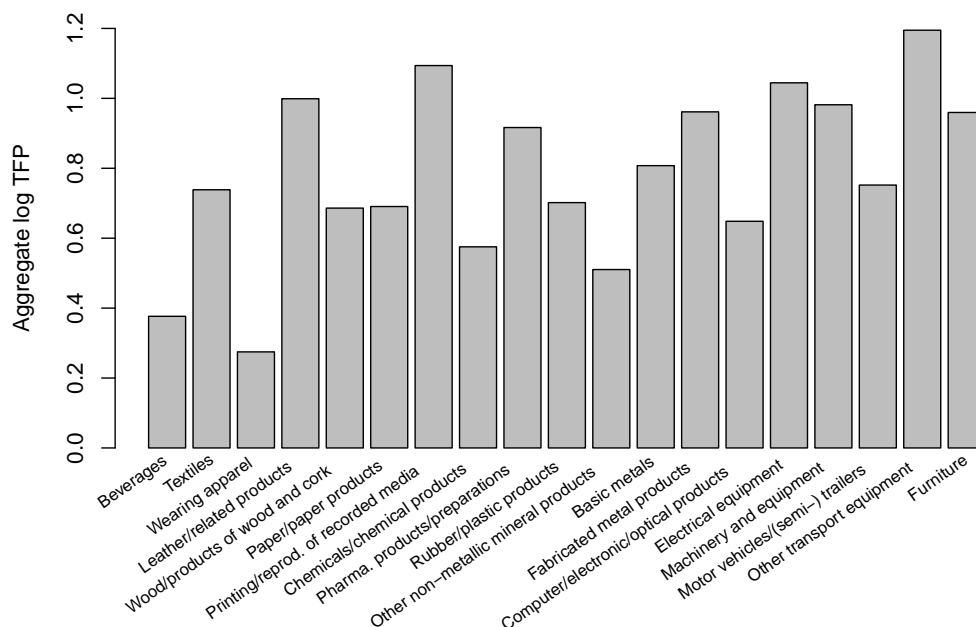


Figure E1: Heterogeneity in aggregate productivity among sectors. Source: FICUS/FARE database, own calculations.

<sup>1</sup>See Appendix B, Table B2, for estimated median elasticities for each sector as well as Appendix G Figure F1, illustrating markdowns per sector.

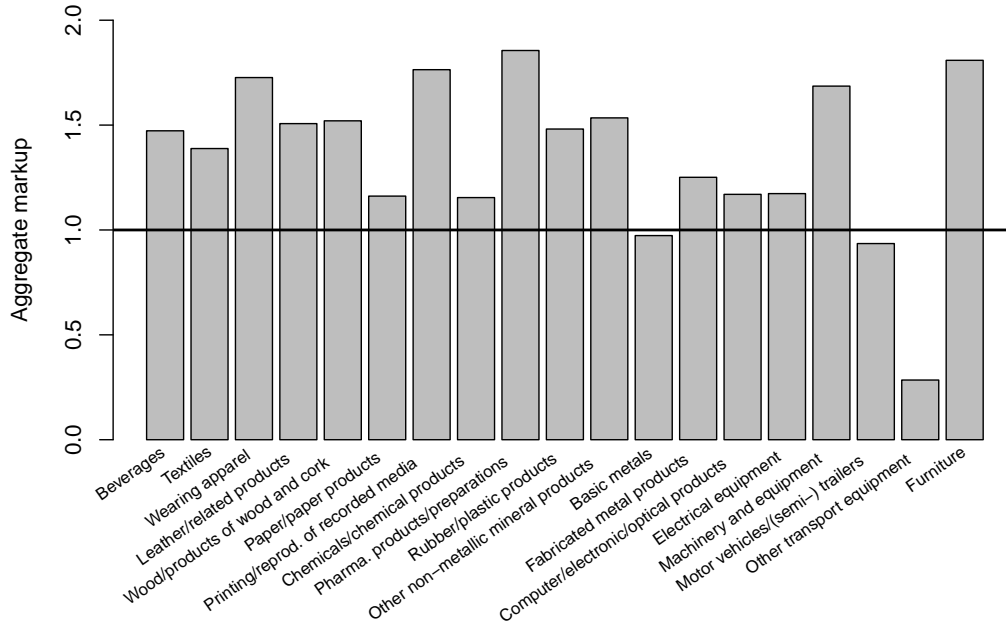


Figure E2: Heterogeneity in aggregate markup among sectors. Source: FICUS/FARE database, own calculations.

## G Further material

Figure F1 illustrates the share of markdowns for each sector. That is, each bar corresponds to the share of firms that reveal prices below the marginal costs, i.e.  $\hat{\mu}_{nt} < 1$ . The sector for beverages exhibits the highest share of markdowns, given by more than 30 %. Other sectors, such as the sector for pharmaceutical products and the manufacture of furniture, only show a share of markdowns slightly larger than zero. These industries also shows the highest aggregate markups (see Figure E2).

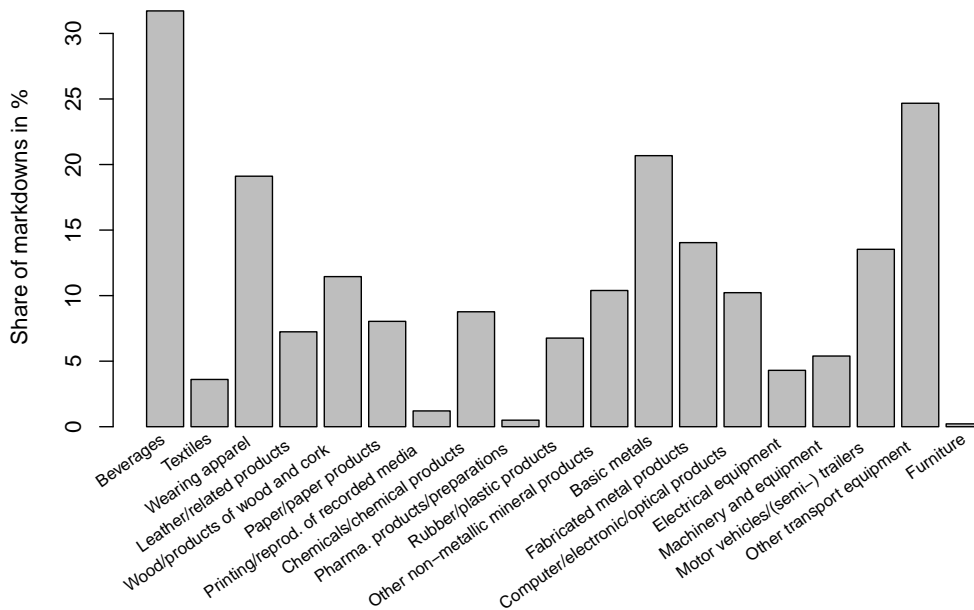


Figure F1: Share of markdowns (share of firms with markup < 1) by sector. Source: FICUS/FARE database, own calculations.

Table F1 provides some descriptive statistics for the estimated output shares w.r.t. capital, labor, and materials, given in the first column by  $\hat{a}_{nt}^K$ ,  $\hat{a}_{nt}^L$ , and  $\hat{a}_{nt}^M$ . All shares are estimated analogously to the output share w.r.t. materials, presented in the main text in equation (17). The table shows that among all inputs, the output share w.r.t. capital is the smallest, given with a mean of 7.71%. Here, firms at the 10th (90th) percentile exhibit an output share w.r.t. capital of 1.42% (15.47%). The highest output share is given for labor, with a mean of 45.35%, which is somewhat higher compared to the mean output share w.r.t. materials, given by 31.55%.

Output share	Mean	Std Dev	Percentiles		
			P10	P50	P90
$\hat{a}_{nt}^K$	7.71	11.22	1.42	5.26	15.47
$\hat{a}_{nt}^L$	45.35	45.02	17.97	36.55	76.70
$\hat{a}_{nt}^M$	31.55	18.46	8.66	29.95	55.56

Source: FICUS/FARE database, own calculations.

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