ONLINE APPENDIX

Resource Misallocation in European Firms: The Role of Constraints, Firm Characteristics and Managerial Decisions

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Appendix A: Additional Tables and Figures

Table A.1. Descriptive statistics, by year

Group of variables	Variable	2015 Mean	2015 St. dev.	2016 Mean	2016 St. dev.	2017 Mean	2017 St. dev.
Outcome variables	log(sales)	16.56	2.32	16.53	2.39	16.65	2.38
	log(fixed assets)	15.29	2.75	15.27	2.79	15.37	2.71
	log(employment)	4.81	1.98	4.80	2.02	4.90	2.02
	log(MRPK)	-0.47	1.48	-0.41	1.43	-0.40	1.39
	log(MRPL)	10.21	1.22	10.20	1.17	10.25	1.17
	log(MRPL) - log(MRPK)	10.68	1.69	10.61	1.66	10.65	1.54
Demographics	Firm age						
	less than 5 years	0.03	0.18	0.04	0.20	0.03	0.17
	5-9 years	0.08	0.28	0.08	0.27	0.07	0.25
	10-19 years	0.20	0.40	0.21	0.41	0.20	0.40
	20+ years	0.68	0.47	0.67	0.47	0.71	0.46
	Subsidiary	0.33	0.47	0.34	0.47	0.35	0.48
	Exporter	0.51	0.50	0.52	0.50	0.51	0.50
Quality of capital and other inputs	Share of state-of-the art machinery and equipment	0.42	0.32	0.41	0.32	0.40	0.32
	Share of high energy efficiency commercial building stock	0.37	0.34	0.35	0.34	0.35	0.34
Capacity utilization	above maximum capacity	0.05	0.22	0.05	0.23	0.08	0.26
	at maximum capacity	0.44	0.50	0.46	0.50	0.42	0.49
	somewhat below full capacity	0.40	0.49	0.38	0.49	0.42	0.49
	substantially below full capacity	0.09	0.28	0.09	0.28	0.07	0.26
Obstacles to investment	Demand for products or services						
	Major	0.26	0.44	0.23	0.42	0.23	0.42
	Minor	0.24	0.43	0.27	0.44	0.26	0.44
	Availability of staff with the right skills						
	Major	0.38	0.49	0.43	0.49	0.46	0.50
	Minor	0.30	0.46	0.31	0.46	0.31	0.46
	Energy costs						
	Major	0.22	0.41	0.23	0.42	0.25	0.43
	Minor	0.32	0.47	0.35	0.48	0.35	0.48
	Access to digital infrastructure						
	Major	0.10	0.30	0.11	0.32	0.14	0.35
	Minor	0.26	0.44	0.31	0.46	0.29	0.46
	Labor market regulations						
	Major	0.28	0.45	0.31	0.46	0.30	0.46
	Minor	0.29	0.46	0.33	0.47	0.36	0.48
	Business regulations and taxation						
	Major	0.32	0.47	0.32	0.47	0.31	0.46
	Minor	0.28	0.45	0.33	0.47	0.37	0.48
	Availability of adequate transport infrastructure						

	Major	0.16	0.36	0.16	0.37	0.18	0.38
	Minor	0.24	0.43	0.28	0.45	0.31	0.46
	Availability of finance						
	Major	0.24	0.43	0.19	0.40	0.19	0.39
	Minor	0.22	0.41	0.26	0.44	0.26	0.44
	Uncertainty about future						
	Major	0.41	0.49	0.38	0.48	0.36	0.48
	Minor	0.32	0.47	0.36	0.48	0.37	0.48
Adjustment	Investment, log(1 + investment)	12.41	3.99	12.29	4.04	12.62	3.84
	Percent change in employment in the last three years	0.12	0.47	0.14	0.44	0.14	0.40
	Investment over the last three years						
	too much	0.04	0.19	0.03	0.18	0.04	0.19
	about the right amount	0.78	0.41	0.79	0.40	0.78	0.41
	too little	0.16	0.37	0.16	0.37	0.17	0.38
	company did not exist three years ago	0.00	0.03	0.00	0.04	0.00	0.02
	Investment priority in the next three years						
	replacing capacity	0.41	0.49	0.32	0.47	0.33	0.47
	capacity expansion for existing products or services	0.25	0.43	0.28	0.45	0.31	0.46
	developing new products, processes or services	0.24	0.43	0.28	0.45	0.26	0.44
	no investment planned	0.09	0.28	0.11	0.31	0.09	0.28
Source of funds	internal funds or retained earnings	0.66	0.37	0.66	0.37	0.67	0.37
	external finance	0.31	0.35	0.31	0.36	0.30	0.35
	intra-group funding	0.02	0.13	0.01	0.10	0.02	0.12
	Finance constrained	0.07	0.25	0.07	0.26	0.06	0.23
Sample size		8,926	8,926	9,447	9,447	9,443	9,443

Note: All statistics are computed using sampling weights.

Table A.2. Correlation matrix: variable index

Index	Group of variables	Variable	
1	**Outcome variables**	log(sales)	
2		log(fixed assets)	
3		log(employment)	
4		log(MRPK)	
5		log(MRPL)	
6		log(MRPL) - log(MRPK)	
7	**Demographics**	Firm age	less than 5 years
8			5-9 years
9			10-19 years
10			20+ years
11		Subsidiary	
12		Exporter	
13	**Quality of capital and other inputs**	Share of state-of-the art machinery and equipment	
14		Share of high energy efficiency commercial building stock	
15	**Capacity utilization**	above maximum capacity	
16		at maximum capacity	
17		somewhat below full capacity	
18		substantially below full capacity	
19	**Obstacles to investment**	Demand for products or services	Major
20			Minor
21		Availability of staff with the right skills	Major
22			Minor
23		Energy costs	Major
24			Minor
25		Access to digital infrastructure	Major
26			Minor
27		Labor market regulations	Major
28			Minor
29		Business regulations and taxation	Major
30			Minor
31		Availability of adequate transport infrastructure	Major
32			Minor
33		Availability of finance	Major
34			Minor
35		Uncertainty about future	Major
36			Minor
37		Investment, log(1 + investment)	
38		Percent change in employment in the last three years	
39	**Adjustment**	Investment over the last three years	too much
40			about the right amount
41			too little
42			company did not exist three years ago
43		Investment priority in the next three years	replacing capacity
44			capacity expansion for existing products or services
45			developing new products, processes or services
46			no investment planned
47			internal funds or retained earnings
48	**Source of funds**	external finance	
49		intra-group funding	
50		Finance constrained	

Table A.3. Correlation matrix: coefficients

Index	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1																							
2	0.86	1																						
3	0.86	0.80	1																					
4	-0.02	-0.51	-0.13	1																				
5	0.48	0.29	0.02	0.24	1																			
6	0.37	0.66	0.13	-0.71	0.52	1																		
7	-0.12	-0.13	-0.11	0.04	-0.05	-0.08	1																	
8	-0.16	-0.17	-0.14	0.08	-0.07	-0.12	-0.05	1																
9	-0.14	-0.13	-0.13	0.04	-0.07	-0.09	-0.10	-0.14	1															
10	0.26	0.27	0.24	-0.10	0.13	0.18	-0.28	-0.42	-0.75	1														
11	0.36	0.26	0.30	0.07	0.21	0.08	-0.01	-0.03	-0.02	0.04	1													
12	0.28	0.24	0.24	-0.05	0.11	0.13	-0.04	-0.06	-0.07	0.11	0.15	1												
13	0.06	0.08	-0.01	-0.07	0.14	0.16	0.01	0.01	0.00	-0.01	-0.02	0.09	1											
14	0.07	0.11	0.04	-0.10	0.07	0.14	-0.03	-0.02	0.02	0.01	-0.03	0.05	0.41	1										
15	-0.01	-0.04	-0.03	0.06	0.03	-0.03	0.03	0.01	0.01	-0.03	0.01	0.01	0.05	0.02	1									
16	0.02	-0.01	0.00	0.08	0.05	-0.03	-0.02	0.02	0.03	-0.03	-0.01	-0.07	0.06	0.07	-0.23	1								
17	0.01	0.04	0.03	-0.06	-0.03	0.03	0.01	-0.02	-0.04	0.04	0.01	0.06	-0.06	-0.06	-0.21	-0.72	1							
18	-0.10	-0.04	-0.09	-0.09	-0.07	0.02	0.01	0.01	-0.01	0.00	-0.03	0.00	-0.04	-0.04	-0.08	-0.26	-0.24	1						
19	0.01	0.03	0.01	-0.05	-0.03	0.02	-0.02	-0.03	-0.01	0.03	-0.03	0.03	-0.01	0.02	-0.04	-0.06	0.02	0.11	1					
20	-0.01	-0.02	-0.01	0.02	-0.03	-0.04	-0.01	0.00	0.00	0.01	0.02	0.02	-0.05	-0.03	-0.01	-0.04	0.06	0.00	-0.33	1				
21	-0.12	-0.12	-0.09	0.03	-0.10	-0.10	0.01	0.02	0.01	-0.03	-0.07	0.00	0.03	0.02	0.07	0.01	-0.04	0.00	0.17	0.03	1			
22	0.12	0.12	0.11	-0.03	0.04	0.06	-0.03	-0.03	0.01	0.02	0.04	0.06	-0.08	-0.06	-0.05	-0.02	0.05	-0.01	-0.05	0.09	-0.57	1		
23	-0.06	0.01	-0.03	-0.11	-0.08	0.04	0.00	-0.02	-0.01	0.02	-0.10	-0.04	0.02	0.02	-0.01	-0.07	0.07	0.03	0.15	0.02	0.17	-0.05	1	
24	0.01	0.01	0.03	0.00	-0.03	-0.02	-0.01	-0.02	0.01	0.01	-0.01	0.04	-0.04	-0.01	0.00	-0.01	0.02	0.00	0.06	0.12	0.07	0.11	-0.40	1
25	-0.01	0.00	-0.03	-0.02	0.04	0.05	0.00	-0.01	-0.01	0.01	-0.04	-0.02	0.06	0.04	0.00	-0.01	0.02	0.00	0.18	-0.04	0.17	-0.06	0.21	0.00
26	0.01	0.03	0.02	-0.02	-0.01	0.01	-0.02	-0.03	-0.01	0.04	-0.04	0.01	-0.05	-0.01	0.01	0.00	0.00	0.00	0.09	0.17	0.09	0.10	0.07	0.27
27	-0.11	-0.09	-0.09	-0.01	-0.09	-0.05	-0.01	0.00	0.01	0.00	-0.10	-0.05	0.01	0.00	0.02	-0.07	0.04	0.04	0.15	0.04	0.23	-0.08	0.26	0.01
28	0.06	0.05	0.06	-0.01	0.02	0.02	-0.01	-0.02	0.01	0.00	0.02	0.06	-0.04	-0.03	0.01	0.00	0.02	-0.02	0.01	0.11	0.01	0.14	-0.04	0.19
29	-0.10	-0.05	-0.09	-0.06	-0.05	0.01	-0.01	0.00	0.01	-0.01	-0.11	-0.06	0.04	0.05	0.01	-0.04	0.03	0.03	0.16	0.01	0.15	-0.06	0.26	-0.01
30	0.05	0.04	0.06	0.02	0.00	-0.01	-0.01	-0.01	-0.01	0.02	0.01	0.03	-0.07	-0.04	-0.01	0.00	0.02	-0.01	0.01	0.11	0.03	0.09	-0.06	0.22
31	0.01	0.05	0.02	-0.06	-0.03	0.03	-0.02	-0.02	-0.01	0.03	-0.05	-0.02	0.02	0.04	0.01	-0.01	0.00	0.02	0.18	-0.01	0.15	-0.07	0.22	-0.02
32	0.02	0.03	0.03	-0.01	-0.02	-0.01	0.00	-0.01	0.00	0.00	-0.01	0.03	-0.06	-0.04	0.00	-0.03	0.03	0.00	0.09	0.16	0.07	0.09	0.07	0.21
33	-0.14	-0.09	-0.12	-0.06	-0.10	-0.02	0.03	0.03	0.01	-0.04	-0.11	-0.06	-0.03	0.00	0.00	-0.06	0.01	0.12	0.27	-0.03	0.10	-0.06	0.20	-0.02
34	-0.04	-0.03	-0.02	0.00	-0.06	-0.04	0.00	0.01	0.02	-0.02	-0.02	0.00	-0.05	-0.03	-0.02	-0.01	0.03	-0.02	0.06	0.21	0.06	0.06	0.03	0.16
35	-0.09	-0.05	-0.08	-0.04	-0.08	-0.02	-0.01	-0.01	0.00	0.01	-0.12	-0.04	-0.02	0.00	-0.04	-0.08	0.04	0.12	0.31	-0.01	0.13	-0.05	0.26	0.00
36	0.10	0.08	0.09	0.01	0.04	0.02	-0.02	-0.02	0.00	0.02	0.07	0.05	-0.07	-0.04	0.00	0.01	0.02	-0.06	-0.12	0.18	-0.05	0.12	-0.11	0.14
37	0.67	0.67	0.65	-0.21	0.21	0.33	-0.07	-0.10	-0.11	0.18	0.26	0.23	0.09	0.07	0.01	0.00	0.03	-0.09	0.00	0.00	-0.05	0.10	-0.02	0.02
38	-0.02	-0.04	-0.01	0.05	-0.04	-0.07	0.11	0.08	0.03	-0.12	-0.03	0.01	0.07	0.03	0.09	0.06	-0.06	-0.08	-0.05	0.02	0.07	-0.02	0.00	0.01
39	-0.04	-0.01	-0.02	-0.05	-0.03	0.02	0.01	0.02	-0.01	0.00	-0.01	0.00	0.02	0.02	0.00	-0.03	0.01	0.06	0.04	0.00	0.02	-0.02	0.01	-0.01
40	0.09	0.07	0.05	0.00	0.09	0.06	-0.01	-0.01	0.02	-0.01	-0.01	0.00	0.13	0.10	0.01	0.10	-0.05	-0.12	-0.07	0.00	-0.04	0.01	-0.03	0.02
41	-0.06	-0.06	-0.03	0.01	-0.08	-0.06	0.00	0.00	-0.02	0.01	0.01	0.01	-0.14	-0.11	-0.01	-0.09	0.05	0.09	0.06	0.01	0.04	0.01	0.03	-0.01
42	-0.04	-0.03	-0.03	-0.01	-0.01	0.00	0.13	0.00	-0.01	-0.04	0.02	-0.01	0.02	-0.02	0.01	-0.01	-0.01	0.03	-0.01	0.01	0.00	0.01	0.01	0.00
43	-0.01	0.00	0.01	-0.02	-0.04	-0.01	0.01	-0.03	0.00	0.00	0.02	-0.09	-0.04	-0.03	-0.02	0.01	0.01	-0.02	-0.03	0.00	-0.02	-0.01	0.03	0.01
44	0.05	0.06	0.05	-0.03	0.02	0.04	0.02	0.02	0.02	-0.03	-0.02	0.03	0.04	0.03	0.02	0.03	-0.03	-0.04	0.00	-0.01	0.03	0.00	-0.03	0.01
45	0.10	0.08	0.07	0.00	0.06	0.04	-0.02	-0.01	-0.04	0.05	0.07	0.15	0.02	0.01	0.00	-0.06	0.05	0.03	0.03	0.04	0.01	0.04	0.00	-0.01
46	-0.21	-0.21	-0.21	0.07	-0.06	-0.10	0.00	0.04	0.03	-0.05	-0.10	-0.13	-0.03	-0.01	-0.01	0.01	-0.03	0.04	0.01	-0.02	-0.01	-0.05	0.00	-0.01
47	-0.08	-0.12	-0.06	0.11	-0.04	-0.13	0.01	0.01	0.02	-0.03	-0.06	-0.03	-0.03	0.00	-0.02	0.03	-0.03	0.01	-0.02	-0.02	-0.03	0.02	-0.08	0.00
48	0.03	0.08	0.02	-0.12	0.01	0.11	-0.02	-0.01	-0.03	0.04	-0.05	0.01	0.03	0.00	0.02	-0.03	0.04	-0.02	0.02	0.02	0.04	-0.03	0.09	0.00
49	0.10	0.09	0.08	-0.01	0.05	0.05	0.01	0.01	0.03	-0.03	0.22	0.03	0.02	0.02	-0.01	0.01	-0.01	0.02	0.01	0.02	-0.01	0.01	-0.02	0.01
50	-0.08	-0.04	-0.05	-0.04	-0.08	-0.02	0.03	0.02	0.01	-0.04	-0.10	-0.02	-0.03	-0.01	0.00	-0.04	0.02	0.05	0.01	0.00	0.01	0.01	0.03	-0.01

Index	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
25	1																								
26	-0.23	1																							
27	0.22	0.13	1																						
28	-0.03	0.16	-0.45	1																					
29	0.19	0.07	0.41	-0.09	1																				
30	-0.02	0.19	-0.10	0.30	-0.48	1																			
31	0.24	0.05	0.23	-0.04	0.23	-0.02	1																		
32	0.04	0.27	0.09	0.18	0.08	0.19	-0.28	1																	
33	0.19	0.05	0.19	-0.04	0.21	-0.04	0.19	0.02	1																
34	0.01	0.24	0.08	0.11	0.04	0.16	0.02	0.27	-0.29	1															
35	0.16	0.10	0.27	-0.05	0.29	-0.05	0.19	0.08	0.28	0.07	1														
36	-0.07	0.09	-0.10	0.16	-0.12	0.17	-0.08	0.09	-0.12	0.10	-0.58	1													
37	0.02	0.01	-0.07	0.05	-0.07	0.06	0.01	0.04	-0.13	0.00	-0.11	0.09	1												
38	0.03	0.00	0.02	0.00	0.02	-0.01	0.02	0.04	-0.03	0.03	-0.06	0.02	0.05	1											
39	0.02	0.00	0.01	0.00	0.03	-0.01	0.00	0.02	0.06	0.00	0.04	-0.01	0.02	0.01	1										
40	-0.01	-0.03	-0.03	-0.01	-0.02	-0.01	-0.01	0.00	-0.16	-0.01	-0.09	0.04	0.11	0.06	-0.37	1									
41	0.00	0.03	0.03	0.01	0.01	0.02	0.02	0.00	0.14	0.02	0.08	-0.03	-0.09	-0.06	-0.09	-0.85	1								
42	0.00	-0.01	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.03	-0.01	-0.01	0.00	-0.02	-0.01	-0.01	-0.06	-0.01	1							
43	-0.02	-0.02	0.02	-0.05	0.00	-0.02	0.00	-0.03	-0.01	0.01	-0.01	0.00	0.01	-0.04	-0.02	-0.03	0.05	-0.01	1						
44	0.00	0.02	-0.03	0.04	-0.02	0.05	0.02	0.02	-0.01	0.01	-0.03	0.02	0.08	0.07	-0.02	0.04	-0.04	0.01	-0.46	1					
45	0.02	0.02	0.00	0.04	0.01	0.00	-0.01	0.02	0.01	0.00	0.01	0.02	0.10	0.00	0.03	-0.02	0.02	-0.01	-0.44	-0.37	1				
46	0.01	-0.01	0.02	-0.03	0.03	-0.04	-0.01	-0.01	0.03	-0.02	0.06	-0.06	-0.29	-0.03	0.02	0.01	-0.04	0.01	-0.24	-0.20	-0.19	1			
47	-0.07	-0.02	-0.09	0.01	-0.06	-0.02	-0.07	-0.02	-0.11	-0.04	-0.06	0.01	-0.18	-0.03	-0.04	0.00	0.01	-0.01	-0.03	0.01	-0.01	0.03	1		
48	0.07	0.02	0.09	-0.01	0.06	0.02	0.07	0.02	0.11	0.05	0.07	-0.02	0.15	0.03	0.04	0.00	0.00	-0.01	0.04	0.00	-0.01	-0.02	-0.94	1	
49	-0.01	0.01	0.01	-0.01	0.01	0.00	0.00	0.02	0.02	-0.01	0.00	-0.01	0.08	0.01	0.01	0.01	-0.02	0.06	-0.01	0.01	0.03	-0.04	-0.24	-0.08	1
50	-0.01	0.01	0.03	-0.01	0.05	-0.02	0.01	-0.02	0.19	-0.03	0.06	-0.01	-0.04	0.00	0.03	-0.10	0.08	0.05	-0.01	0.00	0.02	0.00	0.12	-0.13	0.03

Note: The table reports the correlation coefficients for the variables listed in Table A.2. All statistics are computed using sampling weights.

Table A.4. Predictors of the dispersion of the marginal revenue products of capital and labor

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.009	0.041**
	(0.039)	(0.019)
10-19 years	-0.218***	0.062***
	(0.035)	(0.018)
20+ years	-0.339***	0.097***
	(0.034)	(0.017)
log(employment)	0.031***	-0.024***
	(0.005)	(0.003)
Subsidiary	0.351***	0.139***
	(0.019)	(0.010)
Exporter	0.135***	0.241***
	(0.016)	(0.009)
Quality of capital and other inptus		
Share of state-of-the art machinery and equipment, including ICT	-0.123***	0.140***
	(0.023)	(0.012)
Share of high energy efficiency commercial building stock	-0.260***	0.055***
	(0.020)	(0.010)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.255***	0.099***
	(0.026)	(0.014)
at maximum capacity	0.134***	0.045***
	(0.014)	(0.007)
substantially below full capacity	-0.301***	-0.125***
	(0.022)	(0.012)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.078***	0.001
	(0.018)	(0.009)
Minor	0.058***	0.002
	(0.016)	(0.008)
Availability of staff with the right skills		
Major	0.065***	-0.054***
	(0.017)	(0.009)
Minor	0.036**	0.003
	(0.017)	(0.009)
Energy costs		
Major	-0.132***	-0.087***
	(0.018)	(0.009)
Minor	-0.092***	-0.052***
	(0.015)	(0.008)
Access to digital infrastructure		
Major	0.040*	0.021*
	(0.023)	(0.011)
Minor	0.003	0.036***
	(0.016)	(0.008)
Labor market regulations		
Major	0.003	-0.068***
	(0.018)	(0.009)
Minor	-0.018	-0.045***
	(0.016)	(0.008)
Business regulations and taxation		
Major	-0.041**	0.024***
	(0.019)	(0.009)
Minor	0.023	0.029***
	(0.016)	(0.009)
Availability of adequate transport infrastructure		
Major	-0.030	0.077***

	(0.019)	(0.010)
Minor	0.013	0.050***
	(0.015)	(0.008)
Availability of finance		
Major	-0.058***	-0.084***
	(0.018)	(0.010)
Minor	-0.006	-0.068***
	(0.015)	(0.008)
Uncertainty about future		
Major	0.052***	0.043***
	(0.018)	(0.010)
Minor	0.042**	0.035***
	(0.017)	(0.009)
Adjustment		
Investment, log(1 + investment)	-0.057***	0.049***
	(0.003)	(0.001)
Percent change in employment in the last three years	0.090***	-0.109***
	(0.015)	(0.008)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.232***	-0.098***
	(0.030)	(0.016)
too little	-0.063***	-0.067***
	(0.016)	(0.008)
company did not exist three years ago	-0.269	-0.084
	(0.179)	(0.090)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.054**	-0.028**
	(0.023)	(0.012)
capacity expansion for existing products or services	-0.068***	-0.006
	(0.024)	(0.012)
developing new products, processes or services	-0.056**	-0.007
	(0.025)	(0.012)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.189***	0.066***
	(0.020)	(0.010)
intra-group funding	-0.124**	0.183***
	(0.062)	(0.031)
Credit constrained	-0.099***	-0.087***
	(0.024)	(0.012)
Sample size	27,816	27,663
R^2	0.527	0.776
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.492	0.736
R^2 with X and no fixed effects	0.138	0.289
R^2 with X and country fixed effects	0.170	0.526
R^2 with X and industry fixed effects	0.302	0.461
R^2 with X and year fixed effects	0.139	0.288
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.329	0.676
R^2 with X and slopes varying by country	0.221	0.459
R^2 with X and slopes varying by industry	0.301	0.445
R^2 with X and slopes varying by year	0.141	0.292

Note: The table reports estimates of equation (4) with country × industry × year fixed effects. Industries are defined at 2-digit NACE level. All estimates are based on Huber robust regression. Observations are weighted so that the sample represents the population in terms of employment. All regressors are included simultaneously unless indicated otherwise. Standard errors are clustered by industry and country. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table A.5. Predictors of the dispersion of the marginal revenue products of capital and labor, balanced panel

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	0.131	0.100**
	(0.095)	(0.051)
10-19 years	0.098	0.097**
	(0.089)	(0.048)
20+ years	-0.116	0.032
	(0.086)	(0.046)
log(employment)	0.026**	-0.040***
	(0.011)	(0.006)
Subsidiary	0.345***	0.125***
	(0.043)	(0.022)
Exporter	0.258***	0.295***
	(0.031)	(0.017)
Quality of capital and other inptus		
Share of state-of-the art machinery and equipment, including ICT	0.049	0.262***
	(0.050)	(0.024)
Share of high energy efficiency commercial building stock	-0.184***	0.136***
	(0.043)	(0.020)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.364***	0.270***
	(0.058)	(0.029)
at maximum capacity	0.135***	0.038***
	(0.030)	(0.014)
substantially below full capacity	-0.242***	-0.110***
	(0.050)	(0.024)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.111***	0.043**
	(0.038)	(0.019)
Minor	0.094***	0.113***
	(0.034)	(0.018)
Availability of staff with the right skills		
Major	0.026	-0.088***
	(0.036)	(0.019)
Minor	0.031	0.004
	(0.035)	(0.018)
Energy costs		
Major	-0.107***	-0.102***
	(0.038)	(0.021)
Minor	0.055	-0.041**
	(0.034)	(0.018)
Access to digital infrastructure		
Major	-0.134***	0.104***
	(0.049)	(0.024)
Minor	-0.117***	0.048***
	(0.034)	(0.016)
Labor market regulations		
Major	0.028	-0.098***
	(0.038)	(0.020)
Minor	0.099***	-0.043**
	(0.035)	(0.018)
Business regulations and taxation		
Major	-0.150***	0.026
	(0.040)	(0.020)
Minor	-0.047	0.058***
	(0.036)	(0.017)
Availability of adequate transport infrastructure		
Major	0.056	-0.009

	(0.042)	(0.021)
Minor	-0.134***	0.023
	(0.033)	(0.017)
Availability of finance		
Major	0.026	-0.169***
	(0.041)	(0.021)
Minor	0.137***	-0.080***
	(0.036)	(0.018)
Uncertainty about future		
Major	-0.064	0.063***
	(0.043)	(0.021)
Minor	0.079**	0.038**
	(0.039)	(0.019)
Adjustment		
Investment, log(1 + investment)	-0.051***	0.048***
	(0.006)	(0.003)
Percent change in employment in the last three years	0.187***	-0.126***
	(0.032)	(0.016)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.294***	-0.071**
	(0.069)	(0.036)
too little	-0.104***	-0.043**
	(0.035)	(0.017)
company did not exist three years ago	-3.549***	-0.312
	(0.471)	(0.298)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	0.070	-0.029
	(0.049)	(0.023)
capacity expansion for existing products or services	0.007	-0.072***
	(0.052)	(0.025)
developing new products, processes or services	0.083	-0.043*
	(0.053)	(0.025)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.111***	0.015
	(0.041)	(0.021)
intra-group funding	-0.200	0.155**
	(0.149)	(0.075)
Credit constrained	-0.161***	-0.157***
	(0.048)	(0.024)
Sample size	5,406	5,370
R^2	0.682	0.870
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.642	0.832
R^2 with X and no fixed effects	0.148	0.283
R^2 with X and country fixed effects	0.185	0.550
R^2 with X and industry fixed effects	0.356	0.472
R^2 with X and year fixed effects	0.149	0.286
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.389	0.703
R^2 with X and slopes varying by country	0.386	0.583
R^2 with X and slopes varying by industry	0.475	0.585
R^2 with X and slopes varying by year	0.160	0.293

Note: The sample is restricted to firms that participated in all three waves of EIBIS. See notes to Appendix Table A.4 for more details.

Table A.6. Predictors of the dispersion of the marginal revenue products of capital and labor, sample averaged across waves

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.216**	0.578***
	(0.088)	(0.085)
10-19 years	-0.208***	0.623***
	(0.072)	(0.078)
20+ years	-0.380***	0.665***
	(0.073)	(0.077)
log(employment)	0.079***	-0.085***
	(0.011)	(0.009)
Subsidiary	0.544***	0.092***
	(0.041)	(0.030)
Exporter	0.187***	0.324***
	(0.034)	(0.026)
Quality of capital and other inptus		
Share of state-of-the art machinery and equipment, including ICT	-0.028	0.228***
	(0.050)	(0.037)
Share of high energy efficiency commercial building stock	-0.331***	0.103***
	(0.046)	(0.029)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.312***	0.177***
	(0.072)	(0.054)
at maximum capacity	0.132***	0.108***
	(0.034)	(0.027)
substantially below full capacity	-0.411***	-0.127***
	(0.053)	(0.035)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.065*	0.003
	(0.034)	(0.024)
Minor	-0.005	0.043**
	(0.027)	(0.021)
Availability of staff with the right skills		
Major	0.067**	-0.041*
	(0.032)	(0.023)
Minor	0.106***	0.023
	(0.033)	(0.024)
Energy costs		
Major	-0.115***	-0.180***
	(0.032)	(0.025)
Minor	-0.060**	-0.066***
	(0.029)	(0.021)
Access to digital infrastructure		
Major	0.067	0.093***
	(0.043)	(0.031)
Minor	-0.001	-0.007
	(0.031)	(0.022)
Labor market regulations		
Major	0.110***	-0.086***
	(0.051)	(0.023)
Minor	0.010	-0.066***
	(0.032)	(0.024)
Business regulations and taxation		
Major	-0.063*	0.007
	(0.034)	(0.025)
Minor	-0.002	0.043*
	(0.029)	(0.025)

Availability of adequate transport infrastructure		
Major	-0.087**	0.053**
	(0.037)	(0.027)
Minor	-0.012	0.041*
	(0.030)	(0.023)
Availability of finance		
Major	-0.059*	-0.052**
	(0.034)	(0.025)
Minor	-0.021	-0.046**
	(0.028)	(0.022)
Uncertainty about future		
Major	0.005	0.127***
	(0.038)	(0.024)
Minor	0.002	0.088***
	(0.033)	(0.022)
Adjustment		
Investment, log(1 + investment)	-0.096***	0.092***
	(0.007)	(0.005)
Percent change in employment in the last three years	0.094**	-0.041
	(0.039)	(0.034)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.464***	-0.336***
	(0.084)	(0.062)
too little	-0.121***	-0.074**
	(0.041)	(0.031)
company did not exist three years ago	0.761	0.116
	(0.507)	(0.404)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.123**	0.120***
	(0.061)	(0.041)
capacity expansion for existing products or services	-0.149**	0.047
	(0.061)	(0.044)
developing new products, processes or services	-0.137**	0.113***
	(0.065)	(0.042)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.257***	0.121***
	(0.049)	(0.036)
intra-group funding	-0.165	0.300***
	(0.178)	(0.111)
Credit constrained	-0.018	-0.145***
	(0.062)	(0.044)
Sample size	6,672	6,628
R^2	0.580	0.749
Memorandum		
R^2 with country × industry fixed effects and no X	0.526	0.676
R^2 with X and no fixed effects	0.185	0.283
R^2 with X and country fixed effects	0.244	0.528
R^2 with X and industry fixed effects	0.359	0.506
R^2 with X and country fixed effects and industry fixed effects	0.391	0.671
R^2 with X and slopes varying by country	0.394	0.607
R2 with X and slopes varying by industry	0.511	0.631

Note: The table reports "*between*" estimates of equation (4) with country × industry × year fixed effects. All RHS and LHS variables are averaged across waves. See notes to Appendix Table A.4 for more details.

Table A.7. Predictors of the dispersion of the marginal revenue products of capital and labor, alternative measure of investment

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.002	0.025
	(0.039)	(0.020)
10-19 years	-0.212***	0.045**
	(0.036)	(0.018)
20+ years	-0.341***	0.074***
	(0.035)	(0.018)
log(employment)	-0.031***	0.025***
	(0.005)	(0.002)
Subsidiary	0.220***	0.198***
	(0.020)	(0.011)
Exporter	0.104***	0.261***
	(0.016)	(0.009)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.160***	0.166***
	(0.023)	(0.012)
Share of high energy efficiency commercial building stock	-0.270***	0.067***
	(0.020)	(0.010)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.232***	0.097***
	(0.027)	(0.014)
at maximum capacity	0.126***	0.046***
	(0.014)	(0.007)
substantially below full capacity	-0.304***	-0.136***
	(0.022)	(0.012)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.060***	-0.001
	(0.018)	(0.009)
Minor	0.049***	0.003
	(0.016)	(0.008)
Availability of staff with the right skills		
Major	0.047***	-0.044***
	(0.017)	(0.009)
Minor	0.031*	0.005
	(0.017)	(0.009)
Energy costs		
Major	-0.129***	-0.078***
	(0.018)	(0.010)
Minor	-0.096***	-0.049***
	(0.015)	(0.008)
Access to digital infrastructure		
Major	0.034	0.028**
	(0.023)	(0.012)
Minor	-0.005	0.042***
	(0.016)	(0.008)
Labor market regulations		
Major	0.017	-0.071***
	(0.018)	(0.009)
Minor	-0.009	-0.043***
	(0.016)	(0.008)
Business regulations and taxation		
Major	-0.063***	0.024***
	(0.019)	(0.009)
Minor	0.017	0.030***
	(0.017)	(0.009)

Availability of adequate transport infrastructure		
Major	-0.050***	0.077***
	(0.019)	(0.011)
Minor	-0.006	0.057***
	(0.016)	(0.008)
Availability of finance		
Major	-0.023	-0.098***
	(0.018)	(0.010)
Minor	0.013	-0.077***
	(0.015)	(0.009)
Uncertainty about future		
Major	0.079***	0.047***
	(0.018)	(0.010)
Minor	0.056***	0.036***
	(0.017)	(0.009)
Adjustment		
Indicator variable for positive investment, $\mathbf{1}\{\text{investment} > 0\}$	0.120***	0.215***
	(0.036)	(0.018)
Percent change in employment in the last three years	0.071***	-0.109***
	(0.015)	(0.008)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.274***	-0.079***
	(0.030)	(0.016)
too little	-0.039**	-0.091***
	(0.016)	(0.008)
company did not exist three years ago	-0.189	-0.118
	(0.185)	(0.091)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.095***	0.006
	(0.024)	(0.012)
capacity expansion for existing products or services	-0.116***	0.031**
	(0.024)	(0.012)
developing new products, processes or services	-0.106***	0.038***
	(0.025)	(0.012)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.220***	0.025**
	(0.020)	(0.011)
intra-group funding	0.075	0.103***
	(0.064)	(0.031)
Credit constrained	-0.094***	-0.093***
	(0.024)	(0.012)
Sample size	27,815	27,648
R^2	0.518	0.77
Memorandum		
R^2 with country $\times$ industry $\times$ year fixed effects and no X	0.492	0.736
R^2 with X and no fixed effects	0.119	0.247
R^2 with X and country fixed effects	0.146	0.513
R^2 with X and industry fixed effects	0.294	0.426
R^2 with X and year fixed effects	0.119	0.247
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.321	0.666
R^2 with X and slopes varying by country	0.196	0.437
R^2 with X and slopes varying by industry	0.286	0.409
R^2 with X and slopes varying by year	0.122	0.251

Note: Investment is measured as an indicator variable equal to one if a firm reports positive investment, and zero otherwise (the baseline specification uses log(1+investment)). See notes to Appendix Table A.4 for more details.

Table A.8. Marginal R^2 of adding a group of variables to a specification with fixed effects, sample averaged across waves

Row	Group of variables	List of fixed effects					
		No fixed effects	Country	Industry		Country + Industry + Year	Country × Industry × Year
		(1)	(2)	(3)		(4)	(5)
	Panel A: average MRPK						
(1)	Demographics	0.048	0.036	0.027		0.021	0.017
(2)	Quality of capital	0.024	0.014	0.018		0.010	0.008
(3)	Capacity utilization	0.030	0.030	0.015		0.015	0.009
(4)	Obstacles to investment	0.038	0.027	0.019		0.011	0.008
(5)	Adjustment	0.078	0.080	0.028		0.023	0.020
(6)	Source of funds	0.034	0.026	0.015		0.011	0.010
(7)	"Compensating differentials"	0.128	0.119	0.064		0.051	0.038
(8)	"Distortions"	0.096	0.075	0.047		0.035	0.028
(9)	All variables	0.185	0.168	0.100		0.084	0.066
	Panel B: average MRPL						
(10)	Demographics	0.148	0.051	0.118		0.058	0.042
(11)	Quality of capital	0.049	0.018	0.036		0.014	0.013
(12)	Capacity utilization	0.021	0.013	0.015		0.007	0.006
(13)	Obstacles to investment	0.082	0.030	0.049		0.018	0.015
(14)	Adjustment	0.133	0.053	0.128		0.060	0.040
(15)	Source of funds	0.056	0.013	0.040		0.008	0.007
(16)	"Compensating differentials"	0.172	0.076	0.159		0.080	0.060
(17)	"Distortions"	0.203	0.067	0.147		0.057	0.041
(18)	All variables	0.350	0.130	0.281		0.112	0.091
	Panel C: average MRPL – average MRPK						
(19)	Demographics	0.109	0.077	0.060		0.039	0.026
(20)	Quality of capital	0.055	0.028	0.049		0.024	0.017
(21)	Capacity utilization	0.004	0.009	0.001		0.003	0.003
(22)	Obstacles to investment	0.034	0.022	0.014		0.011	0.009
(23)	Adjustment	0.227	0.164	0.150		0.100	0.076
(24)	Source of funds	0.020	0.012	0.013		0.009	0.008
(25)	"Compensating differentials"	0.265	0.190	0.184		0.121	0.092
(26)	"Distortions"	0.148	0.098	0.079		0.050	0.037
(27)	All variables	0.346	0.235	0.249		0.157	0.119
	Panel D: Productivity gain based on average marginal revenue products						
(28)	Demographics	0.395	0.165	0.294	0.150	0.106	0.395
(29)	Quality of capital	0.145	0.057	0.114	0.047	0.040	0.145
(30)	Capacity utilization	0.032	0.019	0.024	0.011	0.011	0.032
(31)	Obstacles to investment	0.185	0.070	0.107	0.041	0.036	0.185
(32)	Adjustment	0.465	0.232	0.404	0.213	0.150	0.465
(33)	Source of funds	0.120	0.025	0.088	0.019	0.018	0.120
(34)	"Compensating differentials"	0.559	0.285	0.484	0.262	0.199	0.559
(35)	"Distortions"	0.522	0.199	0.362	0.150	0.108	0.522
(36)	All variables	0.982	0.418	0.786	0.347	0.274	0.982

Note: The table replicates Table 5 in the paper for average marginal revenue products. Taking within-firm average marginal products should attenuate adverse effects of measurement errors. This table does not have a column with year fixed effects because panel data are collapsed to a cross-section. See notes to Table 4 for more details.

Table A.9. R^2 for various sets of fixed effects, sample averaged across waves

		List of fixed effects			
		Country	Industry	Country + Industry	Country × Industry
		(1)	(2)	(3)	(4)
	Dispersion				
(1)	MRPK	0.061	0.278	0.314	0.526
(2)	MRPL	0.408	0.243	0.563	0.676
(3)	MRPL - MRPK	0.193	0.190	0.346	0.554
(4)	**Productivity gain**	1.050	0.701	1.529	1.975

Note: The table replicates Table 4 in the paper for average marginal revenue products. Taking within-firm average marginal products should attenuate adverse effects of measurement errors. This table does not have a column with year fixed effects because panel data are collapsed to a cross-section. See notes to Table 5 for more details.

Table A.10. Predictors of the dispersion of the marginal revenue products of capital and labor, EU North/West

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	0.109*	0.001
	(0.064)	(0.029)
10-19 years	-0.103*	0.062**
	(0.056)	(0.026)
20+ years	-0.241***	0.079***
	(0.052)	(0.026)
log(employment)	0.075***	-0.028***
	(0.009)	(0.005)
Subsidiary	0.398***	0.101***
	(0.029)	(0.013)
Exporter	0.206***	0.139***
	(0.025)	(0.013)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.149***	0.087***
	(0.040)	(0.017)
Share of high energy efficiency commercial building stock	-0.129***	0.006
	(0.035)	(0.015)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.284***	0.133***
	(0.039)	(0.019)
at maximum capacity	0.178***	0.065***
	(0.022)	(0.010)
substantially below full capacity	-0.223***	-0.096***
	(0.037)	(0.017)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	-0.047	-0.004
	(0.032)	(0.014)
Minor	-0.006	-0.011
	(0.026)	(0.011)
Availability of staff with the right skills		
Major	0.139***	-0.074***
	(0.029)	(0.012)
Minor	0.059**	-0.014
	(0.027)	(0.013)
Energy costs		
Major	-0.131***	-0.069***
	(0.033)	(0.015)
Minor	-0.108***	-0.054***
	(0.024)	(0.012)
Access to digital infrastructure		
Major	0.031	-0.006
	(0.038)	(0.017)
Minor	-0.028	0.015
	(0.026)	(0.012)
Labor market regulations		
Major	-0.021	-0.072***
	(0.031)	(0.014)
Minor	-0.062**	-0.046***
	(0.025)	(0.012)
Business regulations and taxation		
Major	-0.128***	0.015
	(0.033)	(0.014)
Minor	-0.017	0.013
	(0.026)	(0.012)
Availability of adequate transport infrastructure		
Major	-0.039	0.118***
	(0.035)	(0.017)
Minor	0.009	0.049***
	(0.026)	(0.012)
Availability of finance		
Major	-0.017	-0.090***

	(0.034)	(0.015)
Minor	-0.009	-0.072***
	(0.026)	(0.013)
Uncertainty about future		
Major	0.173***	0.043***
	(0.030)	(0.014)
Minor	0.133***	0.023**
	(0.025)	(0.012)
Adjustment		
Investment, log(1 + investment)	-0.090***	0.047***
	(0.005)	(0.002)
Percent change in employment in the last three years	-0.001	-0.116***
	(0.022)	(0.011)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.230***	-0.044*
	(0.054)	(0.025)
too little	-0.041	0.000
	(0.027)	(0.012)
company did not exist three years ago	-0.620***	0.109
	(0.205)	(0.121)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.070*	-0.010
	(0.039)	(0.017)
capacity expansion for existing products or services	-0.035	0.004
	(0.039)	(0.018)
developing new products, processes or services	-0.064	-0.004
	(0.043)	(0.018)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.285***	0.087***
	(0.034)	(0.015)
intra-group funding	0.268***	0.203***
	(0.085)	(0.040)
Credit constrained	-0.206***	-0.138***
	(0.048)	(0.020)
Sample size	11,172	11,016
R^2	0.509	0.649
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.456	0.591
R^2 with X and no fixed effects	0.166	0.180
R^2 with X and country fixed effects	0.174	0.210
R^2 with X and industry fixed effects	0.309	0.439
R^2 with X and year fixed effects	0.169	0.180
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.318	0.456
R^2 with X and slopes varying by country	0.229	0.252
R^2 with X and slopes varying by industry	0.388	0.445
R^2 with X and slopes varying by year	0.176	0.189

Note: The sample is restricted to Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden, and the UK. See notes to Appendix Table A.4 for more details.

Table A.11. Predictors of the dispersion of the marginal revenue products of capital and labor, EU South

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.357***	0.022
	(0.108)	(0.049)
10-19 years	-0.472***	-0.013
	(0.092)	(0.046)
20+ years	0.664***	0.087*
	(0.094)	(0.044)
log(employment)	0.025**	-0.043***
	(0.011)	(0.007)
Subsidiary	0.253***	0.078***
	(0.050)	(0.023)
Exporter	0.159***	0.316***
	(0.035)	(0.019)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.108**	0.080***
	(0.052)	(0.027)
Share of high energy efficiency commercial building stock	-0.272***	0.074***
	(0.046)	(0.025)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.347***	0.013
	(0.066)	(0.037)
at maximum capacity	0.082***	0.037**
	(0.031)	(0.017)
substantially below full capacity	-0.471***	-0.158***
	(0.052)	(0.026)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.173***	0.009
	(0.039)	(0.021)
Minor	0.179***	0.046**
	(0.041)	(0.022)
Availability of staff with the right skills		
Major	0.120***	-0.033*
	(0.039)	(0.019)
Minor	0.150***	0.004
	(0.039)	(0.020)
Energy costs		
Major	-0.173***	-0.026
	(0.037)	(0.021)
Minor	-0.129***	0.004
	(0.039)	(0.022)
Access to digital infrastructure		
Major	0.042	0.044*
	(0.048)	(0.023)
Minor	-0.013	0.074***
	(0.038)	(0.019)
Labor market regulations		
Major	0.143***	-0.105***
	(0.043)	(0.022)
Minor	0.017	-0.056**
	(0.044)	(0.023)
Business regulations and taxation		
Major	-0.06	0.064***
	(0.044)	(0.021)
Minor	-0.041	0.032
	(0.045)	(0.023)
Availability of adequate transport infrastructure		
Major	0.018	0.044**
	(0.037)	(0.021)
Minor	0.017	0.018

	(0.036)	(0.019)
Availability of finance		
Major	-0.165***	-0.099***
	(0.036)	(0.021)
Minor	-0.068*	-0.074***
	(0.040)	(0.023)
Uncertainty about future		
Major	-0.168***	0.004
	(0.049)	(0.028)
Minor	-0.118**	-0.045
	(0.051)	(0.028)
Adjustment		
Investment, log(1 + investment)	-0.051***	0.048***
	(0.006)	(0.003)
Percent change in employment in the last three years	0.160***	-0.128***
	(0.036)	(0.020)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.231***	-0.124***
	(0.069)	(0.039)
too little	-0.184***	-0.105***
	(0.043)	(0.020)
company did not exist three years ago	-0.701	-0.418*
	(0.491)	(0.238)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.040	0.017
	(0.052)	(0.024)
capacity expansion for existing products or services	-0.043	0.015
	(0.051)	(0.025)
developing new products, processes or services	-0.010	0.054**
	(0.053)	(0.024)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.098**	0.044*
	(0.043)	(0.024)
intra-group funding	-0.613***	0.314***
	(0.147)	(0.084)
Credit constrained	-0.075	-0.075***
	(0.056)	(0.026)
Sample size	5,657	5,602
R^2	0.483	0.627
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.432	0.574
R^2 with X and no fixed effects	0.136	0.185
R^2 with X and country fixed effects	0.147	0.208
R^2 with X and industry fixed effects	0.327	0.471
R^2 with X and year fixed effects	0.136	0.185
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.341	0.525
R^2 with X and slopes varying by country	0.193	0.248
R^2 with X and slopes varying by industry	0.489	0.568
R^2 with X and slopes varying by year	0.153	0.200

Note: The sample is restricted to Cyprus, Greece, Italy, Malta, Portugal, and Spain. See notes to Appendix Table A.4 for more details.

Table A.12. Predictors of the dispersion of the marginal revenue products of capital and labor, EU Center/East

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	0.006	0.066**
	(0.051)	(0.030)
10-19 years	-0.271***	0.093***
	(0.051)	(0.028)
20+ years	-0.374***	0.097***
	(0.050)	(0.028)
log(employment)	0.007	-0.017***
	(0.009)	(0.005)
Subsidiary	0.293***	0.227***
	(0.033)	(0.021)
Exporter	0.096***	0.368***
	(0.027)	(0.016)
Quality of capital and other inptus		
Share of state-of-the art machinery and equipment, including ICT	-0.080**	0.262***
	(0.034)	(0.020)
Share of high energy efficiency commercial building stock	-0.298***	0.101***
	(0.029)	(0.017)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.184***	0.113***
	(0.045)	(0.027)
at maximum capacity	0.058***	0.020*
	(0.021)	(0.012)
substantially below full capacity	-0.260***	-0.132***
	(0.034)	(0.019)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.068***	0.042***
	(0.026)	(0.016)
Minor	0.025	0.023*
	(0.022)	(0.013)
Availability of staff with the right skills		
Major	-0.023	-0.028*
	(0.027)	(0.015)
Minor	-0.045	0.016
	(0.028)	(0.015)
Energy costs		
Major	-0.114***	-0.131***
	(0.027)	(0.016)
Minor	-0.062***	-0.065***
	(0.023)	(0.014)
Access to digital infrastructure		
Major	0.034	0.019
	(0.044)	(0.026)
Minor	0.035	0.032**
	(0.024)	(0.013)
Labor market regulations		
Major	-0.070**	-0.058***
	(0.028)	(0.015)
Minor	0.019	-0.052***
	(0.024)	(0.014)
Business regulations and taxation		
Major	0.012	-0.007
	(0.028)	(0.016)
Minor	0.093***	0.063***
	(0.025)	(0.014)
Availability of adequate transport infrastructure		
Major	0.039	0.060***
	(0.027)	(0.017)
Minor	0.026	0.051***
	(0.023)	(0.013)
Availability of finance		
Major	-0.074***	-0.069***

	(0.026)	(0.016)
Minor	-0.032	-0.050***
	(0.021)	(0.013)
Uncertainty about future		
Major	0.032	0.050***
	(0.028)	(0.017)
Minor	-0.003	0.057***
	(0.027)	(0.015)
Adjustment		
Investment, log(1 + investment)	-0.050***	0.058***
	(0.004)	(0.003)
Percent change in employment in the last three years	0.172***	-0.077***
	(0.026)	(0.014)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.208***	-0.162***
	(0.041)	(0.026)
too little	-0.006	-0.094***
	(0.023)	(0.013)
company did not exist three years ago	1.142***	-0.115
	(0.393)	(0.195)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.06	-0.052**
	(0.037)	(0.021)
capacity expansion for existing products or services	-0.115***	-0.036
	(0.036)	(0.023)
developing new products, processes or services	-0.089**	-0.050**
	(0.038)	(0.023)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.178***	0.043**
	(0.030)	(0.019)
intra-group funding	-0.294**	0.143**
	(0.123)	(0.061)
Credit constrained	-0.040	-0.052***
	(0.032)	(0.018)
Sample size	11,184	11,101
R^2	0.527	0.720
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.496	0.643
R^2 with X and no fixed effects	0.155	0.256
R^2 with X and country fixed effects	0.185	0.389
R^2 with X and industry fixed effects	0.342	0.519
R^2 with X and year fixed effects	0.155	0.257
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.373	0.619
R^2 with X and slopes varying by country	0.227	0.366
R^2 with X and slopes varying by industry	0.407	0.523
R^2 with X and slopes varying by year	0.162	0.265

Note: The sample is restricted to Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. See notes to Appendix Table A.4 for more details.

Table A.13. Marginal R^2 of adding a group of variables to a specification with fixed effects, EU North/West

Row	Group of variables	No fixed effects	Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: MRPK						
(1)	Demographics	0.041	0.035	0.027	0.042	0.024	0.019
(2)	Quality of capital	0.020	0.011	0.015	0.020	0.010	0.007
(3)	Capacity utilization	0.012	0.017	0.005	0.012	0.008	0.008
(4)	Obstacles to investment	0.028	0.025	0.010	0.028	0.009	0.008
(5)	Adjustment	0.073	0.070	0.030	0.073	0.029	0.021
(6)	Source of funds	0.042	0.041	0.028	0.040	0.024	0.022
(7)	"Compensating differentials"	0.103	0.096	0.052	0.103	0.046	0.038
(8)	"Distortions"	0.092	0.086	0.048	0.091	0.044	0.037
(9)	All variables	0.166	0.154	0.091	0.166	0.084	0.071
	Panel B: MRPL						
(10)	Demographics	0.079	0.063	0.059	0.079	0.050	0.034
(11)	Quality of capital	0.001	0.004	0.002	0.002	0.004	0.002
(12)	Capacity utilization	0.011	0.011	0.006	0.011	0.006	0.004
(13)	Obstacles to investment	0.057	0.044	0.023	0.057	0.018	0.016
(14)	Adjustment	0.056	0.048	0.050	0.056	0.044	0.030
(15)	Source of funds	0.050	0.040	0.023	0.050	0.019	0.013
(16)	"Compensating differentials"	0.076	0.068	0.064	0.076	0.058	0.045
(17)	"Distortions"	0.126	0.101	0.069	0.126	0.058	0.040
(18)	All variables	0.180	0.150	0.113	0.180	0.098	0.074
	Panel C: MRPL - MRPK						
(19)	Demographics	0.051	0.047	0.019	0.050	0.018	0.011
(20)	Quality of capital	0.017	0.015	0.016	0.017	0.014	0.010
(21)	Capacity utilization	0.006	0.008	0.001	0.006	0.003	0.004
(22)	Obstacles to investment	0.027	0.028	0.010	0.027	0.010	0.008
(23)	Adjustment	0.160	0.151	0.091	0.160	0.080	0.052
(24)	Source of funds	0.014	0.015	0.012	0.013	0.010	0.009
(25)	"Compensating differentials"	0.176	0.166	0.104	0.175	0.092	0.061
(26)	"Distortions"	0.084	0.080	0.037	0.082	0.034	0.026
(27)	All variables	0.229	0.222	0.138	0.229	0.129	0.093
	Panel D: Productivity gain						
(28)	Demographics	0.236	0.194	0.156	0.234	0.134	0.088
(29)	Quality of capital	0.010	0.021	0.015	0.013	0.020	0.012
(30)	Capacity utilization	0.028	0.027	0.013	0.028	0.014	0.010
(31)	Obstacles to investment	0.160	0.130	0.064	0.160	0.052	0.045
(32)	Adjustment	0.285	0.256	0.215	0.285	0.188	0.124
(33)	Source of funds	0.118	0.094	0.055	0.118	0.045	0.030
(34)	"Compensating differentials"	0.336	0.308	0.253	0.335	0.227	0.163
(35)	"Distortions"	0.363	0.298	0.190	0.361	0.161	0.110
(36)	All variables	0.625	0.547	0.394	0.625	0.349	0.254

Note: The sample is restricted to Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden, and the UK. See notes to Table 5 for more details.

Table A.14. Marginal R^2 of adding a group of variables to a specification with fixed effects, EU South.

Row	Group of variables	No fixed effects	Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: MRPK						
(1)	Demographics	0.040	0.036	0.019	0.040	0.015	0.013
(2)	Quality of capital	0.008	0.007	0.005	0.008	0.004	0.005
(3)	Capacity utilization	0.028	0.025	0.018	0.028	0.017	0.016
(4)	Obstacles to investment	0.030	0.029	0.015	0.030	0.014	0.014
(5)	Adjustment	0.057	0.053	0.018	0.056	0.016	0.013
(6)	Source of funds	0.014	0.011	0.005	0.013	0.005	0.003
(7)	"Compensating differentials"	0.092	0.084	0.043	0.092	0.036	0.034
(8)	"Distortions"	0.076	0.069	0.033	0.075	0.030	0.027
(9)	All variables	0.136	0.126	0.068	0.135	0.060	0.057
	Panel B: MRPL						
(10)	Demographics	0.081	0.086	0.041	0.080	0.049	0.044
(11)	Quality of capital	0.016	0.014	0.006	0.016	0.006	0.007
(12)	Capacity utilization	0.014	0.014	0.006	0.013	0.007	0.007
(13)	Obstacles to investment	0.055	0.048	0.021	0.055	0.015	0.013
(14)	Adjustment	0.084	0.070	0.060	0.083	0.042	0.039
(15)	Source of funds	0.011	0.008	0.010	0.010	0.005	0.005
(16)	"Compensating differentials"	0.125	0.117	0.079	0.124	0.070	0.065
(17)	"Distortions"	0.098	0.088	0.048	0.097	0.037	0.034
(18)	All variables	0.185	0.170	0.108	0.183	0.093	0.085
	Panel C: MRPL - MRPK						
(19)	Demographics	0.094	0.086	0.039	0.094	0.032	0.027
(20)	Quality of capital	0.015	0.012	0.010	0.015	0.009	0.009
(21)	Capacity utilization	0.013	0.009	0.005	0.013	0.004	0.006
(22)	Obstacles to investment	0.032	0.028	0.014	0.031	0.011	0.012
(23)	Adjustment	0.124	0.107	0.063	0.123	0.047	0.034
(24)	Source of funds	0.023	0.014	0.017	0.022	0.007	0.004
(25)	"Compensating differentials"	0.161	0.141	0.080	0.160	0.062	0.050
(26)	"Distortions"	0.122	0.102	0.062	0.121	0.043	0.037
(27)	All variables	0.227	0.200	0.120	0.226	0.095	0.083
	Panel D: Productivity gain						
(28)	Demographics	0.292	0.298	0.138	0.289	0.153	0.136
(29)	Quality of capital	0.053	0.045	0.024	0.053	0.023	0.025
(30)	Capacity utilization	0.034	0.031	0.010	0.031	0.012	0.015
(31)	Obstacles to investment	0.159	0.137	0.061	0.158	0.043	0.039
(32)	Adjustment	0.324	0.271	0.216	0.321	0.152	0.131
(33)	Source of funds	0.046	0.030	0.042	0.043	0.018	0.016
(34)	"Compensating differentials"	0.450	0.412	0.269	0.447	0.229	0.203
(35)	"Distortions"	0.346	0.301	0.175	0.343	0.126	0.113
(36)	All variables	0.654	0.590	0.374	0.648	0.311	0.279

Note: The sample is restricted to Cyprus, Greece, Italy, Malta, Portugal, and Spain. See notes to Table 5 for more details.

Table A.15. Marginal R^2 of adding a group of variables to a specification with fixed effects, EU Center/East

Row	Group of variables	No fixed effects (1)	Country (2)	Industry (3)	Year (4)	Country + Industry + Year (5)	Country × Industry × Year (6)
	Panel A: MRPK						
(1)	Demographics	0.063	0.060	0.019	0.063	0.020	0.016
(2)	Quality of capital	0.018	0.011	0.018	0.018	0.011	0.009
(3)	Capacity utilization	0.010	0.012	0.006	0.010	0.007	0.004
(4)	Obstacles to investment	0.020	0.017	0.009	0.020	0.007	0.004
(5)	Adjustment	0.087	0.080	0.027	0.087	0.023	0.018
(6)	Source of funds	0.019	0.016	0.008	0.019	0.008	0.006
(7)	"Compensating differentials"	0.111	0.100	0.049	0.111	0.041	0.029
(8)	"Distortions"	0.093	0.086	0.034	0.093	0.032	0.024
(9)	All variables	0.155	0.142	0.074	0.155	0.063	0.046
	Panel B: MRPL						
(10)	Demographics	0.107	0.059	0.106	0.106	0.073	0.059
(11)	Quality of capital	0.064	0.029	0.047	0.065	0.021	0.020
(12)	Capacity utilization	0.029	0.018	0.018	0.029	0.009	0.007
(13)	Obstacles to investment	0.059	0.040	0.031	0.059	0.020	0.016
(14)	Adjustment	0.098	0.071	0.087	0.097	0.060	0.048
(15)	Source of funds	0.006	0.005	0.006	0.006	0.005	0.005
(16)	"Compensating differentials"	0.175	0.107	0.155	0.175	0.094	0.079
(17)	"Distortions"	0.118	0.076	0.083	0.117	0.063	0.049
(18)	All variables	0.256	0.153	0.198	0.255	0.121	0.101
	Panel C: MRPL - MRPK						
(19)	Demographics	0.136	0.102	0.076	0.135	0.054	0.043
(20)	Quality of capital	0.067	0.039	0.055	0.068	0.030	0.026
(21)	Capacity utilization	0.002	0.002	0.000	0.002	0.000	0.000
(22)	Obstacles to investment	0.032	0.020	0.016	0.032	0.008	0.008
(23)	Adjustment	0.209	0.153	0.123	0.208	0.092	0.074
(24)	Source of funds	0.025	0.023	0.014	0.025	0.014	0.012
(25)	"Compensating differentials"	0.252	0.180	0.165	0.251	0.114	0.093
(26)	"Distortions"	0.154	0.121	0.082	0.153	0.063	0.051
(27)	All variables	0.309	0.220	0.202	0.308	0.136	0.111
	Panel D: Productivity gain						
(28)	Demographics	0.393	0.233	0.347	0.389	0.237	0.191
(29)	Quality of capital	0.230	0.113	0.173	0.234	0.082	0.076
(30)	Capacity utilization	0.070	0.041	0.042	0.070	0.019	0.015
(31)	Obstacles to investment	0.176	0.115	0.092	0.176	0.056	0.048
(32)	Adjustment	0.441	0.311	0.349	0.437	0.246	0.198
(33)	Source of funds	0.033	0.030	0.027	0.033	0.024	0.023
(34)	"Compensating differentials"	0.673	0.422	0.558	0.671	0.348	0.292
(35)	"Distortions"	0.424	0.282	0.287	0.420	0.215	0.170
(36)	All variables	0.919	0.560	0.695	0.915	0.429	0.359

Note: The sample is restricted to Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. See notes to Table 5 for more details.

Table A.16. R^2 for various sets of fixed effects, by EU region

				List of fixed effects		
		Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(2)	(3)	(4)	(5)	(6)
Panel A: EU North/West						
	Dispersion					
(1)	MRPK	0.019	0.226	0.003	0.240	0.456
(2)	MRPL	0.065	0.329	0.001	0.370	0.591
(3)	MRPL - MRPK	0.033	0.199	0.003	0.227	0.482
(4)	**Productivity gain**	0.193	0.933	0.004	1.061	1.790
Panel B: EU South						
	Dispersion					
(1)	MRPK	0.023	0.264	0.000	0.286	0.432
(2)	MRPL	0.040	0.371	0.002	0.444	0.574
(3)	MRPL - MRPK	0.074	0.246	0.002	0.297	0.459
(4)	Productivity gain	0.174	1.071	0.007	1.303	1.735
Panel C: EU Center/East						
	Dispersion					
(1)	MRPK	0.048	0.277	0.000	0.319	0.496
(2)	MRPL	0.246	0.349	0.002	0.518	0.643
(3)	MRPL - MRPK	0.187	0.216	0.002	0.355	0.541
(4)	Productivity gain	0.816	0.972	0.007	1.540	1.967

Note: The EU North/West sample is restricted to Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Luxembourg, the Netherlands, Sweden, and the UK. The EU South sample is restricted to Cyprus, Greece, Italy, Malta, Portugal, and Spain. The EU Center/East sample is restricted to Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. See notes to Table 4 for more details.

Table A.17. Predictors of the dispersion of the marginal revenue products of capital and labor, capital and labor regressands are from Orbis

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.001	0.045**
	(0.038)	(0.019)
10-19 years	-0.212***	0.063***
	(0.035)	(0.018)
20+ years	-0.335***	0.094***
	(0.034)	(0.017)
log(employment)	0.048***	-0.016***
	(0.006)	(0.003)
Subsidiary	0.323***	0.171***
	(0.019)	(0.010)
Exporter	0.132***	0.244***
	(0.016)	(0.009)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.124***	0.148***
	(0.023)	(0.012)
Share of high energy efficiency commercial building stock	-0.258***	0.059***
	(0.020)	(0.010)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.249***	0.094***
	(0.026)	(0.013)
at maximum capacity	0.128***	0.044***
	(0.014)	(0.007)
substantially below full capacity	-0.315***	-0.133***
	(0.022)	(0.011)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.070***	0.008
	(0.018)	(0.009)
Minor	0.052***	0.011
	(0.016)	(0.008)
Availability of staff with the right skills		
Major	0.064***	-0.050***
	(0.017)	(0.009)
Minor	0.032*	-0.005
	(0.017)	(0.009)
Energy costs		
Major	-0.127***	-0.086***
	(0.018)	(0.009)
Minor	-0.091***	-0.055***
	(0.015)	(0.008)
Access to digital infrastructure		
Major	0.036	0.015
	(0.023)	(0.012)
Minor	0.01	0.035***
	(0.016)	(0.008)
Labor market regulations		
Major	-0.009	-0.070***
	(0.018)	(0.009)
Minor	-0.02	-0.043***
	(0.016)	(0.008)
Business regulations and taxation		
Major	-0.046**	0.027***
	(0.019)	(0.009)
Minor	0.022	0.028***
	(0.017)	(0.009)

Availability of adequate transport infrastructure		
Major	-0.024	0.072***
	(0.019)	(0.010)
Minor	0.008	0.048***
	(0.015)	(0.008)
Availability of finance		
Major	-0.051***	-0.086***
	(0.018)	(0.010)
Minor	-0.003	-0.072***
	(0.015)	(0.008)
Uncertainty about future		
Major	0.059***	0.048***
	(0.018)	(0.010)
Minor	0.048***	0.035***
	(0.017)	(0.009)
Adjustment		
Investment, log(1 + investment)	-0.067***	0.048***
	(0.003)	(0.001)
Percent change in employment in the last three years	0.099***	-0.097***
	(0.015)	(0.008)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.223***	-0.099***
	(0.030)	(0.016)
too little	-0.065***	-0.070***
	(0.016)	(0.008)
company did not exist three years ago	-0.255	-0.066
	(0.176)	(0.087)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.069***	-0.021*
	(0.023)	(0.012)
capacity expansion for existing products or services	-0.087***	-0.002
	(0.023)	(0.012)
developing new products, processes or services	-0.080***	0.008
	(0.025)	(0.012)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.183***	0.066***
	(0.020)	(0.010)
intra-group funding	-0.099	0.122***
	(0.063)	(0.030)
Credit constrained	-0.091***	-0.093***
	(0.024)	(0.012)
Sample size	27,832	27,627
R^2	0.527	0.777
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.492	0.736
R^2 with X and no fixed effects	0.144	0.287
R^2 with X and country fixed effects	0.175	0.53
R^2 with X and industry fixed effects	0.304	0.460
R^2 with X and year fixed effects	0.145	0.287
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.332	0.677
R^2 with X and slopes varying by country	0.226	0.459
R^2 with X and slopes varying by industry	0.305	0.445
R^2 with X and slopes varying by year	0.147	0.290

Note: In this table, the regressors log(employment) and log(1+investment) use data from the Orbis database. Other variables are from EIBIS. See notes to Appendix Table A.4 for more details.

Table A.18. Predictors of the dispersion of the marginal revenue products of capital and labor, no sampling weight.

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.025	0.041**
	(0.040)	(0.021)
10-19 years	-0.195***	0.091***
	(0.038)	(0.020)
20+ years	-0.352***	0.123***
	(0.037)	(0.019)
log(employment)	0.054***	-0.029***
	(0.007)	(0.004)
Subsidiary	0.404***	0.128***
	(0.024)	(0.012)
Exporter	0.148***	0.274***
	(0.019)	(0.010)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.121***	0.152***
	(0.027)	(0.013)
Share of high energy efficiency commercial building stock	-0.281***	0.065***
	(0.023)	(0.011)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.279***	0.098***
	(0.032)	(0.016)
at maximum capacity	0.145***	0.048***
	(0.016)	(0.008)
substantially below full capacity	-0.283***	-0.145***
	(0.025)	(0.012)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.039*	0.029***
	(0.020)	(0.011)
Minor	0.043**	0.010
	(0.018)	(0.009)
Availability of staff with the right skills		
Major	0.052***	-0.061***
	(0.019)	(0.010)
Minor	0.036*	0.003
	(0.019)	(0.010)
Energy costs		
Major	-0.161***	-0.090***
	(0.021)	(0.011)
Minor	-0.105***	-0.048***
	(0.018)	(0.010)
Access to digital infrastructure		
Major	0.064**	0.023*
	(0.029)	(0.014)
Minor	0.025	0.035***
	(0.018)	(0.009)
Labor market regulations		
Major	-0.007	-0.093***
	(0.021)	(0.011)
Minor	-0.005	-0.045***
	(0.019)	(0.010)
Business regulations and taxation		
Major	-0.085***	0.025**
	(0.022)	(0.011)
Minor	0.002	0.036***
	(0.019)	(0.010)
Availability of adequate transport infrastructure		
Major	0.017	0.089***
	(0.022)	(0.012)
Minor	0.023	0.036***
	(0.018)	(0.009)
Availability of finance		

Major	-0.084***	-0.089***
	(0.021)	(0.011)
Minor	-0.014	-0.060***
	(0.018)	(0.010)
Uncertainty about future		
Major	0.067***	0.026**
	(0.022)	(0.011)
Minor	0.054***	0.030***
	(0.020)	(0.010)
Adjustment		
Investment, log(1 + investment)	-0.067***	0.052***
	(0.003)	(0.002)
Percent change in employment in the last three years	0.110***	-0.112***
	(0.018)	(0.009)
Investment over the last three years (omitted category: about the right amount)	-0.269***	-0.110***
too much	(0.034)	(0.018)
	-0.055***	-0.076***
too little	(0.019)	(0.009)
	-0.174	-0.082
company did not exist three years ago	(0.182)	(0.093)
Investment priority in the next three years (omitted category: no investment planned)	-0.090***	0.013
replacing capacity	(0.026)	(0.013)
	-0.126***	0.027**
capacity expansion for existing products or services	(0.027)	(0.014)
	-0.075***	0.029**
developing new products, processes or services	(0.029)	(0.014)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.246***	0.044***
	(0.023)	(0.012)
intra-group funding	-0.166**	0.172***
	(0.073)	(0.037)
Credit constrained	-0.082***	-0.086***
	(0.027)	(0.013)
Sample size	29,351	29,021
R^2	0.425	0.724
Memorandum		
R^2 with country $\times$ industry $\times$ year fixed effects and no X	0.385	0.673
R^2 with X and no fixed effects	0.108	0.251
R^2 with X and country fixed effects	0.142	0.472
R^2 with X and industry fixed effects	0.240	0.410
R^2 with X and year fixed effects	0.109	0.251
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.270	0.621
R^2 with X and slopes varying by country	0.195	0.437
R^2 with X and slopes varying by industry	0.286	0.431
R^2 with X and slopes varying by year	0.112	0.254

Note: In this table, we use equal (rather than sampling) weights. See notes to Appendix Table A.4 for more details.

Table A.19. Marginal R^2 of adding a group of variables to a specification with fixed effects, no sampling weight.

Row	Group of variables	No fixed effects (1)	Country (2)	Industry (3)	Year (4)	Country + Industry + Year (5)	Country × Industry × Year (6)
	Panel A: MRPK						
(1)	Demographics	0.030	0.026	0.018	0.030	0.015	0.013
(2)	Quality of capital	0.013	0.007	0.015	0.013	0.008	0.007
(3)	Capacity utilization	0.014	0.014	0.009	0.014	0.009	0.007
(4)	Obstacles to investment	0.021	0.015	0.010	0.021	0.006	0.005
(5)	Adjustment	0.044	0.048	0.017	0.044	0.017	0.014
(6)	Source of funds	0.022	0.021	0.014	0.022	0.011	0.009
(7)	"Compensating differentials"	0.071	0.070	0.041	0.071	0.036	0.029
(8)	"Distortions"	0.060	0.054	0.032	0.060	0.027	0.022
(9)	All variables	0.108	0.103	0.066	0.108	0.058	0.047
	Panel B: MRPL						
(10)	Demographics	0.124	0.041	0.096	0.124	0.037	0.029
(11)	Quality of capital	0.027	0.008	0.019	0.027	0.006	0.006
(12)	Capacity utilization	0.016	0.008	0.013	0.016	0.006	0.004
(13)	Obstacles to investment	0.068	0.024	0.046	0.068	0.013	0.010
(14)	Adjustment	0.089	0.035	0.088	0.089	0.035	0.026
(15)	Source of funds	0.030	0.006	0.024	0.030	0.004	0.003
(16)	"Compensating differentials"	0.120	0.057	0.110	0.120	0.053	0.041
(17)	"Distortions"	0.161	0.047	0.122	0.161	0.035	0.026
(18)	All variables	0.251	0.090	0.203	0.250	0.072	0.057
	Panel C: MRPL - MRPK						
(19)	Demographics	0.079	0.048	0.047	0.079	0.023	0.017
(20)	Quality of capital	0.037	0.017	0.034	0.037	0.016	0.013
(21)	Capacity utilization	0.001	0.003	0.000	0.001	0.001	0.001
(22)	Obstacles to investment	0.023	0.013	0.012	0.023	0.005	0.004
(23)	Adjustment	0.140	0.097	0.096	0.140	0.059	0.046
(24)	Source of funds	0.019	0.014	0.013	0.019	0.009	0.007
(25)	"Compensating differentials"	0.167	0.114	0.120	0.167	0.073	0.058
(26)	"Distortions"	0.107	0.064	0.066	0.107	0.032	0.024
(27)	All variables	0.226	0.144	0.166	0.225	0.092	0.074
	Panel D: Productivity gain						
(28)	Demographics	0.390	0.145	0.289	0.390	0.112	0.086
(29)	Quality of capital	0.104	0.036	0.079	0.104	0.029	0.026
(30)	Capacity utilization	0.033	0.015	0.028	0.033	0.011	0.007
(31)	Obstacles to investment	0.187	0.067	0.125	0.187	0.035	0.027
(32)	Adjustment	0.364	0.173	0.326	0.364	0.148	0.111
(33)	Source of funds	0.085	0.019	0.068	0.085	0.014	0.010
(34)	"Compensating differentials"	0.458	0.236	0.396	0.458	0.198	0.155
(35)	"Distortions"	0.499	0.161	0.369	0.499	0.110	0.081
(36)	All variables	0.838	0.335	0.671	0.834	0.255	0.203

Note: In this table, we use equal (rather than sampling) weights. See notes to Table 5 for more details.

Table A.20. R^2 for various sets of fixed effects, no sampling weight.

		Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(2)	(3)	(4)	(5)	(6)
	Dispersion					
(1)	MRPK	0.041	0.179	0.001	0.216	0.385
(2)	MRPL	0.386	0.213	0.000	0.552	0.673
(3)	MRPL - MRPK	0.168	0.119	0.000	0.283	0.449
(4)	**Productivity gain**	1.155	0.572	-0.001	1.605	2.004

(The column group header spanning columns (2)–(6) reads "List of fixed effects".)

Note: In this table, we use equal (rather than sampling) weights. See notes to Table 4 for more details.

Table A.21. Predictors of the dispersion of the marginal revenue products of capital and labor, firm-level cost shares are used to compute marginal revenue products.

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.009	0.020
	(0.039)	(0.016)
10-19 years	-0.218***	0.039***
	(0.035)	(0.015)
20+ years	-0.339***	0.087***
	(0.034)	(0.014)
log(employment)	0.031***	0.005**
	(0.005)	(0.003)
Subsidiary	0.351***	0.087***
	(0.019)	(0.008)
Exporter	0.135***	0.174***
	(0.016)	(0.007)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.123***	0.113***
	(0.023)	(0.009)
Share of high energy efficiency commercial building stock	-0.260***	0.031***
	(0.020)	(0.008)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.255***	0.083***
	(0.026)	(0.012)
at maximum capacity	0.134***	0.026***
	(0.014)	(0.006)
substantially below full capacity	-0.301***	-0.065***
	(0.022)	(0.010)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.078***	0.011
	(0.018)	(0.008)
Minor	0.058***	-0.002
	(0.016)	(0.007)
Availability of staff with the right skills		
Major	0.065***	-0.035***
	(0.017)	(0.007)
Minor	0.036**	0.010
	(0.017)	(0.007)
Energy costs		
Major	-0.132***	-0.070***
	(0.018)	(0.008)
Minor	-0.092***	-0.046***
	(0.015)	(0.007)
Access to digital infrastructure		
Major	0.040*	0.009
	(0.023)	(0.009)
Minor	0.003	0.031***
	(0.016)	(0.007)
Labor market regulations		
Major	0.003	-0.075***
	(0.018)	(0.008)
Minor	-0.018	-0.043***
	(0.016)	(0.007)
Business regulations and taxation		
Major	-0.041**	0.007
	(0.019)	(0.008)
Minor	0.023	0.022***
	(0.016)	(0.007)
Availability of adequate transport infrastructure		
Major	-0.030	0.041***
	(0.019)	(0.009)
Minor	0.013	0.034***
	(0.015)	(0.007)
Availability of finance		

Major	-0.058***	-0.041***
	(0.018)	(0.008)
Minor	-0.006	-0.028***
	(0.015)	(0.007)
Uncertainty about future		
Major	0.052***	0.040***
	(0.018)	(0.008)
Minor	0.042**	0.031***
	(0.017)	(0.007)
Adjustment		
Investment, log(1 + investment)	-0.057***	0.032***
	(0.003)	(0.001)
Percent change in employment in the last three years	0.090***	-0.156***
	(0.015)	(0.007)
Investment over the last three years (omitted category: about the right amount)	-0.232***	-0.075***
too much	(0.030)	(0.013)
	-0.063***	-0.040***
too little	(0.016)	(0.007)
	-0.269	-0.052
company did not exist three years ago	(0.179)	(0.073)
Investment priority in the next three years (omitted category: no investment planned)	-0.054**	0.004
replacing capacity	(0.023)	(0.009)
	-0.068***	0.005
capacity expansion for existing products or services	(0.024)	(0.010)
	-0.056**	0.016
developing new products, processes or services	(0.025)	(0.010)
Source of funds (omitted category: external finance)		
internal funds or retained earnings		
	0.189***	0.072***
intra-group funding	(0.020)	(0.008)
	-0.124**	0.117***
Credit constrained	(0.062)	(0.024)
	-0.099***	-0.101***
	(0.024)	(0.010)
Sample size	27,816	27,325
R²	0.527	0.805
Memorandum		
R² with country × industry × year fixed effects and no *X*	0.492	0.773
R² with *X* and no fixed effects	0.138	0.294
R² with *X* and country fixed effects	0.170	0.685
R² with *X* and industry fixed effects	0.302	0.338
R² with *X* and year fixed effects	0.139	0.294
R² with *X* and country fixed effects, industry fixed effects and year fixed effects	0.329	0.707
R² with *X* and slopes varying by country	0.221	0.570
R² with *X* and slopes varying by industry	0.300	0.398
R² with *X* and slopes varying by year	0.141	0.298

Note: In this table, the outcome variables (marginal revenue products for labor and capital) are computed using firm-level (rather than country×industry) cost shares. See notes to Appendix Table A.4 for more details.

Table A.22. Marginal R^2 of adding a group of variables to a specification with fixed effects, firm-level cost shares are used to compute marginal revenue products.

Row	Group of variables	No fixed effects (1)	Country (2)	Industry (3)	Year (4)	Country + Industry + Year (5)	Country × Industry × Year (6)
	Panel A: MRPK						
(1)	Demographics	0.049	0.039	0.022	0.049	0.018	0.013
(2)	Quality of capital	0.016	0.009	0.016	0.016	0.008	0.007
(3)	Capacity utilization	0.016	0.016	0.009	0.016	0.010	0.008
(4)	Obstacles to investment	0.024	0.017	0.011	0.024	0.005	0.004
(5)	Adjustment	0.062	0.064	0.017	0.062	0.017	0.013
(6)	Source of funds	0.027	0.022	0.015	0.027	0.011	0.008
(7)	"Compensating differentials"	0.094	0.088	0.042	0.093	0.036	0.028
(8)	"Distortions"	0.085	0.070	0.038	0.085	0.029	0.021
(9)	All variables	0.138	0.124	0.070	0.138	0.058	0.045
	Panel B: MRPL						
(10)	Demographics	0.147	0.044	0.114	0.147	0.031	0.023
(11)	Quality of capital	0.031	0.004	0.019	0.032	0.003	0.003
(12)	Capacity utilization	0.008	0.003	0.008	0.008	0.003	0.002
(13)	Obstacles to investment	0.066	0.015	0.049	0.066	0.009	0.007
(14)	Adjustment	0.119	0.039	0.099	0.119	0.027	0.021
(15)	Source of funds	0.046	0.005	0.037	0.046	0.004	0.003
(16)	"Compensating differentials"	0.147	0.053	0.115	0.147	0.037	0.029
(17)	"Distortions"	0.191	0.045	0.153	0.191	0.031	0.023
(18)	All variables	0.294	0.073	0.233	0.294	0.051	0.041
	Panel C: MRPL - MRPK						
(19)	Demographics	0.099	0.068	0.049	0.099	0.024	0.016
(20)	Quality of capital	0.034	0.013	0.031	0.034	0.011	0.010
(21)	Capacity utilization	0.006	0.009	0.002	0.006	0.003	0.002
(22)	Obstacles to investment	0.023	0.013	0.013	0.023	0.004	0.003
(23)	Adjustment	0.181	0.120	0.101	0.180	0.053	0.040
(24)	Source of funds	0.025	0.014	0.015	0.025	0.007	0.006
(25)	"Compensating differentials"	0.211	0.140	0.126	0.210	0.064	0.050
(26)	"Distortions"	0.133	0.081	0.073	0.133	0.033	0.023
(27)	All variables	0.269	0.165	0.171	0.268	0.081	0.064
	Panel D: Productivity gain						
(28)	Demographics	0.460	0.168	0.334	0.460	0.096	0.069
(29)	Quality of capital	0.109	0.020	0.075	0.111	0.016	0.015
(30)	Capacity utilization	0.018	0.008	0.017	0.018	0.005	0.003
(31)	Obstacles to investment	0.180	0.043	0.133	0.180	0.025	0.019
(32)	Adjustment	0.477	0.200	0.360	0.476	0.120	0.092
(33)	Source of funds	0.130	0.016	0.103	0.130	0.012	0.010
(34)	"Compensating differentials"	0.564	0.245	0.415	0.563	0.147	0.115
(35)	"Distortions"	0.590	0.166	0.452	0.590	0.100	0.073
(36)	All variables	0.979	0.303	0.751	0.978	0.189	0.152

Note: In this table, the outcome variables (marginal revenue products for labor and capital) are computed using firm-level (rather than country×industry) cost shares. See notes to Table 5 for more details.

Table A.23. R^2 for various sets of fixed effects, firm-level cost shares are used to compute marginal revenue products.

		List of fixed effects				
		Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(2)	(3)	(4)	(5)	(6)
	Dispersion					
(1)	MRPK	0.053	0.239	0.000	0.275	0.492
(2)	MRPL	0.621	0.118	0.000	0.662	0.773
(3)	MRPL - MRPK	0.222	0.215	0.000	0.412	0.594
(4)	**Productivity gain**	1.810	0.406	0.000	2.000	2.363

Note: In this table, the outcome variables (marginal revenue products for labor and capital) are computed using firm-level (rather than country×industry) cost shares. See notes to Table 4 for more details.

Table A.24. Predictors of the dispersion of the marginal revenue products of capital and labor, Manufacturing

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.041	0.014
	(0.072)	(0.038)
10-19 years	-0.158**	0.020
	(0.065)	(0.034)
20+ years	-0.274***	0.021
	(0.064)	(0.033)
log(employment)	0.021**	-0.008
	(0.009)	(0.005)
Subsidiary	0.167***	0.215***
	(0.028)	(0.016)
Exporter	0.025	0.253***
	(0.027)	(0.015)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.257***	0.140***
	(0.035)	(0.020)
Share of high energy efficiency commercial building stock	-0.269***	0.070***
	(0.032)	(0.018)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.289***	0.119***
	(0.039)	(0.022)
at maximum capacity	0.130***	0.050***
	(0.021)	(0.012)
substantially below full capacity	-0.225***	-0.063***
	(0.030)	(0.018)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.111***	0.013
	(0.027)	(0.014)
Minor	0.132***	0.031**
	(0.024)	(0.013)
Availability of staff with the right skills		
Major	0.005	-0.064***
	(0.028)	(0.015)
Minor	0.042	0.015
	(0.028)	(0.015)
Energy costs		
Major	-0.054*	-0.083***
	(0.029)	(0.017)
Minor	-0.086***	-0.036***
	(0.025)	(0.014)
Access to digital infrastructure		
Major	0.085**	0.002
	(0.037)	(0.020)
Minor	-0.007	0.054***
	(0.026)	(0.014)
Labor market regulations		
Major	-0.060**	-0.077***
	(0.030)	(0.016)
Minor	-0.070***	-0.059***
	(0.026)	(0.014)
Business regulations and taxation		
Major	-0.03	0.025
	(0.028)	(0.015)
Minor	0.078***	0.041***
	(0.025)	(0.014)
Availability of adequate transport infrastructure		

Major	-0.03	0.064***
	(0.031)	(0.018)
Minor	-0.007	0.032**
	(0.024)	(0.013)
Availability of finance		
Major	-0.078***	-0.096***
	(0.027)	(0.016)
Minor	0.022	-0.080***
	(0.025)	(0.014)
Uncertainty about future		
Major	0.058**	0.026
	(0.029)	(0.017)
Minor	0.031	0.028*
	(0.026)	(0.016)
Adjustment		
Investment, log(1 + investment)	-0.029***	0.054***
	(0.004)	(0.003)
Percent change in employment in the last three years	0.074***	-0.088***
	(0.022)	(0.013)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.227***	-0.195***
	(0.046)	(0.026)
too little	-0.009	-0.087***
	(0.025)	(0.014)
company did not exist three years ago	-0.055	0.223
	(0.344)	(0.159)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.017	0.070***
	(0.043)	(0.025)
capacity expansion for existing products or services	-0.067	0.074***
	(0.044)	(0.025)
developing new products, processes or services	-0.050	0.087***
	(0.044)	(0.025)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.219***	0.121***
	(0.033)	(0.017)
intra-group funding	0.038	0.212***
	(0.085)	(0.044)
Credit constrained	-0.112***	-0.060***
	(0.037)	(0.019)
Sample size	8,278	8,217
R^2	0.540	0.826
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.508	0.774
R^2 with X and no fixed effects	0.101	0.396
R^2 with X and country fixed effects	0.196	0.688
R^2 with X and industry fixed effects	0.148	0.447
R^2 with X and year fixed effects	0.103	0.180
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.230	0.396
R^2 with X and slopes varying by country	0.302	0.654
R^2 with X and slopes varying by industry	0.250	0.513
R^2 with X and slopes varying by year	0.111	0.407

Note: In this table, the sample is restricted to firms in manufacturing. See notes to Appendix Table A.4 for more details.

Table A.25. Predictors of the dispersion of the marginal revenue products of capital and labor, Services

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	0.104*	0.018
	(0.063)	(0.031)
10-19 years	-0.138**	0.020
	(0.057)	(0.029)
20+ years	-0.301***	0.035
	(0.055)	(0.028)
log(employment)	0.008	-0.054***
	(0.009)	(0.005)
Subsidiary	0.467***	0.136***
	(0.033)	(0.018)
Exporter	0.237***	0.275***
	(0.024)	(0.014)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.021	0.211***
	(0.039)	(0.019)
Share of high energy efficiency commercial building stock	-0.256***	0.006
	(0.036)	(0.016)
Capacity utilization (omitted category: somewhat below full capacity)		
above maximum capacity	0.220***	0.103***
	(0.049)	(0.027)
at maximum capacity	0.116***	0.060***
	(0.023)	(0.011)
substantially below full capacity	-0.337***	-0.130***
	(0.043)	(0.021)
Obstacles to investment (omitted category: not an obstacle at all)		
Demand for products or services		
Major	0.018	-0.048***
	(0.030)	(0.017)
Minor	-0.02	-0.034***
	(0.028)	(0.013)
Availability of staff with the right skills		
Major	0.134***	-0.007
	(0.028)	(0.014)
Minor	0.076***	0.011
	(0.028)	(0.014)
Energy costs		
Major	-0.210***	-0.123***
	(0.032)	(0.015)
Minor	-0.118***	-0.090***
	(0.025)	(0.014)
Access to digital infrastructure		
Major	-0.002	0.064***
	(0.037)	(0.018)
Minor	0.022	0.038***
	(0.027)	(0.013)
Labor market regulations		
Major	-0.033	-0.093***
	(0.030)	(0.015)
Minor	-0.037	-0.063***
	(0.028)	(0.013)
Business regulations and taxation		
Major	-0.068**	0.026*
	(0.032)	(0.015)
Minor	0.018	0.045***
	(0.029)	(0.015)
Availability of adequate transport infrastructure		

Major	0.063**	0.102***
	(0.028)	(0.016)
Minor	0.079***	0.073***
	(0.026)	(0.014)
Availability of finance		
Major	-0.069**	-0.083***
	(0.032)	(0.016)
Minor	-0.011	-0.053***
	(0.025)	(0.014)
Uncertainty about future		
Major	0.087***	0.046***
	(0.032)	(0.016)
Minor	0.047	0.048***
	(0.029)	(0.014)
Adjustment		
Investment, log(1 + investment)	-0.071***	0.041***
	(0.005)	(0.002)
Percent change in employment in the last three years	0.040	-0.157***
	(0.026)	(0.014)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.323***	-0.077***
	(0.049)	(0.026)
too little	-0.139***	-0.085***
	(0.028)	(0.014)
company did not exist three years ago	-0.402	-0.023
	(0.341)	(0.133)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	0.006	-0.059***
	(0.039)	(0.019)
capacity expansion for existing products or services	0.016	-0.039**
	(0.038)	(0.019)
developing new products, processes or services	0.005	-0.059***
	(0.041)	(0.020)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.169***	0.044**
	(0.034)	(0.017)
intra-group funding	-0.185*	0.110**
	(0.107)	(0.052)
Credit constrained	-0.139***	-0.157***
	(0.043)	(0.021)
Sample size	11,691	11,574
R^2	0.447	0.715
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.386	0.669
R^2 with X and no fixed effects	0.170	0.291
R^2 with X and country fixed effects	0.194	0.439
R^2 with X and industry fixed effects	0.284	0.468
R^2 with X and year fixed effects	0.170	0.291
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.300	0.630
R^2 with X and slopes varying by country	0.302	0.472
R^2 with X and slopes varying by industry	0.284	0.445
R^2 with X and slopes varying by year	0.177	0.297

Note: In this table, the sample is restricted to firms in the service sector. See notes to Appendix Table A.4 for more details.

Table A.26. Predictors of the dispersion of the marginal revenue products of capital and labor, Construction and utilities

Regressor	Dependent variable	
	log(MRPK)	log(MRPL)
Demographics		
Firm age (omitted category: less than 5 years)		
5-9 years	-0.059	0.023
	(0.065)	(0.031)
10-19 years	-0.285***	0.114***
	(0.059)	(0.029)
20+ years	-0.400***	0.195***
	(0.059)	(0.029)
log(employment)	0.108***	0.022***
	(0.012)	(0.006)
Subsidiary	0.479***	0.053***
	(0.045)	(0.020)
Exporter	0.088**	0.183***
	(0.035)	(0.018)
Quality of capital and other inputs		
Share of state-of-the art machinery and equipment, including ICT	-0.128***	0.028
	(0.046)	(0.021)
Share of high energy efficiency commercial building stock		
	-0.249***	0.103***
Capacity utilization (omitted category: somewhat below full capacity)	(0.036)	(0.019)
above maximum capacity		
	0.204***	0.084***
at maximum capacity	(0.046)	(0.023)
	0.096***	0.019
substantially below full capacity	(0.027)	(0.014)
	-0.444***	-0.181***
Obstacles to investment (omitted category: not an obstacle at all)	(0.044)	(0.021)
Demand for products or services		
Major	0.058*	0.056***
	(0.035)	(0.017)
Minor	0.047	0.018
	(0.029)	(0.016)
Availability of staff with the right skills		
Major	0.077**	-0.052***
	(0.033)	(0.016)
Minor	-0.012	0.021
	(0.034)	(0.015)
Energy costs		
Major	-0.200***	-0.050***
	(0.034)	(0.017)
Minor	-0.138***	-0.016
	(0.028)	(0.015)
Access to digital infrastructure		
Major	0.146***	-0.014
	(0.045)	(0.022)
Minor	0.061**	-0.013
	(0.028)	(0.015)
Labor market regulations		
Major	0.142***	-0.038**
	(0.034)	(0.017)
Minor	0.097***	-0.004
	(0.031)	(0.016)
Business regulations and taxation		
Major	-0.114***	0.023
	(0.036)	(0.018)
Minor	-0.077**	-0.001
	(0.031)	(0.017)

Availability of adequate transport infrastructure		
Major	-0.174***	0.049**
	(0.041)	(0.021)
Minor	-0.057*	0.027*
	(0.031)	(0.015)
Availability of finance		
Major	-0.058*	-0.070***
	(0.033)	(0.017)
Minor	-0.036	-0.055***
	(0.029)	(0.016)
Uncertainty about future		
Major	0.087**	0.040**
	(0.036)	(0.019)
Minor	0.107***	0.011
	(0.033)	(0.016)
Adjustment		
Investment, log(1 + investment)	-0.075***	0.051***
	(0.005)	(0.003)
Percent change in employment in the last three years	0.209***	-0.071***
	(0.026)	(0.014)
Investment over the last three years (omitted category: about the right amount)		
too much	-0.156**	-0.101***
	(0.065)	(0.032)
too little	0.02	-0.035**
	(0.032)	(0.014)
company did not exist three years ago	-0.429*	-0.387***
	(0.258)	(0.142)
Investment priority in the next three years (omitted category: no investment planned)		
replacing capacity	-0.170***	-0.029
	(0.038)	(0.019)
capacity expansion for existing products or services	-0.154***	-0.014
	(0.040)	(0.019)
developing new products, processes or services	-0.097**	0.007
	(0.046)	(0.022)
Source of funds (omitted category: external finance)		
internal funds or retained earnings	0.213***	0.020
	(0.038)	(0.020)
intra-group funding	-0.443***	0.300***
	(0.169)	(0.094)
Credit constrained	0.01	-0.056***
	(0.046)	(0.021)
Sample size	7,863	7,864
R^2	0.543	0.762
Memorandum		
R^2 with country × industry × year fixed effects and no X	0.492	0.718
R^2 with X and no fixed effects	0.211	0.336
R^2 with X and country fixed effects	0.288	0.684
R^2 with X and industry fixed effects	0.338	0.344
R^2 with X and year fixed effects	0.212	0.336
R^2 with X and country fixed effects, industry fixed effects and year fixed effects	0.400	0.696
R^2 with X and slopes varying by country	0.409	0.638
R^2 with X and slopes varying by industry	0.318	0.390
R^2 with X and slopes varying by year	0.225	0.346

Note: In this table, the sample is restricted to firms in the construction and utility sectors. See notes to Appendix Table A.4 for more details.

Table A.27. Marginal R^2 of adding a group of variables to a specification with fixed effects, Manufacturing

		List of fixed effects					
Row	Group of variables	No fixed effects	Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: MRPK						
(1)	Demographics	0.016	0.010	0.015	0.016	0.010	0.006
(2)	Quality of capital	0.027	0.009	0.028	0.027	0.011	0.013
(3)	Capacity utilization	0.015	0.017	0.011	0.016	0.013	0.009
(4)	Obstacles to investment	0.030	0.011	0.024	0.030	0.008	0.008
(5)	Adjustment	0.012	0.010	0.012	0.013	0.011	0.009
(6)	Source of funds	0.023	0.010	0.018	0.023	0.007	0.006
(7)	"Compensating differentials"	0.054	0.035	0.049	0.054	0.033	0.029
(8)	"Distortions"	0.058	0.029	0.047	0.057	0.024	0.018
(9)	All variables	0.101	0.063	0.086	0.102	0.054	0.046
	Panel B: MRPL						
(10)	Demographics	0.181	0.070	0.140	0.180	0.065	0.048
(11)	Quality of capital	0.038	0.011	0.026	0.039	0.010	0.006
(12)	Capacity utilization	0.010	0.007	0.011	0.010	0.007	0.004
(13)	Obstacles to investment	0.094	0.021	0.068	0.094	0.017	0.015
(14)	Adjustment	0.190	0.074	0.135	0.189	0.063	0.044
(15)	Source of funds	0.050	0.006	0.040	0.050	0.005	0.006
(16)	"Compensating differentials"	0.215	0.092	0.159	0.215	0.081	0.057
(17)	"Distortions"	0.236	0.069	0.179	0.235	0.062	0.048
(18)	All variables	0.396	0.117	0.304	0.395	0.104	0.078
	Panel C: MRPL - MRPK						
(19)	Demographics	0.098	0.041	0.076	0.099	0.041	0.034
(20)	Quality of capital	0.058	0.024	0.051	0.057	0.025	0.024
(21)	Capacity utilization	0.005	0.005	0.001	0.005	0.002	0.001
(22)	Obstacles to investment	0.034	0.016	0.024	0.033	0.010	0.010
(23)	Adjustment	0.147	0.072	0.125	0.146	0.063	0.051
(24)	Source of funds	0.025	0.008	0.016	0.025	0.006	0.005
(25)	"Compensating differentials"	0.192	0.096	0.162	0.191	0.088	0.075
(26)	"Distortions"	0.127	0.049	0.095	0.127	0.040	0.033
(27)	All variables	0.283	0.124	0.230	0.283	0.107	0.090
	Panel D: Productivity gain						
(28)	Demographics	0.566	0.220	0.437	0.565	0.207	0.158
(29)	Quality of capital	0.148	0.051	0.109	0.149	0.048	0.035
(30)	Capacity utilization	0.022	0.013	0.022	0.022	0.012	0.006
(31)	Obstacles to investment	0.261	0.065	0.187	0.260	0.050	0.045
(32)	Adjustment	0.649	0.267	0.483	0.644	0.227	0.166
(33)	Source of funds	0.143	0.019	0.110	0.143	0.015	0.017
(34)	"Compensating differentials"	0.739	0.325	0.565	0.738	0.289	0.215
(35)	"Distortions"	0.714	0.215	0.538	0.713	0.190	0.150
(36)	All variables	1.278	0.405	0.991	1.275	0.357	0.276

Note: The sample is restricted to firms in manufacturing. See notes to Table 5 for more details.

Table A.28. Marginal R^2 of adding a group of variables to a specification with fixed effects, Services

Row	Group of variables	No fixed effects	Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(1)	(2)	(3)	(4)	(5)	(6)
	Panel A: MRPK						
(1)	Demographics	0.074	0.067	0.041	0.074	0.035	0.027
(2)	Quality of capital	0.007	0.004	0.010	0.007	0.007	0.005
(3)	Capacity utilization	0.007	0.008	0.007	0.007	0.009	0.007
(4)	Obstacles to investment	0.028	0.023	0.011	0.028	0.008	0.007
(5)	Adjustment	0.072	0.064	0.033	0.072	0.030	0.024
(6)	Source of funds	0.058	0.051	0.023	0.058	0.020	0.015
(7)	"Compensating differentials"	0.111	0.099	0.056	0.111	0.050	0.040
(8)	"Distortions"	0.105	0.096	0.055	0.105	0.049	0.037
(9)	All variables	0.170	0.155	0.091	0.170	0.083	0.066
	Panel B: MRPL						
(10)	Demographics	0.177	0.098	0.075	0.177	0.031	0.024
(11)	Quality of capital	0.019	0.006	0.020	0.020	0.008	0.007
(12)	Capacity utilization	0.008	0.007	0.008	0.008	0.007	0.004
(13)	Obstacles to investment	0.078	0.048	0.036	0.078	0.014	0.012
(14)	Adjustment	0.061	0.026	0.061	0.061	0.023	0.017
(15)	Source of funds	0.043	0.023	0.028	0.043	0.006	0.006
(16)	"Compensating differentials"	0.123	0.090	0.085	0.123	0.046	0.038
(17)	"Distortions"	0.187	0.087	0.101	0.187	0.028	0.023
(18)	All variables	0.291	0.163	0.168	0.291	0.066	0.058
	Panel C: MRPL - MRPK						
(19)	Demographics	0.090	0.052	0.060	0.090	0.032	0.026
(20)	Quality of capital	0.028	0.013	0.030	0.028	0.014	0.013
(21)	Capacity utilization	0.002	0.003	0.001	0.002	0.001	0.002
(22)	Obstacles to investment	0.025	0.012	0.018	0.025	0.007	0.006
(23)	Adjustment	0.158	0.097	0.123	0.158	0.071	0.050
(24)	Source of funds	0.026	0.020	0.023	0.027	0.015	0.012
(25)	"Compensating differentials"	0.180	0.110	0.145	0.180	0.083	0.063
(26)	"Distortions"	0.130	0.074	0.095	0.130	0.048	0.038
(27)	All variables	0.251	0.150	0.198	0.251	0.111	0.091
	Panel D: Productivity gain						
(28)	Demographics	0.511	0.269	0.236	0.511	0.095	0.075
(29)	Quality of capital	0.077	0.028	0.080	0.079	0.032	0.030
(30)	Capacity utilization	0.018	0.016	0.017	0.018	0.013	0.008
(31)	Obstacles to investment	0.211	0.122	0.106	0.211	0.039	0.033
(32)	Adjustment	0.296	0.140	0.279	0.296	0.123	0.087
(33)	Source of funds	0.104	0.051	0.084	0.106	0.021	0.020
(34)	"Compensating differentials"	0.456	0.297	0.352	0.456	0.184	0.146
(35)	"Distortions"	0.564	0.249	0.335	0.564	0.097	0.080
(36)	All variables	0.931	0.496	0.604	0.931	0.247	0.214

Note: The sample is restricted to firms in services. See notes to Table 5 for more details.

Table A.29. Marginal R^2 of adding a group of variables to a specification with fixed effects, Construction and utilities.

Row	Group of variables	No fixed effects (1)	Country (2)	Industry (3)	Year (4)	Country + Industry + Year (5)	Country × Industry × Year (6)
	Panel A: MRPK						
(1)	Demographics	0.048	0.042	0.021	0.048	0.018	0.015
(2)	Quality of capital	0.028	0.017	0.019	0.028	0.010	0.009
(3)	Capacity utilization	0.021	0.014	0.019	0.020	0.014	0.011
(4)	Obstacles to investment	0.062	0.045	0.021	0.062	0.010	0.010
(5)	Adjustment	0.095	0.102	0.024	0.095	0.024	0.017
(6)	Source of funds	0.023	0.015	0.017	0.023	0.011	0.008
(7)	"Compensating differentials"	0.145	0.135	0.061	0.144	0.049	0.036
(8)	"Distortions"	0.110	0.084	0.049	0.110	0.036	0.029
(9)	All variables	0.211	0.190	0.103	0.211	0.084	0.064
	Panel B: MRPL						
(10)	Demographics	0.153	0.070	0.150	0.152	0.045	0.034
(11)	Quality of capital	0.030	0.005	0.026	0.031	0.005	0.003
(12)	Capacity utilization	0.031	0.006	0.031	0.032	0.005	0.004
(13)	Obstacles to investment	0.077	0.014	0.074	0.077	0.008	0.006
(14)	Adjustment	0.153	0.070	0.166	0.152	0.045	0.031
(15)	Source of funds	0.051	0.008	0.045	0.050	0.005	0.003
(16)	"Compensating differentials"	0.187	0.079	0.195	0.187	0.056	0.041
(17)	"Distortions"	0.216	0.077	0.210	0.216	0.049	0.034
(18)	All variables	0.336	0.107	0.329	0.336	0.077	0.056
	Panel C: MRPL - MRPK						
(19)	Demographics	0.080	0.062	0.049	0.080	0.024	0.019
(20)	Quality of capital	0.051	0.022	0.047	0.051	0.013	0.011
(21)	Capacity utilization	0.005	0.008	0.000	0.005	0.004	0.004
(22)	Obstacles to investment	0.057	0.048	0.020	0.057	0.011	0.008
(23)	Adjustment	0.229	0.172	0.124	0.228	0.068	0.057
(24)	Source of funds	0.023	0.015	0.021	0.023	0.014	0.014
(25)	"Compensating differentials"	0.267	0.192	0.160	0.266	0.083	0.070
(26)	"Distortions"	0.147	0.111	0.084	0.146	0.044	0.037
(27)	All variables	0.352	0.249	0.227	0.350	0.113	0.095
	Panel D: Productivity gain						
(28)	Demographics	0.454	0.225	0.427	0.452	0.132	0.100
(29)	Quality of capital	0.119	0.028	0.110	0.121	0.022	0.015
(30)	Capacity utilization	0.072	0.016	0.067	0.075	0.009	0.008
(31)	Obstacles to investment	0.225	0.064	0.199	0.225	0.027	0.019
(32)	Adjustment	0.599	0.317	0.553	0.596	0.179	0.135
(33)	Source of funds	0.143	0.029	0.129	0.140	0.022	0.019
(34)	"Compensating differentials"	0.700	0.343	0.647	0.699	0.210	0.164
(35)	"Distortions"	0.655	0.275	0.603	0.654	0.154	0.112
(36)	All variables	1.139	0.447	1.041	1.136	0.277	0.215

Note: The sample is restricted to firms in the construction and utilities sectors. See notes to Table 5 for more details.

Table A.30. R^2 for various sets of fixed effects, by sector

| | | | | List of fixed effects | | |
		Country	Industry	Year	Country + Industry + Year	Country × Industry × Year
		(2)	(3)	(4)	(5)	(6)
Panel A: Manufacturing						
	Dispersion					
(1)	MRPK	0.135	0.057	0.001	0.178	0.508
(2)	MRPL	0.594	0.176	0.001	0.621	0.774
(3)	MRPL - MRPK	0.319	0.115	0.002	0.368	0.630
(4)	**Productivity gain**	1.804	0.548	0.004	1.904	2.398
Panel B: Services						
	Dispersion					
(1)	MRPK	0.043	0.198	0.000	0.229	0.386
(2)	MRPL	0.288	0.315	0.001	0.571	0.669
(3)	MRPL - MRPK	0.203	0.116	0.000	0.283	0.462
(4)	Productivity gain	0.945	0.817	0.003	1.646	2.009
Panel C: Construction and utilities						
	Dispersion					
(1)	MRPK	0.121	0.262	0.002	0.329	0.492
(2)	MRPL	0.590	0.020	0.000	0.627	0.718
(3)	MRPL - MRPK	0.228	0.223	0.003	0.441	0.569
(4)	Productivity gain	1.696	0.151	0.002	1.912	2.194

Note: The table report results for marginal contributions of fixed effects by sector. See notes to Table 4 for more details.

Table A.31. Machado-Mata decomposition of the marginal revenue products of capital and labor

Country b Country X	σ(MRPK)					σ(MRPL)				
	Own Own	Germany Own	Own Germany	Greece Own	Own Greece	Own Own	Germany Own	Own Germany	Greece Own	Own Greece
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Austria	1.38	0.91	1.43	1.62	1.62	0.75	0.62	0.76	0.91	0.83
Belgium	1.43	0.92	1.56	1.65	1.63	0.79	0.63	0.78	0.91	0.88
Bulgaria	1.34	0.98	1.36	1.70	1.56	1.02	0.67	1.01	0.90	1.08
Cyprus	1.72	0.94	1.77	1.75	1.83	1.15	0.67	1.36	0.94	1.38
Czech Rep.	1.15	0.86	1.37	1.68	1.47	0.73	0.62	0.77	0.82	0.79
Germany	0.92	0.92	0.92	1.66	0.94	0.61	0.61	0.61	0.91	0.69
Denmark	1.40	0.88	1.43	1.74	1.55	0.75	0.64	0.75	0.89	0.81
Estonia	1.56	0.98	1.53	1.75	1.70	1.03	0.65	0.97	0.90	1.08
Greece	1.64	0.94	1.66	1.64	1.64	0.91	0.69	0.91	0.91	0.91
Spain	1.04	0.88	1.14	1.59	1.14	0.71	0.64	0.71	0.90	0.78
Finland	1.26	0.93	1.33	1.75	1.56	0.75	0.61	0.80	0.88	0.95
France	1.09	0.91	1.08	1.73	1.07	0.60	0.65	0.59	0.91	0.62
Croatia	1.41	0.94	1.44	1.60	1.61	0.83	0.63	0.82	0.89	0.97
Hungary	1.29	0.93	1.32	1.71	1.41	0.85	0.64	0.84	0.91	0.94
Ireland	1.44	0.90	1.42	1.64	1.45	0.95	0.64	1.00	0.88	1.03
Italy	1.11	0.92	1.06	1.59	1.20	0.67	0.66	0.69	0.91	0.72
Lithuania	1.56	0.96	1.56	1.72	1.61	0.91	0.68	0.91	0.93	1.01
Luxembourg	1.88	0.91	2.39	1.73	2.47	0.88	0.66	1.08	0.93	1.08
Latvia	1.57	0.97	1.62	1.63	1.69	1.05	0.66	0.99	0.89	1.14
Malta	1.84	0.93	1.98	1.71	1.99	0.97	0.64	1.17	0.88	1.27
Netherlands	1.31	0.88	1.43	1.71	1.61	0.71	0.64	0.68	0.94	0.75
Poland	1.10	0.93	1.11	1.56	1.21	0.67	0.61	0.76	0.85	0.81
Portugal	1.41	0.93	1.52	1.57	1.63	0.82	0.65	0.92	0.90	0.90
Romania	1.31	0.96	1.33	1.63	1.43	0.88	0.65	0.92	0.88	0.96
Sweden	1.31	0.92	1.34	1.75	1.45	0.71	0.65	0.62	0.96	0.67
Slovenia	1.27	0.92	1.36	1.62	1.52	0.78	0.62	0.80	0.87	0.89
Slovakia	1.33	0.93	1.38	1.62	1.46	0.98	0.62	1.05	0.87	1.17
UK	1.12	0.89	1.17	1.63	1.20	0.63	0.63	0.63	0.92	0.70

Note: The table reports actual and counterfactual dispersion of marginal revenue products when all variables in **X** are used for the decomposition. See section V.D for more details.

Table A.32. Shapley R2 decomposition by variable.

Regressor	Shapley value decomposition of R^2		
	Dependent variable		
	log(MRPK)	log(MRPL)	log(MRPL) - log(MRPK)
	(1)	(2)	(3)
Demographics			
Firm age	0.0079	0.0206	0.0336
log(employment)	0.0088	0.0127	0.0151
Subsidiary	0.0077	0.0383	0.0049
Exporter	0.0006	0.0059	0.0061
Quality of capital and other inputs			
Share of state-of-the art machinery and equipment, including ICT	0.0023	0.0132	0.0142
Share of high energy efficiency commercial building stock	0.0099	0.0050	0.0147
Capacity utilization	0.0136	0.0069	0.0028
Obstacles to investment			
Demand for products or services	0.0005	0.0008	0.0005
Availability of staff with the right skills	0.0014	0.0096	0.0086
Energy costs	0.0101	0.0083	0.0016
Access to digital infrastructure	0.0008	0.0065	0.0020
Labor market regulations	0.0008	0.0025	0.0014
Business regulations and taxation	0.0022	0.0017	0.0009
Availability of adequate transport infrastructure	0.0009	0.0007	0.0003
Availability of finance	0.0023	0.0097	0.0024
Uncertainty about future	0.0005	0.0029	0.0009
Adjustment			
Investment, log(1 + investment)	0.0262	0.0482	0.1014
Percent change in employment in the last three years	0.0027	0.0011	0.0051
Investment over the last three years	0.0028	0.0077	0.0040
Investment priority in the next three years	0.0031	0.0032	0.0053
Source of funds	0.0128	0.0187	0.0164
Credit constrained	0.0012	0.0043	0.0005

Note: The table reports Shapley decomposition of R2 that is more detailed than in Table 6. See notes to Table 6 for more details.

Appendix Figure A.1. Machado-Mata decomposition of the marginal revenue products of capital and labor for Greece

Panel A. Marginal revenue product of capital (MRPK)
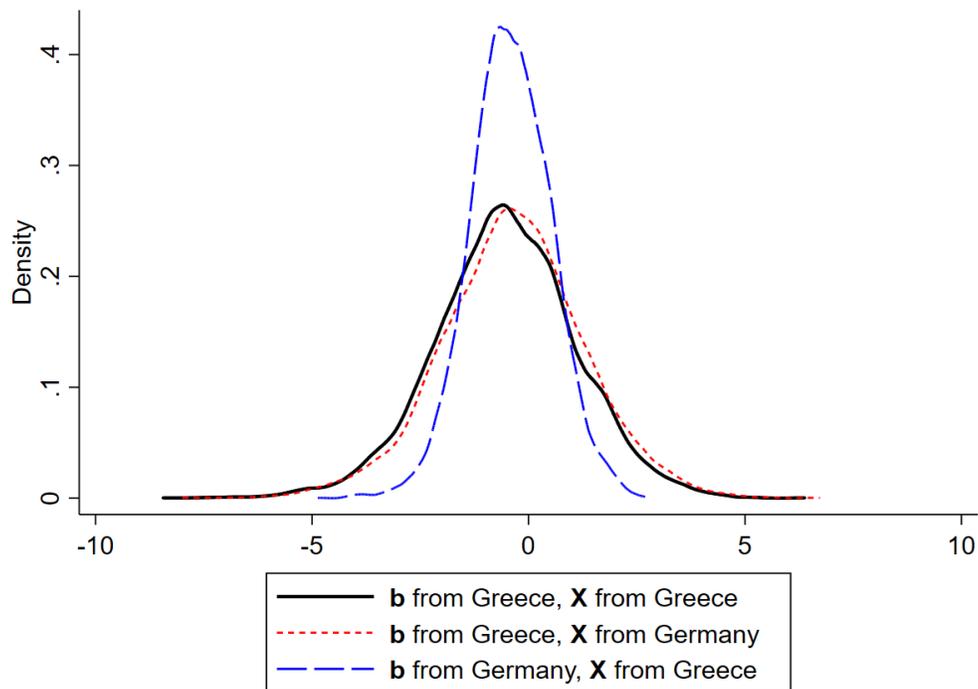
Panel B. Marginal revenue product of labor (MRPL)
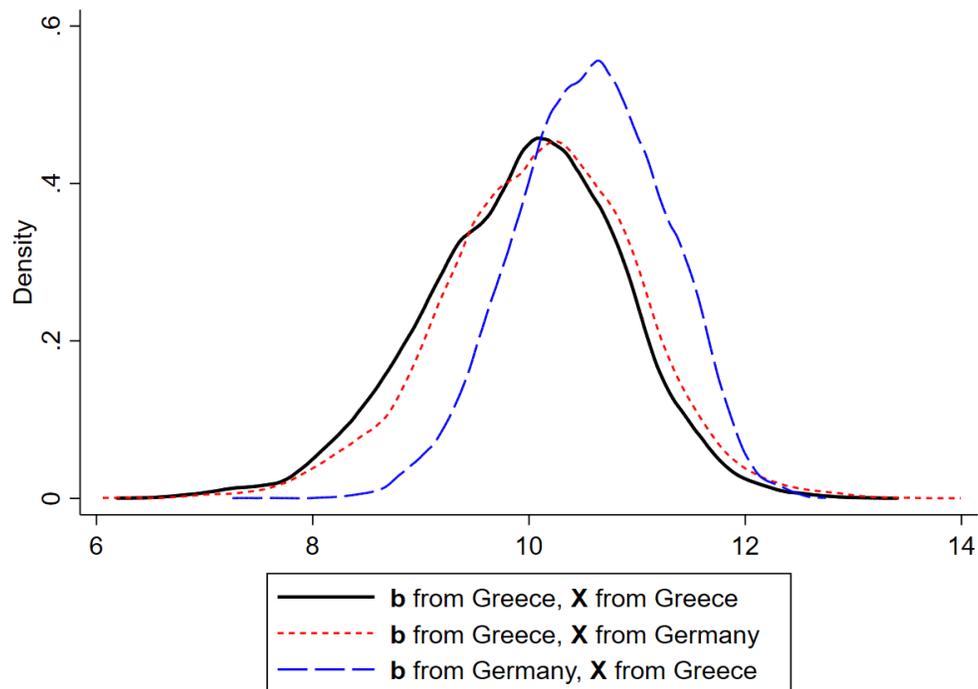
Note: The figures show actual and counterfactual distributions of the log marginal revenue product of capital (Panel A) and marginal revenue product of labor (Panel B) when all variables are used for **X**.

Appendix B: Derivations for the Hsieh-Klenow model

A. SETUP

The setup follows Hsieh and Klenow (2009). The objective function of the firm is

$$\max \tau_i^Y P_i Y_i - \tau_i^K r K_i - \tau_i^L w L_{it} - \tau_i^X P_X X_i$$

Subject to

Demand: $Y_i = Y \left(\frac{P_i}{P} \right)^{-\sigma}$

Production function: $Y_i = A_i K_i^\alpha L_i^\beta X_i^{1-\alpha-\beta}$

where i indexes firms (we skip time index to simplify notation), Y_i is output of firm i, Y is aggregate output, P_i is the price of firm i's output, P is the price index, K_i is capital, L_i is labor, X_i is materials (intermediate input), A_i is productivity, $\tau^Y, \tau^K, \tau^L, \tau^X$ are distortions in product and input market (no distortion corresponds to $\tau = 1$). Aggregate demand is given by the Dixit-Stiglitz aggregator:

$$Y = \left(\int Y_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}$$

We define TFP as $TFP_i \equiv \frac{Y_i}{K_i^\alpha L_i^\beta X_i^{1-\alpha-\beta}} = A_i$.

We define TFPR as $TFPR_i \equiv \frac{P_i Y_i}{K_i^\alpha L_i^\beta X_i^{1-\alpha-\beta}}$.

We define aggregate TFP as $A \equiv \frac{Y}{K^\alpha L^\beta X^{1-\alpha-\beta}}$ where aggregate capital, labor, and materials are $K = \int K_i di$, $L = \int L_i di$, $X = \int X_i di$.

We define marginal revenue product of capital as $MRPK_i \equiv \frac{\sigma-1}{\sigma} \frac{P_i Y_i}{K_i}$

We define marginal revenue product of labor as $MRPL_i \equiv \frac{\sigma-1}{\sigma} \frac{P_i Y_i}{L_i}$

We define marginal revenue product of intermediate inputs as $MRPX_i \equiv \frac{\sigma-1}{\sigma} \frac{P_i Y_i}{X_i}$

Note that using demand for firm i's output and the Dixit-Stiglitz aggregator we can find

$$Y = \left(\int Y_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}} = \left(\int \left[Y \left(\frac{P_i}{P} \right)^{-\sigma} \right]^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}} = Y P^\sigma \left(\int P_i^{-(\sigma-1)} di \right)^{\frac{\sigma}{\sigma-1}}$$

which implies that

$$P = \left(\int P_i^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}$$

B. OPTIMALITY CONDITIONS

The Lagrangian for the firm is

$$\mathcal{L} = \tau_i^Y P_i Y \left(\frac{P_i}{P} \right)^{-\sigma} - \tau_i^K r K_i - \tau_i^L w L_i - \tau_i^X P_X X_i - \lambda_i \left\{ Y \left(\frac{P_i}{P} \right)^{-\sigma} - A_i K_i^\alpha L_i^\beta X_i^{1-\alpha-\beta} \right\}$$

Optimality conditions are:

$$\frac{\partial \mathcal{L}}{\partial K_i} = 0 \Rightarrow \tau_i^K r = \lambda_i \alpha \frac{Y_i}{K_i} \Rightarrow K_i = \lambda_i \alpha \frac{Y_i}{\tau_i^K r}$$

$$\frac{\partial \mathcal{L}}{\partial L_i} = 0 \Rightarrow \tau_i^L w = \lambda_i \beta \frac{Y_i}{L_i} \Rightarrow L_i = \lambda_i \beta \frac{Y_i}{\tau_i^L w}$$

$$\frac{\partial \mathcal{L}}{\partial X_i} = 0 \Rightarrow \tau_i^X P_X = \lambda_i (1 - \alpha - \beta) \frac{Y_i}{X_i} \Rightarrow X_i = \lambda_i (1 - \alpha - \beta) \frac{Y_i}{\tau_i^X P_X}$$

$$\frac{\partial \mathcal{L}}{\partial P_i} = 0 \Rightarrow P_i = \frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \lambda_i$$

Note that λ_i is the marginal cost for firm i. Using the production function and the optimality conditions for L_i, K_i, X_i, we can find

$$Y_i = A_i K_i^\alpha L_i^\beta X_i^{1-\alpha-\beta} = A_i \left(\lambda_i \alpha \frac{Y_i}{\tau_i^K r}\right)^\alpha \left(\lambda_i \beta \frac{Y_i}{\tau_i^L w}\right)^\beta \left(\lambda_i (1-\alpha-\beta) \frac{Y_i}{\tau_i^X P_X}\right)^{1-\alpha-\beta}$$

$$= A_i Y_i \lambda_i \left(\frac{\alpha}{\tau_i^K r}\right)^\alpha \left(\frac{\beta}{\tau_i^L w}\right)^\beta \left(\frac{(1-\alpha-\beta)}{\tau_i^X P_X}\right)^{1-\alpha-\beta}$$

which implies that

$$\lambda_i = \frac{1}{A_i} \left(\frac{\tau_i^K r}{\alpha}\right)^\alpha \left(\frac{\tau_i^L w}{\beta}\right)^\beta \left(\frac{\tau_i^X P_X}{(1-\alpha-\beta)}\right)^{1-\alpha-\beta} = \left[\left(\frac{r}{\alpha}\right)^\alpha \left(\frac{w}{\beta}\right)^\beta \left(\frac{P_X}{(1-\alpha-\beta)}\right)^{1-\alpha-\beta}\right] \frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i} =$$

$$= B \frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i}$$

where $B \equiv \left(\frac{r}{\alpha}\right)^\alpha \left(\frac{w}{\beta}\right)^\beta \left(\frac{P_X}{(1-\alpha-\beta)}\right)^{1-\alpha-\beta}$ does not depend on firm-specific distortions.

It follows that

$$P_i = \frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \frac{1}{A_i} \left(\frac{\tau_i^K r}{\alpha}\right)^\alpha \left(\frac{\tau_i^L w}{\beta}\right)^\beta \left(\frac{\tau_i^X P_X}{(1-\alpha-\beta)}\right)^{1-\alpha-\beta} = \frac{\sigma}{\sigma-1} B \frac{1}{\tau_i^Y} \frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i}$$

We can also find expressions for marginal revenue products

$$MRPK_i \equiv \frac{\sigma-1}{\sigma} \alpha \frac{P_i Y_i}{K_i} = \frac{\tau_i^K}{\tau_i^Y} R$$

$$MRPL_i \equiv \frac{\sigma-1}{\sigma} \beta \frac{P_i Y_i}{L_i} = \frac{\tau_i^L}{\tau_i^Y} W$$

$$MRPX_i \equiv \frac{\sigma-1}{\sigma} (1-\alpha-\beta) \frac{P_i Y_i}{X_i} = \frac{\tau_i^X}{\tau_i^Y} P^X$$

C. AGGREGATION

Aggregate capital in the economy is given by

$$K = \int K_i di = \int \lambda_i \alpha \frac{Y_i}{\tau_i^K r} di = \int \lambda_i \alpha \frac{Y \left(\frac{P_i}{P}\right)^{-\sigma}}{\tau_i^K r} di = Y P^\sigma \left(\frac{\alpha}{r}\right) \int \frac{1}{\tau_i^K} \lambda_i P_i^{-\sigma} di$$

$$= Y P^\sigma \left(\frac{\alpha}{r}\right) \int \frac{1}{\tau_i^K} \lambda_i \left(\frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \lambda_i\right)^{-\sigma} di = Y P^\sigma \left(\frac{\alpha}{r}\right) \frac{\sigma}{\sigma-1} \int \frac{(\tau_i^Y)^\sigma}{\tau_i^K} \lambda_i^{1-\sigma} di$$

$$= Y P^\sigma \left(\frac{\alpha}{r}\right) \frac{\sigma}{\sigma-1} \int \frac{(\tau_i^Y)^\sigma}{\tau_i^K} \left(B \frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di$$

$$= Y P^\sigma \left(\frac{\alpha}{r}\right) \frac{\sigma}{\sigma-1} B^{1-\sigma} \int \frac{(\tau_i^Y)^\sigma}{\tau_i^K} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di$$

Note that $Y P^\sigma \left(\frac{\alpha}{r}\right) \frac{\sigma}{\sigma-1} B^{1-\sigma}$ does not depend on firm-specific outcomes.

Aggregate labor in the economy is given by

$$L = \int L_i di = \int \lambda_i \beta \frac{Y_i}{\tau_i^L w} di = \int \lambda_i \beta \frac{Y \left(\frac{P_i}{P}\right)^{-\sigma}}{\tau_i^L w} di = Y P^\sigma \left(\frac{\beta}{w}\right) \int \frac{1}{\tau_i^L} \lambda_i P_i^{-\sigma} di$$

$$= Y P^\sigma \left(\frac{\beta}{w}\right) \int \frac{1}{\tau_i^L} \lambda_i \left(\frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \lambda_i\right)^{-\sigma} di = Y P^\sigma \left(\frac{\beta}{w}\right) \frac{\sigma}{\sigma-1} \int \frac{(\tau_i^Y)^\sigma}{\tau_i^L} \lambda_i^{1-\sigma} di$$

$$= Y P^\sigma \left(\frac{\beta}{w}\right) \frac{\sigma}{\sigma-1} \int \frac{(\tau_i^Y)^\sigma}{\tau_i^L} \left(B \frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di$$

$$= Y P^\sigma \left(\frac{\beta}{w}\right) \frac{\sigma}{\sigma-1} B^{1-\sigma} \int \frac{(\tau_i^Y)^\sigma}{\tau_i^L} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di$$

Aggregate intermediate input in the economy is given by

$$X = \int X_i di = \int \lambda_i(1 - \alpha - \beta)\frac{Y_i}{\tau_i^X P_X} di = \int \lambda_i(1 - \alpha - \beta)\frac{Y\left(\frac{P_i}{P}\right)^{-\sigma}}{\tau_i^X P_X} di$$

$$= YP^\sigma \left(\frac{1 - \alpha - \beta}{P_X}\right)\int \frac{1}{\tau_i^X}\lambda_i P_i^{-\sigma} di$$

$$= YP^\sigma \left(\frac{1 - \alpha - \beta}{P_X}\right)\int \frac{1}{\tau_i^X}\lambda_i \left(\frac{\sigma}{\sigma - 1}\frac{1}{\tau_i^Y}\lambda_i\right)^{-\sigma} di = YP^\sigma \left(\frac{1 - \alpha - \beta}{P_X}\right)\frac{\sigma}{\sigma - 1}\int \frac{(\tau_i^Y)^\sigma}{\tau_i^X}\lambda_i^{1-\sigma} di$$

$$= YP^\sigma \left(\frac{1 - \alpha - \beta}{P_X}\right)\frac{\sigma}{\sigma - 1}\int \frac{(\tau_i^Y)^\sigma}{\tau_i^X}\left(\boldsymbol{B}\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di$$

$$= YP^\sigma \left(\frac{1 - \alpha - \beta}{P_X}\right)\frac{\sigma}{\sigma - 1}\boldsymbol{B}^{1-\sigma}\int \frac{(\tau_i^Y)^\sigma}{\tau_i^X}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di$$

Aggregate price index is given by

$$P = \left(\int P_i^{1-\sigma} di\right)^{\frac{1}{1-\sigma}} = \left(\int \left(\frac{\sigma}{\sigma - 1}\boldsymbol{B}\frac{1}{\tau_i^Y}\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{\frac{1}{1-\sigma}}$$

$$= \frac{\sigma}{\sigma - 1}\boldsymbol{B}\left(\int \left(\frac{1}{\tau_i^Y}\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{\frac{1}{1-\sigma}}$$

D. AGGREGATE TFP

Using our definition of aggregate TFP, we have

$$A \equiv \frac{Y}{K^\alpha L^\beta X^{1-\alpha-\beta}}$$

Let's compute the denominator of this expression:

$$K^\alpha L^\beta X^{1-\alpha-\beta} = \left(YP^\sigma \left(\frac{\alpha}{r}\right)\frac{\sigma}{\sigma - 1}\boldsymbol{B}^{1-\sigma}\int \frac{(\tau_i^Y)^\sigma}{\tau_i^K}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^\alpha$$

$$\times \left(YP^\sigma \left(\frac{\beta}{w}\right)\frac{\sigma}{\sigma - 1}\boldsymbol{B}^{1-\sigma}\int \frac{(\tau_i^Y)^\sigma}{\tau_i^L}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^\beta$$

$$\times \left(YP^\sigma \left(\frac{1 - \alpha - \beta}{P_X}\right)\frac{\sigma}{\sigma - 1}\boldsymbol{B}^{1-\sigma}\int \frac{(\tau_i^Y)^\sigma}{\tau_i^X}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{1-\alpha-\beta}$$

$$= \left[YP^\sigma \frac{\sigma}{\sigma-1}\boldsymbol{B}^{1-\sigma}\left(\frac{\alpha}{r}\right)^\alpha\left(\frac{\beta}{w}\right)^\beta\left(\frac{1-\alpha-\beta}{P_X}\right)^{1-\alpha-\beta}\right]\times\left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^K}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^\alpha \times$$

$$\left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^L}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^\beta \times \left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^X}\left(\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{1-\alpha-\beta}$$

Note that we defined $\boldsymbol{B} \equiv \left(\frac{r}{\alpha}\right)^\alpha\left(\frac{w}{\beta}\right)^\beta\left(\frac{P_X}{(1-\alpha-\beta)}\right)^{1-\alpha-\beta}$ and so we can simplify this expression a bit more:

$$K^{\alpha}L^{\beta}X^{1-\alpha-\beta} = \left[YP^{\sigma}\frac{\sigma}{\sigma-1}\boldsymbol{B}^{-\sigma}\right] \times \left(\int \frac{(\tau_i^Y)^{\sigma}}{\tau_i^K}\left(\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{\alpha}$$

$$\times \left(\int \frac{(\tau_i^Y)^{\sigma}}{\tau_i^L}\left(\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{\beta} \times \left(\int \frac{(\tau_i^Y)^{\sigma}}{\tau_i^X}\left(\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{1-\alpha-\beta}$$

Because Y appears in the numerator and denominator of A, it follows that

$$A \equiv \frac{Y}{K^{\alpha}L^{\beta}X^{1-\alpha-\beta}} =$$

$$= \left[P^{-\sigma}\frac{\sigma-1}{\sigma}\boldsymbol{B}^{\sigma}\right] \times \left(\int \frac{(\tau_i^Y)^{\sigma}}{\tau_i^K}\left(\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{-\alpha}$$

$$\times \left(\int \frac{(\tau_i^Y)^{\sigma}}{\tau_i^L}\left(\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{-\beta}$$

$$\times \left(\int \frac{(\tau_i^Y)^{\sigma}}{\tau_i^X}\left(\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{-(1-\alpha-\beta)}$$

E. APPROXIMATION TO AGGREGATE PRODUCTIVITY

Hsieh and Klenow (2009) assume log-normal distribution of firm-specific variables $A_i, \tau_i^Y, \tau_i^K, \tau_i^L, \tau_i^X$. We can use this assumption to derive exact formulae for output lost due to frictions $\tau_i^Y, \tau_i^K, \tau_i^L, \tau_i^X$. Assume that each of these variables are distributed independently (zero covariance):

$$\log A_i \sim N(\mu_A, V_A)$$
$$\log \tau_i^Y \sim N(0, V_{\tau Y})$$
$$\log \tau_i^K \sim N(0, V_{\tau K})$$
$$\log \tau_i^L \sim N(0, V_{\tau L})$$
$$\log \tau_i^X \sim N(0, V_{\tau X})$$

Consider the aggregate price level:

$$P^{-\sigma} = \frac{\sigma}{\sigma-1}\boldsymbol{B}\left(\int \left(\frac{1}{\tau_i^Y}\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)^{\frac{\sigma}{\sigma-1}}$$

Then using $\int z_i di = E(z_i)$ (that is a cross-sectional average is equal to the mathematical expectation of random variable z_i) and the property of log-normal variable $E(z) = \exp\left(mean_z + \frac{1}{2}variance_z\right)$,[1] we have

$$-\sigma \log P = \log\frac{\sigma}{\sigma-1}\boldsymbol{B} + \frac{\sigma}{1-\sigma}\log\left(\int \left(\frac{1}{\tau_i^Y}\frac{(\tau_i^K)^{\alpha}(\tau_i^L)^{\beta}(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma} di\right)$$

$$= constant + \frac{\sigma}{\sigma-1}\log(E[\exp\{(1-\sigma)\alpha\log\tau_i^K + (1-\sigma)\beta\log\tau_i^L + (1-\sigma)(1-\alpha-\beta)\log\tau_i^X - (1-\sigma)\log\tau_i^Y$$
$$- (1-\sigma)\log A_i\}])$$

$$= constant + \frac{\sigma}{\sigma-1}\log(E[\exp\{-(\sigma-1)\alpha\log\tau_i^K - (\sigma-1)\beta\log\tau_i^L - (\sigma-1)(1-\alpha-\beta)\log\tau_i^X + (\sigma-1)\log\tau_i^Y$$
$$+ (\sigma-1)\log A_i\}])$$

---

[1] Note that $E(z^a) = \exp\left(a \times mean_z + \frac{a^2}{2}variance_z\right)$.

$$= constant + \frac{\sigma}{\sigma - 1} \log \left(\left[\exp \left\{ \frac{[(\sigma - 1)\alpha]^2}{2} V_{\tau K} + \frac{[(\sigma - 1)\beta]^2}{2} V_{\tau L} + \frac{[(\sigma - 1)(1 - \alpha - \beta)]^2}{2} V_{\tau X} + \frac{[(\sigma - 1)]^2}{2} V_{\tau Y} \right. \right. \right.$$

$$\left. \left. \left. + (\sigma - 1)\mu_A + \frac{(\sigma - 1)^2}{2} V_A \right\} \right] \right)$$

$$= constant + \frac{\sigma}{\sigma - 1} \left\{ \frac{[(\sigma - 1)\alpha]^2}{2} V_{\tau K} + \frac{[(\sigma - 1)\beta]^2}{2} V_{\tau L} + \frac{[(\sigma - 1)(1 - \alpha - \beta)]^2}{2} V_{\tau X} + \frac{[(\sigma - 1)]^2}{2} V_{\tau Y} + (\sigma - 1)\mu_A \right.$$

$$\left. + \frac{(\sigma - 1)^2}{2} V_A \right\}$$

$$= constant + \left\{ \frac{\sigma(\sigma - 1)\alpha^2}{2} V_{\tau K} + \frac{\sigma(\sigma - 1)\beta^2}{2} V_{\tau L} + \frac{\sigma(\sigma - 1)(1 - \alpha - \beta)^2}{2} V_{\tau X} + \frac{\sigma(\sigma - 1)}{2} V_{\tau Y} + \sigma\mu_A + \frac{\sigma(\sigma - 1)}{2} V_A \right\}$$

Now let's derive terms (in logs) that are highlighted in green, red and blue:

$$\log \left[\left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^K} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1 - \alpha - \beta}}{A_i} \right)^{1 - \sigma} di \right)^{-\alpha} \right] =$$

$$= -\alpha \log E \left(\frac{(\tau_i^Y)^\sigma}{\tau_i^K} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1 - \alpha - \beta}}{A_i} \right)^{1 - \sigma} \right)$$

$$= -\alpha \log E \left((\tau_i^Y)^\sigma (\tau_i^K)^{\alpha(1 - \sigma) - 1} (\tau_i^L)^{\beta(1 - \sigma)} (\tau_i^X)^{(1 - \alpha - \beta)(1 - \sigma)} A_i^{\sigma - 1} \right)$$

$$= -\alpha \left(\frac{(\alpha(1 - \sigma) - 1)^2}{2} V_{\tau K} + \frac{(\beta(1 - \sigma))^2}{2} V_{\tau L} + \frac{((1 - \alpha - \beta)(1 - \sigma))^2}{2} V_{\tau X} + \frac{\sigma^2}{2} V_{\tau Y} + (\sigma - 1)\mu_A + \frac{(\sigma - 1)^2}{2} V_A \right)$$

$$\log \left[\left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^L} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1 - \alpha - \beta}}{A_i} \right)^{1 - \sigma} di \right)^{-\beta} \right] =$$

$$= -\beta \log E \left(\frac{(\tau_i^Y)^\sigma}{\tau_i^L} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1 - \alpha - \beta}}{A_i} \right)^{1 - \sigma} \right)$$

$$= -\beta \log E \left((\tau_i^Y)^\sigma (\tau_i^K)^{\alpha(1 - \sigma)} (\tau_i^L)^{\beta(1 - \sigma) - 1} (\tau_i^X)^{(1 - \alpha - \beta)(1 - \sigma)} A_i^{\sigma - 1} \right)$$

$$= -\beta \left(\frac{(\alpha(1 - \sigma))^2}{2} V_{\tau K} + \frac{(\beta(1 - \sigma) - 1)^2}{2} V_{\tau L} + \frac{((1 - \alpha - \beta)(1 - \sigma))^2}{2} V_{\tau X} + \frac{\sigma^2}{2} V_{\tau Y} + (\sigma - 1)\mu_A + \frac{(\sigma - 1)^2}{2} V_A \right)$$

$$\log \left[\left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^X} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1 - \alpha - \beta}}{A_i} \right)^{1 - \sigma} di \right)^{-(1 - \alpha - \beta)} \right] =$$

$$= -(1 - \alpha - \beta) \log E \left(\frac{(\tau_i^Y)^\sigma}{\tau_i^X} \left(\frac{(\tau_i^K)^\alpha (\tau_i^L)^\beta (\tau_i^X)^{1 - \alpha - \beta}}{A_i} \right)^{1 - \sigma} \right)$$

$$= -(1 - \alpha - \beta) \log E \left((\tau_i^Y)^\sigma (\tau_i^K)^{\alpha(1 - \sigma)} (\tau_i^L)^{\beta(1 - \sigma)} (\tau_i^X)^{(1 - \alpha - \beta)(1 - \sigma) - 1} A_i^{\sigma - 1} \right)$$

$$= -(1 - \alpha - \beta) \left(\frac{(\alpha(1 - \sigma))^2}{2} V_{\tau K} + \frac{(\beta(1 - \sigma))^2}{2} V_{\tau L} + \frac{((1 - \alpha - \beta)(1 - \sigma) - 1)^2}{2} V_{\tau X} + \frac{\sigma^2}{2} V_{\tau Y} + (\sigma - 1)\mu_A \right.$$

$$\left. + \frac{(\sigma - 1)^2}{2} V_A \right)$$

Now we can put together to compute the log of aggregate TFP

$$\log A = \log \left[P^{-\sigma} \frac{\sigma - 1}{\sigma} B^\sigma \right] + \log Green + \log Red + \log Blue$$

$$= constant - \sigma \log P + \log Green + \log Red + \log Blue$$

$$= constant + \left\{ \frac{\sigma(\sigma-1)\alpha^2}{2} V_{\tau K} + \frac{\sigma(\sigma-1)\beta^2}{2} V_{\tau L} + \frac{\sigma(\sigma-1)(1-\alpha-\beta)^2}{2} V_{\tau X} + \frac{\sigma(\sigma-1)}{2} V_{\tau Y} + \sigma\mu_A + \frac{\sigma(\sigma-1)}{2} V_A \right\}$$

$$- \alpha \left(\frac{(\alpha(1-\sigma)-1)^2}{2} V_{\tau K} + \frac{(\beta(1-\sigma))^2}{2} V_{\tau L} + \frac{((1-\alpha-\beta)(1-\sigma))^2}{2} V_{\tau X} + \frac{\sigma^2}{2} V_{\tau Y} + (\sigma-1)\mu_A \right.$$

$$\left. + \frac{(\sigma-1)^2}{2} V_A \right)$$

$$- \beta \left(\frac{(\alpha(1-\sigma))^2}{2} V_{\tau K} + \frac{(\beta(1-\sigma)-1)^2}{2} V_{\tau L} + \frac{((1-\alpha-\beta)(1-\sigma))^2}{2} V_{\tau X} + \frac{\sigma^2}{2} V_{\tau Y} + (\sigma-1)\mu_A \right.$$

$$\left. + \frac{(\sigma-1)^2}{2} V_A \right)$$

$$- (1-\alpha-\beta) \left(\frac{(\alpha(1-\sigma))^2}{2} V_{\tau K} + \frac{(\beta(1-\sigma))^2}{2} V_{\tau L} + \frac{((1-\alpha-\beta)(1-\sigma)-1)^2}{2} V_{\tau X} + \frac{\sigma^2}{2} V_{\tau Y} + (\sigma \right.$$

$$\left. -1)\mu_A + \frac{(\sigma-1)^2}{2} V_A \right)$$

$$= constant - \left\{ \frac{\alpha(1-\alpha)}{2} + \frac{\alpha^2\sigma}{2} \right\} V_{\tau K} - \left\{ \frac{\beta(1-\beta)}{2} + \frac{\beta^2\sigma}{2} \right\} V_{\tau L} - \left\{ \frac{(1-\alpha-\beta)(\alpha+\beta)}{2} + \frac{(1-\alpha-\beta)^2\sigma}{2} \right\} V_{\tau X} - \frac{\sigma}{2} V_{\tau Y}$$

$$+ \mu_A + \frac{(\sigma-1)}{2} V_A$$

Note that TFP is increasing in the variance of productivity V_A and it is decreasing in the variable of distortions $V_{\tau K}, V_{\tau L}, V_{\tau X}, V_{\tau Y}$

F. IDENTIFICATION OF DISTORTIONS τ

Using the optimality condition for capital and the expression for the optimal price

$$MRPK_i \equiv \frac{P_i Y_i}{K_i} = P_i \frac{Y_i}{K_i} = P_i \times \frac{\tau_i^K r}{\lambda_i \alpha} = \frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \lambda_i \times \frac{\tau_i^K r}{\lambda_i \alpha} = \frac{\sigma}{\sigma-1} \frac{\tau_i^K}{\tau_i^Y} \frac{r}{\alpha}$$

Using the same logic, we have

$$MRPL_i \equiv \frac{P_i Y_i}{L_i} = P_i \frac{Y_i}{L_i} = P_i \times \frac{\tau_i^L w}{\lambda_i \beta} = \frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \lambda_i \times \frac{\tau_i^L w}{\lambda_i \beta} = \frac{\sigma}{\sigma-1} \frac{\tau_i^L}{\tau_i^Y} \frac{w}{\beta}$$

$$MRPX_i \equiv \frac{P_i Y_i}{X_i} = P_i \frac{Y_i}{X_i} = P_i \times \frac{\tau_i^X P_X}{\lambda_i(1-\alpha-\beta)} = \frac{\sigma}{\sigma-1} \frac{1}{\tau_i^Y} \lambda_i \times \frac{\tau_i^X P_X}{\lambda_i(1-\alpha-\beta)} = \frac{\sigma}{\sigma-1} \frac{\tau_i^X}{\tau_i^Y} \frac{P_X}{(1-\alpha-\beta)}$$

We have four unknowns $\tau_i^Y, \tau_i^K, \tau_i^L, \tau_i^X$ and three moments $MPRK_i, MRPL_i, MRPX_i$. The system is not identified. We need to impose an identifying assumption.

The Hsieh-Klenow framework assumes that $\tau_i^L = 1$ for all i and hence, one can find

$$\log MRPL_i = constant - \log(\tau_i^Y)$$

so that one can estimate $V_{\tau Y} \equiv var \left(\log(\tau_i^Y) \right) = var \left(\log MRPL_i \right) = V_{MRPL}$. Then one can note that

$$\log MRPK_i = constant + \log(\tau_i^K) - \log(\tau_i^Y) = constant + \log(\tau_i^K) + \log MRPL_i$$

and hence

$$\log(\tau_i^K) = constant + \log MRPK_i - \log MRPL_i$$

$$V_{\tau K} \equiv var \left(\log(\tau_i^K) \right) = var(\log MRPK_i - \log MRPL_i)$$

$$= var \left(\log MRPL_i \right) + var \left(\log MRPK_i \right) - 2cov(\log MRPL_i, \log MRPK_i)$$

$$= V_{MRPL} + V_{MRPK} - 2V_{MRPL,MRPK}$$

One can alternatively assume that $\tau_i^K = 1$ for all i and τ_i^L is varying across firms. Then

$$V_{\tau Y} \equiv var \left(\log(\tau_i^Y) \right) = var \left(\log MRPK_i \right) = V_{MRPK}$$

$$V_{\tau L} \equiv var\left(\log(\tau_i^l)\right) = var(\log MRPL_i - \log MRPK_i)$$
$$= var\left(\log MRPL_i\right) + var\left(\log MRPK_i\right) - 2cov(\log MRPL_i, \log MRPK_i) =$$
$$= V_{MRPL} + V_{MRPK} - 2V_{MRPL,MRPK}$$

Note that we do not have materials in the EIBIS. Is this a problem? The answer is not necessarily. We know that $V_{\tau X} \geq 0$ and hence a distortion in the intermediate input market will lower aggregate TFP. If we do not observe $MRPX$, we likely understate the effect of the distortions and thus our estimate is conservative.

If we make the assumption as in Hsieh and Klenow, then the (conservative) loss in aggregate TFP (and hence aggregate output) is

$$loss = -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha^2\sigma}{2}\right\}V_{\tau K} - \frac{\sigma}{2}V_{\tau Y} = -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha^2\sigma}{2}\right\}[V_{MRPL} + V_{MRPK} - 2V_{MRPL,MRPK}] - \frac{\sigma}{2}V_{MRPL}$$

If we make the other assumption, then

$$loss = -\left\{\frac{\beta(1-\beta)}{2} + \frac{\beta^2\sigma}{2}\right\}V_{\tau L} - \frac{\sigma}{2}V_{\tau Y} = -\left\{\frac{\beta(1-\beta)}{2} + \frac{\beta^2\sigma}{2}\right\}[V_{MRPL} + V_{MRPK} - 2V_{MRPL,MRPK}] - \frac{\sigma}{2}V_{MRPK}$$

G. CORRELATED DISTORTIONS

The assumption of uncorrelated distortions τ simplifies algebra but empirically the distortions may be correlated. To keep the derivations concise, we focus on the case where we set $\tau_i^L = \tau_i^X = 1$ for all i and we abstract from productivity shocks A_i (set $A_i = 1$ for all i) without loss of generality. Let $\rho \equiv corr\left(\log(\tau_i^Y), \log(\tau_i^K)\right)$.

Consider first the expression for the level of prices in the economy:

$$-\sigma \log P = \log\frac{\sigma}{\sigma-1}B + \frac{\sigma}{1-\sigma}\log\left(\int \left(\frac{1}{\tau_i^Y}\frac{(\tau_i^K)^\alpha(\tau_i^L)^\beta(\tau_i^X)^{1-\alpha-\beta}}{A_i}\right)^{1-\sigma}di\right)$$

$$= \log\frac{\sigma}{\sigma-1}B + \frac{\sigma}{1-\sigma}\log\left(\int \left(\frac{1}{\tau_i^Y}(\tau_i^K)^\alpha\right)^{1-\sigma}di\right)$$

$$= constant + \frac{\sigma}{\sigma-1}\log(E[\exp\{-(\sigma-1)\alpha\log\tau_i^K + (\sigma-1)\log\tau_i^Y\}])$$

$$= constant + \frac{\sigma}{\sigma-1}\log\left(\left[\exp\left\{\frac{[(\sigma-1)\alpha]^2}{2}V_{\tau K} + \frac{[(\sigma-1)]^2}{2}V_{\tau Y} - \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma(\sigma-1)\alpha\right\}\right]\right)$$

$$= constant + \left\{\frac{\sigma(\sigma-1)\alpha^2}{2}V_{\tau K} + \frac{\sigma(\sigma-1)}{2}V_{\tau Y} - \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma(\sigma-1)\alpha\right\}$$

Now consider the green, red and blue terms:

$$\log\left[\left(\int \frac{(\tau_i^Y)^\sigma}{\tau_i^K}\left((\tau_i^K)^\alpha\right)^{1-\sigma}di\right)^{-\alpha}\right] = -\alpha\log E\left((\tau_i^Y)^\sigma(\tau_i^K)^{\alpha(1-\sigma)-1}\right)$$

$$= -\alpha\left(\frac{(\alpha(1-\sigma)-1)^2}{2}V_{\tau K} + \frac{\sigma^2}{2}V_{\tau Y} + \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma(\alpha(1-\sigma)-1)\right)$$

$$\log\left[\left(\int (\tau_i^Y)^\sigma\left((\tau_i^K)^\alpha\right)^{1-\sigma}di\right)^{-\beta}\right] = -\beta\log E\left((\tau_i^Y)^\sigma(\tau_i^K)^{\alpha(1-\sigma)}\right)$$

$$= -\beta\left(\frac{(\alpha(1-\sigma))^2}{2}V_{\tau K} + \frac{\sigma^2}{2}V_{\tau Y} + \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma(1-\sigma)\alpha\right)$$

$$\log\left[\left(\int (\tau_i^Y)^\sigma \left((\tau_i^K)^\alpha\right)^{1-\sigma} di\right)^{-(1-\alpha-\beta)}\right] = -(1-\alpha-\beta)\log E\left((\tau_i^Y)^\sigma (\tau_i^K)^{\alpha(1-\sigma)}\right)$$

$$= -(1-\alpha-\beta)\left(\frac{(\alpha(1-\sigma))^2}{2}V_{\tau K} + \frac{\sigma^2}{2}V_{\tau Y} + \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma(1-\sigma)\alpha\right)$$

It follows that the productivity loss is given by

$$loss = \log\left[P^{-\sigma}\frac{\sigma-1}{\sigma}B^\sigma\right] + \log Green + \log Red + \log Blue$$

$$= constant - \left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha^2\sigma}{2}\right\}V_{\tau K} - \frac{\sigma}{2}V_{\tau Y} - \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma\alpha$$

In our data, $\rho > 0$ so that ignoring the correlation between τ_i^K and τ_i^Y understates productivity losses from the distortions.

We can also note that this expression can be mapped into the marginal R^2 framework. Recall that
$$\log(\tau_{it}^Y) = constant - \log(MRPL_{it}),$$

$$\log(\tau_{it}^K) = constant + \log(MRPK_{it}) - \log(MRPL_{it}).$$

so that
$$\log(\tau_{it}^K) - \log(\tau_{it}^Y) = constant + \log(MRPK_{it})$$

We can write the expression for productivity loss

$$loss = -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha^2\sigma}{2}\right\}V_{\tau K} - \frac{\sigma}{2}V_{\tau Y} - \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma\alpha$$

$$= -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha^2\sigma}{2}\right\}V_{\tau K} - \frac{\sigma}{2}V_{\tau Y} + \frac{\sigma\alpha}{2}V_{\tau Y} + \frac{\sigma\alpha}{2}V_{\tau K} - \rho\sqrt{V_{\tau K}V_{\tau Y}}\sigma\alpha - \frac{\sigma\alpha}{2}V_{\tau Y} - \frac{\sigma\alpha}{2}V_{\tau K} =$$

$$= -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha(1+\alpha)\sigma}{2}\right\}V_{\tau K} - \frac{\sigma(1+\alpha)}{2}V_{\tau Y} + \frac{\sigma\alpha}{2}var\left(\log(\tau_{it}^K) - \log(\tau_{it}^Y)\right) =$$

$$= -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha(1+\alpha)\sigma}{2}\right\}var(\log(MRPK_{it}) - \log(MRPL_{it})) - \frac{\sigma(1+\alpha)}{2}var(\log(MRPL_{it}))$$
$$+ \frac{\sigma\alpha}{2}var(\log(MRPK_{it}))$$

Thus, the gains from removing a vector of distortions can be computed as

$$loss = -\left\{\frac{\alpha(1-\alpha)}{2} + \frac{\alpha(1+\alpha)\sigma}{2}\right\} \times var(\log(MRPK_{it}) - \log(MRPL_{it})) \times (marginal\ R^2)$$
$$- \frac{\sigma(1+\alpha)}{2} \times var(\log(MRPL_{it})) \times (marginal\ R^2) + \frac{\sigma\alpha}{2}var(\log(MRPK_{it})) \times (marginal\ R^2).$$

Appendix C: Additional derivations

A. Cost shares

Note that in a steady state, when adjustment costs are zero, the costs of capital and labor are given by

$$R_i(U_i)K_i = \left((1 - \sigma^{-1})\alpha \frac{S_i}{K_i}\right)K_i = (1 - \sigma^{-1})\alpha S_i$$

$$W_i(E_i)L_i = \left((1 - \sigma^{-1})\beta \frac{S_i}{L_i}\right)L_i = (1 - \sigma^{-1})\beta S_i$$

where we drop the time index to underscore that this is a steady state. Hence, the steady-state cost shares for capital and labor are

$$s_i^K = \frac{R_i(U_i)K_i}{R_i(U_i)K_i + W_i(E_i)L_i + P_i^X X_i} = \frac{\alpha}{\alpha + \beta + \omega} = \frac{\alpha}{\gamma} \Leftrightarrow \alpha = \gamma s^K,$$

$$s_i^L = \frac{W_i(E_i)L_i}{R_i(U_i)K_i + W_i(E_i)L_i + P_i^X X_i} = \frac{\beta}{\alpha + \beta + \omega} = \frac{\beta}{\gamma} \Leftrightarrow \beta = \gamma s^L.$$

In the same spirit, $\omega = \gamma s^X$. We use these expressions to replace β, α, and ω in the expressions for marginal revenue products to obtain

$$MRPK_{it} = (1 - \sigma^{-1})\gamma s^K \frac{S_{it}}{K_{it}},$$

$$MRPL_{it} = (1 - \sigma^{-1})\gamma s^L \frac{S_{it}}{L_{it}},$$

$$MRPX_{it} = (1 - \sigma^{-1})\gamma s^X \frac{S_{it}}{X_{it}}.$$

Since markup $\mu = (\sigma - 1)/\sigma$,

$$(1 - \sigma^{-1})\gamma = \frac{1}{\mu}\gamma = (1 - s_\pi) \approx 1$$

given that the share of pure economic profit in total revenue s_π is approximately zero in the data (e.g., Basu and Fernald, 1997).[2] Hence, we can further simplify the expressions for marginal revenue products to obtain

$$MRPK_{it} \approx s^K \frac{S_{it}}{K_{it}},$$

$$MRPL_{it} \approx s^L \frac{S_{it}}{L_{it}},$$

$$MRPX_{it} \approx s^X \frac{S_{it}}{X_{it}}.$$

---

[2] Weaker assumptions may suffice. For example, to study a cross-sectional dispersion of marginal revenue products, it is enough to have γ/μ constant across industries and countries. If even this assumption is not satisfied, one ought to consider using country and/or industry fixed effects to control for the variation in market power and in returns to scale.

B. Quality adjustment for capital

Although it is conventional to define marginal products for physical units (e.g., number of employees and/or hours worked), capital is typically measured in dollars such as the replacement value of capital or the book value of fixed assets. In other words, in a typical survey (including our survey) we measure

$$\widehat{MRPK}_{it} \equiv (1 - \sigma^{-1})\alpha \frac{S_{it}}{\tilde{R}_{it} K_{it}} \approx \frac{R_{it}(U_{it})}{\tilde{R}_{it}} \left\{ 1 + \phi_K \left(\frac{K_{it}}{K_{i,t-1}} - 1 \right) - \frac{\phi_K}{1 + r_{t+1}} \times \left(\frac{K_{i,t+1}}{K_{it}} - 1 \right) \right\}$$

where $\tilde{R}_{it}$ is a measure of the capital price used in constructing the replacement value or the balance sheet value of fixed assets. In the case of replacement value of capital, we may have $R_{it}(U_{it}) \approx \tilde{R}_{it}$. With the balance sheet value of fixed asset, $\tilde{R}_{it}$ likely reflects the historical price rather than the current market price. Given technical change and inflation, the difference between the market and historical prices can be large, especially for assets that were acquired a long time ago (e.g., buildings).

For example, suppose that capital is bought at time t_0 and, for simplicity that capital also does not depreciate, so that the balance sheet value is $p_\tau K_\tau$ at the time of purchase. $p_{t_0} K_{t_0}$ is also the balance-sheet value of fixed assets. The market price of capital at time t is given by $p_t = p_{t_0} \left(\frac{\Pi}{A} \right)^{t-t_0}$, where Π and A are gross rates of inflation and technical change. Hence,

$$(1 - \sigma)\alpha \frac{S_t}{p_{t_0} K_{t_0}} = (1 - \sigma)\alpha \frac{S_t}{p_t K_{t_0}} \times \left(\frac{A}{\Pi} \right)^{t-t_0}.$$

If $\Pi > A$, a large share of state-of-the-art capital means a lower $\widehat{MRPK}_{it}$ measured with the balance-sheet value of fixed assets. With depreciation, we obtain similar results but in this case the outcome also depends on whether the book value of capital depreciates faster on paper or de facto.

We are fortunate to have proxy information that enables us to try to correct for this effect. In particular, from EIBIS we know the share of capital (including machinery, equipment and ICT) that the management considers to be "state-of-the-art", which presumably means capital that has been obtained recently. Thus, for firms with a large share of state-of-the-art capital we can expect $R_{it}(U_{it}) \approx \tilde{R}_{it}$.

Appendix D: R^2 for OLS vs. Instrumental Variables

Appendix D derives and compares R^2 for ordinary least squares (OLS) and instrumental variable (IV) estimators under various assumptions.

A. STRUCTURAL MODEL

Consider the following system:

$$y = \alpha x + u \tag{D.1}$$

$$x = z + e \tag{D.2}$$

where z is an instrumental variable (without loss of generality we can assume that the coefficient on z is equal to one; we can always normalize z so that this is the case), y is an outcome variable, x is a (potentially endogenous) regressor, u and e are error terms which could be correlated (x is endogenous) or uncorrelated (x is exogenous). We assume that z is a valid instrument and is uncorrelated with e and u. Note that the system in (D.1)-(D.2) can also be used to represent the relationships between variables after partialling out other factors and thus the logic developed below extends to marginal R^2 and multivariate contexts as well.

B. OLS

When we run an OLS regression for equation (D.1), we find that R^2 is given by

$$R^2_{OLS} \equiv 1 - \frac{var(\hat{u}_{OLS})}{var(y)} \tag{D.3}$$

where $\hat{u}_{OLS}$ is the residual of the regression. Note that by construction of OLS regression we have

$$var(y) = var(\hat{\alpha}_{OLS}x) + var(\hat{u}_{OLS}) \tag{D.4}$$

and so it does not matter whether we use equation (D.3) to compute R^2 or instead we use

$$R^2_{OLS} = \frac{var(\hat{\alpha}_{OLS}x)}{var(y)} = \frac{\hat{\alpha}^2_{OLS}var(x)}{var(y)}. \tag{D.5}$$

We can find that

$$\hat{u}_{OLS} \equiv y - \hat{\alpha}x = (\alpha x + u) - \frac{cov(y,x)}{var(x)}x = (\alpha x + u) - \frac{cov(\alpha x + u,x)}{var(x)}x$$

$$= (\alpha x + u) - \alpha x - \frac{cov(u,x)}{var(x)}x = u - \frac{cov(u,x)}{var(x)}x \tag{D.6}$$

It follows that

$$var(\hat{u}_{OLS}) = var\left(u - \frac{cov(u,x)}{var(x)}x\right)$$

$$= var(u) + \left[\frac{cov(u,x)}{var(x)}\right]^2 var(x) - 2cov(u,x)\frac{cov(u,x)}{var(x)}$$

$$= var(u) - \frac{[cov(u,x)]^2}{var(x)} < var(u) \tag{D.7}$$

Thus, OLS understates the variance of the error term and so OLS will inflate R^2: $var(\hat{u}_{OLS}) < var(u)$.

Also notice that $cov(x,u) = cov(z + e, u) = cov(e, u)$ and so we can alternatively write

$$var(\hat{u}_{OLS}) = var(u) - \frac{[cov(u,e)]^2}{var(x)} \tag{D.7'}$$

C. INSTRUMENTAL VARIABLES (IV)

Now consider the IV regression where the first stage is given by equation (D.2). In this case, we can show that we can recover a consistent estimate of α. In this case, we can compute the *structural* error term in equation (1) as

$$\hat{u}_{IV} = y - \hat{\alpha}_{IV}x \tag{D.8}$$

Because the estimate is consistent, we have also the correct estimate of the variance of the error term u as the sample size increases to infinity:

$$var(\hat{u}_{IV}) = var(u). \tag{D.9}$$

But this means that $R^2_{IV} \equiv 1 - \frac{var(\hat{u}_{IV})}{var(y)} \leq R^2_{OLS}$.

If $cov(u,x) = 0$ (or equivalently $cov(e,u) = 0$), we have $R^2_{IV} = R^2_{OLS}$. However, notice that with the IV regression we can no longer use equations (D.3) and (D.5) equivalently because:

$$var(y) = var(\hat{\alpha}_{IV}x + u) = \hat{\alpha}^2_{IV}var(x) + var(u) + 2\hat{\alpha}_{IV}cov(x,u) \tag{D.10}$$

and hence

$$\frac{\hat{\alpha}^2_{IV}var(x)}{var(y)} \neq 1 - \frac{var(\hat{u}_{IV})}{var(y)}. \tag{D.11}$$

As a result, R^2_{IV} can be negative.

While we can guarantee that $1 - \frac{var(\hat{u}_{IV})}{var(y)} \leq 1 - \frac{var(\hat{u}_{OLS})}{var(y)}$, we cannot guarantee that

$$\frac{\hat{\alpha}^2_{IV}var(x)}{var(y)} \leq \frac{\hat{\alpha}^2_{OLS}var(x)}{var(y)}. \tag{D.12}$$

D. PREDICTIVE ERROR

To address this issue, Pesaran and Smith (1994) propose using *predictive* error in IV regressions to do model comparisons and model selection. In contrast to structural errors, these errors can be used for model selections because they have a well-defined measure of fit: generalized R^2 (or GR^2) which is calculated as follows

$$\tilde{u}_{IV} = y - \hat{\alpha}_{IV}\hat{x} \tag{D.13}$$

where $\hat{x}$ is the predicted value of x in the first-stage regression (D.2). Effectively, computing this residual amounts to regressing y on z, i.e., running a reduced-form regression. In this case, because z is uncorrelated with e or u, we have

$$var(y) = var(\hat{\alpha}_{IV}z + u) = \hat{\alpha}^2_{IV}var(z) + var(u) \tag{D.14}$$

What is the relation of $var(\tilde{u}_{IV})$ to $var(\hat{u}_{OLS})$? Using the logic of equation (D.7) and the fact that $\hat{\alpha}_{IV} \rightarrow_p \alpha$, we can find

$$var(\tilde{u}_{IV}) = var(y - \hat{\alpha}_{IV}\hat{x}) = var(y - \alpha z) = var\big(y - \alpha(x - e)\big)$$

$$= var\big(\alpha x + u - \alpha(x - e)\big) = var(u + \alpha e)$$

$$= var(u) + \alpha^2 var(e) + 2\alpha cov(e, u) \qquad\qquad (D.15)$$

The second term in equation (D.15) is positive (and so we push R^2 down) but the third term is ambiguous: the sign depends how x influences y (the sign of α) and how the error terms are correlated.

Now using equation (D.7'), we compute

$$var(\hat{u}_{OLS}) - var(\tilde{u}_{IV}) = \left\{var(u) - \frac{[cov(u,e)]^2}{var(x)}\right\} - \{var(u) + \alpha^2 var(e) + 2\alpha cov(e, u)\}$$

$$= -\frac{[cov(u,e)]^2}{var(x)} - \alpha^2 var(e) - 2\alpha cov(e, u) \qquad\qquad (D.16)$$

The first two terms are negative (and so this helps us ensure that R^2_{OLS} is greater that GR^2_{IV}) but the last term is ambiguous because we need to know more about the nature of the omitted variable that gives a non-zero correlation between e and u as well as how x influences y.

One special case to guarantee $R^2_{OLS} \geq GR^2_{IV}$ is when the omitted variable moves y and x in the same direction (i.e., $cov(u, e) > 0$) as x moves y. For example, $cov(u, e) > 0$ and $\alpha > 0$. Alternatively, $cov(u, e) < 0$ and $\alpha < 0$. If $\alpha cov(e, u) \geq 0$, OLS overstates the contribution of x to variable of y and hence R^2_{OLS} continues to be an upper bound for the variation in y due to x.

One may expect condition $\alpha cov(e, u) = cov(x, u) \geq 0$ to be satisfied in our setting: more productive firms are more likely to run into distortionary constraints (e.g., red tape) and these constraints are likely to raise the marginal revenue product of an input (red tape makes firms employ too little of the input). Consider the following model as an illustration of this point. Suppose that a firm is maximizing profits subject to a size constraint:

$$\max_{E,L} A(EL)^\alpha - w(E)L \ \ s.t. \ \ L \leq \bar{L}$$

where L is labor input, $\bar{L}$ is the maximum firm size allowed by red tape, E is effort of workers, $w(E)$ is the wage function for effort, A is productivity (entrepreneurial talents of the firm's manager). We will assume that the wage function is increasing and convex: $w'(E) > 0, w''(E) > 0$. The parameter $\alpha < 1$ measures returns to scale. Firms are heterogenous in their draws of A.

The Lagrangian is $\mathcal{L} = A(EL)^\alpha - w(E)L - \lambda(L - \bar{L})$ where λ is the Lagrange multiplier on the size constraint. Optimality conditions for E and L are respectively:

$$\alpha A E^{\alpha-1} L^\alpha = w'(E)L,$$

$$MRPL \equiv \alpha A E^\alpha L^{\alpha-1} = w(E) + \lambda.$$

Note that when the size constraint is not binding, $\lambda = 0$ and hence the optimal level of effort E^* is given by

$$\frac{w'(E^*)E^*}{w(E^*)} = 1.$$

and so effort does not depend on productivity A. If the size constraint is not binding, the marginal revenue product of labor is

$$MRPL = w(E^*).$$

If the size constraint is binding, the optimal effort is given by

$$\alpha A (E^*)^{\alpha-1}\bar{L}^\alpha = w'(E^*)\bar{L} \Leftrightarrow A = \frac{\bar{L}^{1-\alpha}}{\alpha}w'(E^*)(E^*)^{1-\alpha}.$$

Because $w''(E) > 0$ and $\alpha < 1$, it follows that E^* is increasing in productivity A. To determine λ in this case, we note that

$$\alpha A (E^*)^\alpha \bar{L}^{\alpha-1} = w(E^*) + \lambda \Longrightarrow w'(E^*)E^* = w(E^*) + \lambda \Longrightarrow \lambda = w'(E^*)E^* - w(E^*)$$

Given our assumptions about the wage function, we have

$$\frac{\partial\lambda}{\partial E^*} = w''(E^*)E^* + w'(E^*) - w'(E^*) = w''(E^*)E^* > 0,$$

that is, the Lagrange multiplier on the size constraint is increasing in effort. Trivially, $MRPL$ is increasing in effort.

Now suppose we have a measure of how binding the size constraint is (e.g., in the survey, we ask firms to report how binding various constraints are: major issue, minor issue, not an issue) but we do not observe effort. We regress $MRPL$ on λ. The optimality condition for labor implies that the regression takes the following form:

$$MRPL = \lambda + w(E) = \lambda + error,$$

where the error term $error$ absorbs unobserved effort $w(E)$. Clearly the structural coefficient on λ is positive and $cov(\lambda, error) = cov(\lambda, w(E)) > 0$. Thus, the condition for $R^2_{OLS} \geq R^2_{IV}$ and $R^2_{OLS} \geq GR^2_{IV}$ is satisfied.

E. MEASUREMENT ERROR

Suppose we do not have the right measure of x and instead have two imperfect measures of x: $x_1^* = x + \eta_1$ and $x_2^* = x + \eta_2$. To keep algebra simple, we assume that:

1) η is uncorrelated with u and e
2) η_1 is uncorrelated with η_2.
3) $var(\eta_1) = var(\eta_2) = var(\eta)$

Also, to focus on the measurement error, we assume that $cov(u, e) = 0$ and so we do not have endogeneity considered above.

Using x_1^* (or x_2^*) in estimating equation (D.1) yields

$$\hat{\alpha}_{ME}^{OLS} = \alpha \frac{var(x)}{var(x)+var(\eta)} \tag{D.17}$$

$$\hat{u}_{ME,OLS} = y - \hat{\alpha}_{ME}^{OLS}x_1^* = (\alpha x + u) - \alpha \frac{var(x)}{var(x)+var(\eta)}(x + \eta_1)$$

$$= u + \alpha \frac{var(\eta)}{var(x)+var(\eta)}x - \alpha \frac{var(x)}{var(x)+var(\eta)}\eta_1 \tag{D.18}$$

Because u, x, η_1 are assumed to be uncorrelated, we have

$$var(\hat{u}_{ME,OLS}) = var(u) + \alpha^2 \left[\frac{var(\eta)}{var(x)+var(\eta)}\right]^2 var(x) + \alpha^2 \left[\frac{var(x)}{var(x)+var(\eta)}\right]^2 var(\eta)$$

$$= var(u) + \alpha^2 \frac{var(\eta)var(x)}{(var(x)+var(\eta))^2}\{var(x) + var(\eta)\} =$$

$$= var(u) + \alpha^2 \frac{var(x)}{var(x)+var(\eta)} var(\eta) \tag{D.19}$$

Because $var(\hat{u}_{ME,OLS}) > var(u)$, it follows that

$$R^2_{ME,OLS} = 1 - \frac{var(\hat{u}_{ME,OLS})}{var(y)} < R^2_{true} = 1 - \frac{var(u)}{var(y)} \tag{D.20}$$

Furthermore, one can show that

$$R^2_{ME,OLS} = 1 - \frac{var(\hat{u}_{ME,OLS})}{var(y)} = 1 - \frac{var(u)+\alpha^2\frac{var(x)}{var(x)+var(\eta)}var(\eta)}{var(y)}$$

$$= \left(1 - \frac{var(u)}{var(y)}\right) - \frac{\alpha^2 var(x)}{var(y)} \times \frac{var(\eta)}{var(x)+var(\eta)} = R^2_{true} - R^2_{true}\frac{var(\eta)}{var(x)+var(\eta)}$$

$$= R^2_{true} \frac{var(x)}{var(x)+var(\eta)} \tag{D.21}$$

where $R^2_{true} \equiv 1 - \frac{var(u)}{var(y)} = \frac{\alpha^2 var(x)}{var(y)}$.

We can use x_2^* as an instrument to x_1^* because η_1 and η_2 are uncorrelated. This IV regression will give us $\hat{\alpha}_{IV} \to_p \alpha$.

However, having an IV estimate does not help here, because the structural error in this regression will still have measurement error

$$\hat{u}_{ME,IV} = y - \hat{\alpha}_{IV}x_1^* = y - \alpha x_1^* = \alpha x + u - \alpha(x + \eta_1) = u - \alpha\eta_1 \tag{D.22}$$

and hence

$$var(\hat{u}_{ME,IV}) = var(u) + \alpha^2 var(\eta). \tag{D.23}$$

Because $var(\hat{u}_{ME,IV}) > var(u)$, we have

$$R^2_{ME,IV} = 1 - \frac{var(\hat{u}_{ME,IV})}{var(y)} < R^2_{true}$$

Because $var(\hat{u}_{ME,IV}) > var(\hat{u}_{ME,OLS})$, we also have $R^2_{ME,IV} < R^2_{ME,OLS}$.

Now consider using a predictive IV error term $\tilde{u}_{IV} = y - \hat{\alpha}_{IV}\hat{x}_1^*$ where $\hat{x}_1^* = \hat{\psi}x_2^*$ and $\hat{\psi} = \frac{cov(x_1^*,x_2^*)}{var(x_2^*)} = \frac{var(x)}{var(x)+var(\eta)}$. Because x_2^* also has measurement error, we obtain

$$\tilde{u}_{IV} = y - \hat{\alpha}_{IV}\hat{x}_1^* = y - \alpha\hat{\psi}x_2^*$$

$$= \alpha x + u - \alpha \hat{\psi}(x + \eta_2) = u + \alpha(1 - \hat{\psi})x - \alpha\hat{\psi}\eta_2 \qquad (D.24)$$

Because u, x, η_2 are uncorrelated, we have

$$var(\tilde{u}_{IV}) = var(u) + \alpha^2(1 - \hat{\psi})^2 var(x) + \alpha^2\hat{\psi}^2 var(\eta) =$$

$$= var(u) + \alpha^2 \left(\frac{var(\eta)}{var(x)+var(\eta)}\right)^2 var(x) + \alpha^2 \left(\frac{var(x)}{var(x)+var(\eta)}\right)^2 var(\eta) =$$

$$= var(u) + \alpha^2 \frac{var(\eta)var(x)}{[var(x)+var(\eta)]^2}\{var(x) + var(\eta)\} =$$

$$= var(u) + \alpha^2 \frac{var(x)}{var(x)+var(\eta)} var(\eta) \qquad (D.25)$$

Because $var(\tilde{u}_{IV}) > var(u)$, we know

$$GR^2_{ME,IV} \equiv 1 - \frac{var(\tilde{u}_{IV})}{var(y)} < R^2_{true}. \qquad (D.26)$$

When we compare $GR^2_{ME,IV}$ (equation D.26) and $R^2_{ME,OLS}$ (equation D.19), we can see that $GR^2_{ME,IV} = R^2_{ME,OLS}$. Thus, OLS continues to provide an upper bound for predictive power of x in explaining y.

We can do a little better even when we have multiple measurements of x. Notice that we can use $\bar{x}^* = (x_1^* + x_2^*)/2$ as a regressor. In this case, the measurement error is reduced: $var(\bar{x}^*) = var\left(x + \frac{\eta_1}{2} + \frac{\eta_2}{2}\right) = var(x) + \frac{1}{4}var(\eta) + \frac{1}{4}var(\eta) = var(x) + \frac{1}{2}var(\eta)$. As a result,

$$R^2_{ME,OLS} = R^2_{true} \frac{var(x)}{var(x)+\frac{1}{2}var(\eta)} \qquad (D.27)$$

and hence $R^2_{ME,OLS}$ is less biased. Thus, by running a regression with average values of x^*, we can reduce the size of measurement errors and try to improve the upper bound for R^2.

Appendix E: EIBIS Questionnaire

EIB Group Survey of Investment and Investment Finance

General module questionnaire – 2016

INTRODUCTION

READ OUT TO ALL
Hello, my name is .... and I'm calling from [NETWORK PARTNER] **on behalf of the European Investment Bank (EIB Group).**

IF NAMED RESPONDENT IN SAMPLE: **Could I speak to** [NAME FROM SAMPLE]**?**

IF NO NAMED RESPONDENT IN SAMPLE OR NAMED RESPONDENT NOT AVAILABLE:
We're conducting a survey to better understand business investment decisions. Can I speak to the most senior person at [INSERT COMPANY NAME FROM SAMPLE] with responsibility for investment decisions and how these are financed? IF NECESSARY This person could be the owner, a Finance Manager, the Finance Director or Head of Accounts, the Chief Financial Officer (CFO) or the Chief Executive Officer (CEO)?

READ OUT TO ALL
Your business has been selected to participate in this survey on business investment in [COUNTRY OF INTERVIEW] **to help policy-makers identify ways to support businesses like yours.**

Your co-operation will ensure that the views expressed are representative of businesses in [COUNTRY OF INTERVIEW]**.**

Information already held about your company from the Bureau van Dijk Orbis database will be appended to your survey answers for analysis purposes, but your confidentiality will be maintained and all linked data will be anonymised.

I would like to send you some information on the type of questions that we will ask in the survey. Could I have your email address to send it to you? If you don't receive the email promptly please check your junk folder. EMAIL DATASHEET TO RESPONDENT

If you would like, the European Investment Bank will email you a summary report of the findings as a thank you for taking part in the research.

The survey will take about 15 to 20 minutes of your time. Would it be convenient to conduct the interview now? SINGLE CODE ONLY

REASSURANCES TO USE IF NECESSARY:
- **Everything you say will be treated in the strictest confidence and your answers will only be reported at the aggregate level together with all the other organisations taking part.**
- **It doesn't matter if you have not invested in the past year – we need to talk to a wide range of organisations in this survey and you will not be asked irrelevant questions.**
- **The survey is not technical and you don't need any specific financial knowledge to take part.**
- **We can share some of the questions with you by email, to help you find the right person to take part.**
- **Findings from the survey will be published on the www.eib.org website at the end of 2016, in order to help businesses like yours.**
- **Details of the survey are on the European Investment Bank (www.eib.org/) website and the Ipsos website www.ipsos.com)**
- **If respondent wishes to confirm validity of survey or get more information about aims and objectives, they can visit the website or call:**
    - **MRS: Market Research Society on XXXX**

o **EIB: eibis@eib.org**
o **NETWORK PARTNER: XXXX**

SCREENER

READ OUT TO ALL
I'd like to ask you some questions about your business.

ASK ALL
1. **Can I check how long** [INSERT COMPANY NAME] **has been operating?** READ OUT IF NECESSARY **In the case of a past acquisition, please refer to when the acquiring enterprise was registered or, in the case of a merger, to the largest enterprise involved in terms of employees**? SINGLE CODE ONLY

   o Less than 2 years
   o 2 years to less than 5 years
   o 5 years to less than 10 years
   o 10 years to less than 20 years
   o 20 years or more
   o Company has ceased trading/been sold/passed on – CLOSE INTERVIEW
   o Don't know – CLOSE INTERVIEW
   o Refused – CLOSE INTERVIEW

ASK ALL
2. **How many people does your company employ either full or part time at all its locations, including yourself**? READ IF NECESSARY: **Please include freelancers working regularly for your company. Full-time and part-time employees should each count as one employee. Employees working less than 12 hours per week should be excluded.** WRITE IN NUMBER

   o WRITE IN NUMBER – CLOSE IF LESS THAN 5 EMPLOYEES
   o Don't know – GO TO Q3
   o Refused – GO TO Q3

ASK IF DON'T KNOW OR REFUSED AT Q2
3. **What is the approximate number?** SINGLE CODE ONLY

   o Less than 5 employees - CLOSE INTERVIEW
   o 5-9 employees
   o 10-49 employees
   o 50-99 employees
   o 100-249 employees
   o 250-499 employees
   o 500-999 employees
   o 1,000+ employees
   o Don't know – PROMPT USING SAMPLE INFORMATION AND IF STILL DON'T KNOW, CLOSE INTERVIEW
   o Refused – PROMPT USING SAMPLE INFORMATION AND IF STILL DON'T KNOW, CLOSE INTERVIEW

   SCRIPT: ALLOCATE Q2/Q3 TO QUOTA

ASK ALL
4. IF SECTOR IN SAMPLE **Can I check** [INSERT SECTOR] **is the main sector of activity of this company?**

   IF SECTOR NOT IN SAMPLE **What is the main sector of activity of this company?** SINGLE CODE ONLY

   o NACE 4 list

   SCRIPT: ALLOCATE Q4 TO QUOTA

ASK ALL
5. **Can I just check is** [INSERT NAME OF COMPANY] **a subsidiary of another company?** SINGLE CODE ONLY

   o Yes
   o No

- o Don't know
- o Refused

SECTION A: BACKGROUND

READ OUT TO ALL SUBSIDIARIES (CODE 1 AT Q5) **In your replies to all of the following questions, please respond on behalf of the subsidiary only and not the parent company.**

ASK ALL
6. **Thinking about the number of people employed by your company, by how much has it changed in the last three years?** READ IF NECESSARY: **Please include both full-time and part-time employees working 12 hours or more. Please include freelancers working regularly for your company. Full-time and part-time employees should each count as one employee. Employees working less than 12 hours per week should be excluded.** SCRIPTING: ALLOW NUMBER OR PERCENTAGE

   - o NUMBER more than 3 years ago
   - o NUMBER less than 3 years ago
   - o PERCENTAGE more than 3 years ago
   - o PERCENTAGE less than 3 years ago
   - o No change in number of people employed in last three years
   - o Company didn't exist three years ago
   - o Don't know
   - o Refused

ASK ALL
7. **Can I check was your organisation's last financial year** [ENTER STANDARD COUNRTY DATES]? SINGLE CODE ONLY

   - o Yes
   - o No
   - o Don't know
   - o Refused

ASK IF NO OR DON'T KNOW AT Q7
8. **Can I confirm in which month and year did the organisation's last full, finalised accounting period end?** IF NECESSARY: **The accounting period is the period for which the full financial statements are prepared and balanced. Generally the accounting period is 12 months long, but it can be shorter or longer.** INTERVIEWER NOTE: WE ARE INTERESTED IN THE LAST FINANCIAL YEAR EVEN IF THE ORGANISATION IS STILL TO FILE A FINANCIAL STATEMENT FOR THAT YEAR. CODE MONTH AND YEAR

   SINGLE CODE MONTH
   - o January
   - o February
   - o March
   - o April
   - o May
   - o June
   - o July
   - o August
   - o September
   - o October
   - o November
   - o December
   - o Don't know

   SINGLE CODE YEAR
   - o 2015
   - o 2016
   - o Don't know
   - o Refused

ASK IF NO OR DON'T KNOW AT Q7

9. **And can I check your organisation's financial year is 12 months?** SINGLE CODE ONLY

   o Yes - 12 months
   o No – longer/shorter than 12 months WRITE IN NUMBER OF MONTHS IF NOT 12 MONTHS
   o Don't know
   o Refused

SCRIPT CHECK: IF RESPONDENT SAYS LESS THAN 12 MONTHS, THE ANSWER AT Q8 CANNOT BE JANUARY TO CURRENT MONTH MINUS ONE

SCRIPT:
- IF ACCOUNTING PERIOD IS JANUARY TO DECEMBER 2015 PLEASE REFER TO '2015' AT THE FOLLOWING RELEVANT QUESTIONS
- ALL OTHERS REFER TO 'THE 2015/16 FINANCIAL YEAR' <u>EXCEPT</u> THOSE WHO SAY ACCOUNTING PERIOD ENDED JANUARY TO NOVEMBER 2015 AT Q8 WHICH SHOULD REFER TO 'THE 2014/15 FINANCIAL YEAR'
- IF DON'T KNOW OR REFUSED REFER TO COUNTRY STANDARD DATES

ASK ALL
10. **What was the approximate turnover of the company in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**?** ADD AS NECESSARY**: This is the total amount received in respect of sales of goods and services.** WRITE IN AMOUNT

    o WRITE IN AMOUNT IN EUROS OR LOCAL CURRENCY
    o Don't know
    o Refused

ASK IF DON'T KNOW OR REFUSED AT Q10
11. **Was it approximately?** SINGLE CODE ONLY

ASK ALL
12. **In** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**, was your company operating at its maximum capacity attainable under normal conditions?** READ OUT SCALE. SINGLE CODE ONLY.

    INTERVIEWER EXPLAIN IF NECESSARY: **By normal conditions, I mean your company's general practices regarding the utilisation of machines and equipment, overtime, work shifts, holidays etc.**

    o Above maximum capacity
    o At maximum capacity
    o Somewhat below full capacity
    o Substantially below full capacity
    o Don't know
    o Refused

SECTION B: MAIN INVESTMENT

READ OUT TO ALL
The following questions are about your investment and associated expenditure in all your company's locations.

ASK ALL
13. **In** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**, how much did your business invest in each of the following with the intention of maintaining or increasing your company's future earnings?** READ OUT A TO F. ROTATE ORDER OF A TO WRITE IN AMOUNT IN EUROS OR LOCAL CURRENCY FOR EACH. RECORD ZERO IF NO INVESTMENT MADE

    A. Land, business buildings and infrastructure
    B. Machinery and equipment
    C. Research and Development (including the acquisition of intellectual property)
    D. Software, data, IT networks and website activities
    E. Training of employees

F. Organisation and business process improvements INTERVIEWER ADD IF NECESSARY such as restructuring and streamlining

- o WRITE IN EUROS OR LOCAL CURRENCY FOR EACH. RECORD ZERO IF NO INVESTMENT MADE
- o Don't know
- o Refused

ASK ALL WHO DON'T KNOW OR REFUSED AT Q13
14. **Can you estimate what the business' total investment spend was in these areas** [ADD AS APPROPRIATE IF INVESTED IN LAST FINANCIAL YEAR **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**] **with the intention of maintaining or increasing your company's future earnings?** WRITE IN AMOUNT IN EUROS OR LOCAL CURRENCY

- o WRITE IN AMOUNT IN EUROS OR LOCAL CURRENCY
- o No investment made
- o Don't know
- o Refused

ASK IF DON'T KNOW AT Q14
   15. **Was it approximately?** SINGLE CODE ONLY

ASK IF DID NOT INVEST IN ANY AREA AT Q13 (ZERO FOR ALL A TO F) OR IF TOTAL INVESTMENT ZERO AT Q14 OR Q15
   16. **And did you invest in** [ADD AS APPROPRIATE **2014** OR **the 2014/15 financial year** OR **the 2013/14 financial year**] **in any of these areas with the intention of maintaining or increasing your company's future earnings?** SINGLE CODE ONLY

- o Yes
- o No
- o Don't know
- o Refused

ASK ALL WHO HAVE INVESTED AT Q13, Q14 OR Q15
   17. **Overall, was this more, less or about the same amount of investment as in the previous year?** SINGLE CODE ONLY

- o More investment than the previous year
- o Investment broadly stayed the same to the previous year
- o Less investment than in the previous year
- o Don't know
- o Refused

ASK ALL WHO HAVE INVESTED AT Q13, Q14 OR Q15
   18. **What proportion of the total investment in** [ADD AS APPROPRIATE IF INVESTED IN LAST FINANCIAL YEAR AT Q20 **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**] **was for** READ OUT A TO C? WRITE IN PERCENTAGES. SCRIPT CHECK ADDS UP TO 100%

- A. Replacing existing buildings, machinery, equipment and IT
- B. Expanding capacity for existing products/services
- C. Developing or introducing new products, processes or services
- o Other (SPECIFY)
- o Don't know
- o Refused

ASK IF DEVELOPED OR INTRODUCED NEW PRODUCTS, PROCESSES OR SERVICES AT Q18C
   19. **Were the new products, process or services...** READ OUT A TO C? SINGLE CODE ONLY
   INTERVIEWER NOTE: IF MORE THAN ONE PRODUCT, PROCESS OR SERVICE HAS BEEN INTRODUCED PLEASE CODE TO THE HIGHEST BAND (E.G. IF PRODUCT NEW TO THE COMPANY AND SERVICE NEW TO THE COUNTRY CODE THE COUNTRY)

- A. New to the company
- B. New to the country
- C. New to the global market
- o Don't know

o   Refused

ASK ALL WHO HAVE INVESTED AT Q13, Q14 OR Q15
20. **How much, if at all, do you expect the number of employees in your business to increase or decrease as a direct effect of your investment in the last financial year? Please count employees who were and will be recruited as a direct result of your investment and subtract all employees who were and will be rationalised.** WRITE IN NUMBER OR PERCENTAGE

INTERVIEWER ADD IF NECESSARY: **Full-time and part-time employees should each count as one employee. Employees working less than 12 hours should be excluded.**

o   (NUMBER) higher due to investment
o   (NUMBER) lower due to investment
o   (PERCENTAGE) higher due to investment
o   (PERCENTAGE) lower due to investment
o   No change
o   Don't know
o   Refused

SECTION C: INVESTMENT PLAN AND PIPELINE

ASK ALL WHO HAVE INVESTED AT Q13, Q14 OR Q15
21. **For the <u>current</u> financial year, do you expect your total investment spend to be …** READ OUT A TO D? SINGLE CODE ONLY

A.   More than last year
B.   Around the same amount as last year
C.   Less than last year
D.   No investment planned
o   Don't know
o   Refused

ASK ALL WHO HAVE <u>NOT</u> INVESTED AT Q13, Q14 OR Q15 (INCLUDING DON'T KNOW/REFUSALS]
22. **Have you already invested, or do you expect to invest, in the <u>current</u> financial year?** SINGLE CODE ONLY

o   Yes
o   No
o   Don't know
o   Refused

ASK ALL WHO HAVE PLANNED TO INVEST AT Q21 (CODE 1 TO 3) OR Q22 (CODE 1)
23. **How do each of the following affect your ability to carry out your planned investment. Does it affect it positively or negatively, or make no difference at all?** READ OUT A TO E. SINGLE CODE ONLY FOR EACH

A.   **Availability of internal finance within the company (e.g. internal funds like cash)**
B.   **Availability of external finance (e.g. bank financing, private or public equity)**
C.   **Business prospects specific to your sector or industry**
D.   **Overall economic climate**
E.   **Political and regulatory climate**

o   Positively affect the ability to carry out planned investment
o   Make no difference to the ability to carry out planned investment
o   Negatively affect the ability to carry out planned investment
o   Don't know
o   Refused

ASK ALL
24. **Looking back at your investment over the last three years, was it too much, too little, or about the right amount to ensure the success of your business going forward?** SINGLE CODE ONLY

o   Too much

- o About the right amount
- o Too little
- o Company didn't exist three years ago
- o Don't know
- o Refused

ASK ALL
25. **And looking ahead to the next three years, which of the following is your investment priority** [READ OUT A TO D]**?** SINGLE CODE ONLY

   A. Replacing existing buildings, machinery, equipment and IT
   B. Capacity expansion for existing products/services
   C. Developing or introducing new products, processes or services
   D. Or do you have no investment planned?
   - o Don't know
   - o Refused

SECTION D: INVESTMENT FINANCE

ASK ALL WHO HAVE INVESTED AT Q13, Q14 OR Q15
I now want to ask you some questions about the financing of your investment activities in [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**].

ASK IF SUBSIDIARY (CODE 1) AT Q5
26. **Firstly can you tell me to what extent is your company involved in decisions about seeking <u>external finance</u> for your investment activities?** READ OUT A TO D. SINGLE CODE ONLY

   A. To a great extent
   B. To some extent
   C. Hardly at all
   D. Not at all
   - o Don't know
   - o Refused

SCRIPTING NOTE: SUBSIDIARIES WHO ARE INVOLVED HARDLY/NOT AT ALL/DON'T KNOW/REFUSED CODES 3 TO 6 AT Q26) GO TO Q37

ASK ALL WHO HAVE INVESTED AT Q13, Q14 OR Q15 <u>EXCEPT</u> SUBSIDIARIES INVOLVED HARDLY/NOT AT ALL/DON'T KNOW/REFUSED
27. **Approximately what proportion of your investment in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**] **was financed by each of the following?** READ OUT A TO C. WRITE IN PERCENTAGES. SCRIPT CHECK = 100%

   A. Internal funds or retained earnings (e.g. cash, profits)   %
   B. External Finance (e.g. financing from banks, private or public equity)   %
   C. SUBSIDIARIES ONLY Intra-group Funding e.g. Loan from parent company   %
   - o Don't know
   - o Refused

ASK IF USED EXTERNAL FINANCE AT Q27
28. **Which of the following types of external finance did you use for your investment activities in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**?** READ OUT A TO H. MULTICODE OK

   A. Bank loans excluding subsidised bank loans, overdrafts and other credit lines
   B. Other terms of bank finance including overdrafts and other credit lines
   C. Newly issued bonds [READ OUT IF NECESSARY: These are debt obligations that a company sells to financial investors with the legal commitment to repay at a later stage with interest]
   D. Newly issued equity [READ OUT IF NECESSARY: This includes quoted or unquoted shares]

E. Leasing or hire purchase [READ OUT IF NECESSARY: Obtaining the use of a fixed asset, for example cars or machinery, in exchange for regular payments, but without the immediate ownership of the asset]
F. Factoring/invoice discounting [READ OUT IF NECESSARY: Selling your invoices to a factoring company. This company gets your debt and has to collect it. It will make a profit by paying you less cash than the face value of the invoice]
G. Loans from family/friends/business partner
H. Grants [READ OUT IF NECESSARY: Involving for example support from public sources]
o Other (Specify)
o Don't know
o Refused

IF USED MORE THAN ONE SOURCE OF FINANCE AT Q28
29. **Approximately what proportion of your external finance does each of the following represent** READ OUT A TO H IF USED AT Q28]**?** WRITE IN PERCENTAGES. SCRIPT CHECK = 100%

A. Bank loans excluding subsidised bank loans, overdrafts and other credit lines
B. Other terms of bank finance including overdrafts and other credit lines
C. Newly issued bonds [READ OUT IF NECESSARY: These are debt obligations that a company sells to financial investors with the legal commitment to repay at a later stage with interest]
D. Newly issued equity [READ OUT IF NECESSARY: This includes quoted or unquoted shares
E. Leasing or hire purchase [READ OUT IF NECESSARY: Obtaining the use of a fixed asset, for example cars or machinery, in exchange for regular payments, but without the immediate ownership of the asset]
F. Factoring/invoice discounting [READ OUT IF NECESSARY: Selling your invoices to a factoring company. This company gets your debt and has to collect it. It will make a profit by paying you less cash than the face value of the invoice]
G. Loans from family/friends/business partner
H. Grants [READ OUT IF NECESSARY: Involving for example support from public sources]
o Other (Specify)
o Don't know
o Refused

ASK IF USED EXTERNAL FINANCE AT Q27
30. **Thinking about all of the external finance you obtained, how satisfied or dissatisfied are you with it in terms of …?** READ OUT A TO E. READ OUT SCALE. SINGLE CODE ONLY FOR EACH

A. The amount you obtained
B. The cost of the external finance you obtained
C. The length of time over which it has to be repaid
D. The collateral required
E. The type of external finance you obtained

• Very satisfied
• Fairly satisfied
• Neither satisfied nor dissatisfied
• Fairly dissatisfied
• Very dissatisfied
• Don't know
• Refused

ASK ALL WHO SAID EQUITY (CODE D/4) AT Q28
31. **For the equity you obtained, how much was from a private equity firm/venture capitalists/business angels?** READ OUT A TO C. SINGLE CODE ONLY

A. All
B. Some
C. None
o Don't know
o Refused

ASK ALL WHO DID NOT USE ANY EXTERNAL FINANCING (CODE B/2 AT Q27 = ZERO)

32. **Did you <u>seek</u> any external financing for your investment activities in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]? SINGLE CODE ONLY

   o Yes
   o No
   o Don't know
   o Refused

ASK IF DID NOT SEEK EXTERNAL FINANCING AT Q32
33. **What was your <u>main reason</u> for not applying for external finance for your investment activities?** DO NOT READ OUT. SINGLE CODE ONLY

   o No need as were not planning to undertake large investments
   o Thought we'd be turned down
   o Thought it would be too expensive
   o Preferred not to take on additional risk
   o The current economic conditions made it a bad time to access bank loans
   o Did not know where to find the appropriate finance we needed
   o Was happy to use internal finance/didn't need the finance
   o Was happy with existing external finance/lines of credit
   o We have a parent company which we get funding from
   o It wasn't our decision
   o Other (SPECIFY)
   o Don't know
   o Refused

ASK IF USED A BANK LOAN (CODE A/1) AT Q28
34. **Which bank provided you with the loan?** INTERVIEWER NOTE IF MORE THAN ONE BANK ASK RESPONDENT FOR MAIN BANK. SINGLE CODE ONLY

   o LIST OF BANKS [USING BANKSCOPE INSTITUTES]
   o Other (SPECIFY)
   o Don't know
   o Refused

ASK IF DID NOT USE A BANK LOAN (NOT CODE A/1) AT Q28
35. **For the last bank loan that you obtained, which bank provided you with the loan?** INTERVIEWER NOTE IF MORE THAN ONE BANK ASK RESPONDENT FOR MAIN BANK. SINGLE CODE ONLY

   o LIST OF BANKS [USING BANKSCOPE INSTITUTES]
   o Other (SPECIFY)
   o Never had a bank loan
   o Don't know
   o Refused

ASK IF USED EXTERNAL FINANCE AT Q27
36. **If you were to seek external finance over the next three years, which type of finance would you want to play a more prominent role in your financing mix?** DO NOT PROMPT. SINGLE CODE ONLY

   INTERVIEWER NOTE: IF RESPONDENT MENTIONS A GRANT PROBE FURTHER AND RECORD OTHER TYPE OF EXTERNAL FINANCE **What else?**

   o Bank loan
   o Overdraft
   o Bond issuance
   o Newly issued equity
   o Leasing or hire purchase
   o Factoring/invoice
   o Other (specify)
   o Don't know
   o Refused

ASK IF SUBSIDIARY NOT INVOLVED/INVOLVED HARDLY AT ALL IN FINANCE DECISIONS (Q26 CODE 3 to 6) <u>OR</u> IF SUBSIDIARY AND NOT RECEIVED INTRA-GROUP FINANCE (CODE C AT Q27 = ZERO)

37. **Have you tried to obtain intra-group finance for your investment activities in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**? By this I mean finance from your parent company or another group member.**
IF YES FOR SUBSIDIARY NOT INVOLVED/INVOLVED HARDLY AT ALL IN FINANCING DECISIONS (Q26 CODE 3 to 6): **Did you receive it?** SINGLE CODE ONLY

- o Yes, and received it [SHOW ONLY FOR Q26 CODE 3 to 6]
- o Yes, but did not receive it [SHOW ONLY FOR Q26 CODE 3 to 6]
- o Yes [SHOW ONLY FOR CODE C AT Q27 = ZERO]
- o No
- o Don't know
- o Refused

SECTION E: OBSTACLES TO INVESTMENT

READ OUT TO ALL
I would now like to ask you about any obstacles you face in your investment activities in general.

ASK ALL
38. **Thinking about your investment activities in** [ADD COUNTRY OF INTERVIEW], **to what extent is each of the following an obstacle**? **Is a major obstacle, a minor obstacle or not an obstacle at all?** READ OUT A TO I. ROTATE ORDER. STATEMENT I SHOULD ALWAYS BE ASKED LAST. SINGLE CODE ONLY

- A. **Demand for products or services**
- B. **Availability of staff with the right skills**
- C. **Energy costs**
- D. **Access to digital infrastructure**
- E. **Labour market regulations**
- F. **Business regulations** (READ IF NECESSARY **e.g. licences, permits, bankruptcy) and taxation**
- G. **Availability of adequate transport infrastructure**
- H. **Availability of finance**
- I. **Uncertainty about the future**

- o A major obstacle
- o A minor obstacle
- o Not an obstacle at all
- o Don't know
- o Refused

SECTION F: INNOVATION

READ OUT TO ALL
Now I would like to ask you some questions about your company.

ASK ALL
39. **What proportion, if any, of your machinery and equipment, including ICT, would you say is state-of-the-art? By state-of-the-art I mean cutting edge or developed from the most recent ideas or methods.** INTERVIEWER EXPLAIN THE PROPORTION SHOULD BE BASED ON AN ESTIMATE OF THE MARKET VALUE OF THE COMPANY'S MACHINERY AND EQUIPMENT. WRITE IN PERCENTAGE. IF NONE OF THE MACHINERY OR EQUIPMENT IS STATE OF THE ART RECORD 0%

- o WRITE IN PERCENTAGE
- o Don't know
- o Refused

ASK IF DON'T KNOW AT Q39
40. **Could you estimate the percentage?** PROMPT WITH BANDS. SINGLE CODE ONLY

- o Less than 25%
- o 25% to less than 50%
- o 50% to less than 75%
- o 75% or more
- o Don't know
- o Refused

ASK ALL
41. **What proportion, if any, of your commercial building stock satisfies high or highest energy efficiency standards?**
    IF NONE RECORD 0%
    INTERVIEWER NOTE: THIS INCLUDES BOTH OWNED AND RENTED BUILDING STOCK

- o WRITE IN PERCENTAGE
- o Don't know
- o Refused

ASK IF DON'T KNOW AT Q41
42. **Could you estimate the percentage?** PROMPT WITH BANDS. SINGLE CODE ONLY

- o Less than 25%
- o 25% to less than 50%
- o 50% to less than 75%
- o 75% or more
- o Don't know
- o Refused

SECTION G: INTERNATIONALISATION

ASK ALL
43. **In [ADD AS APPROPRIATE 2015 OR the 2015/16 financial year OR the 2014/15 financial year], has your company**
    READ OUT A AND B? MULTICODE OK FOR A AND B

- A. Directly exported goods and services to another country
- B. Invested in another country
- o Don't know
- o Refused

SECTION H: FIXED ASSETS

READ OUT TO ASK ALL
The following questions are to understand the economic value added (EVA) of your company. By this, I mean the difference between the value of all inputs and the price at which the products/ services of your company when they are sold.

ASK ALL
44. **In [ADD AS APPROPRIATE 2015 OR the 2015/16 financial year OR the 2014/15 financial year], what was the value of the business' total fixed assets. Please include tangible assets (e.g. buildings, equipment, vehicles) and intangible assets (e.g. patents, trademarks and copyright) but exclude financial assets such as cash or bank accounts.** WRITE IN AMOUNT

- o WRITE IN AMOUNT IN EUROS OR LOCAL CURRENCY
- o Don't know
- o Refused

ASK IF DON'T KNOW AT Q44
- o **Was it approximately?** READ OUT BANDS. SINGLE CODE ONLY

- o Up to EUR 50,000
- o More than EUR 50,000 and up to EUR 100,000

- More than EUR 100,000 and up to EUR 500,000
- More than EUR 500,000 and up to EUR 1 million
- More than EUR 1 million and up to EUR 2 million
- More than EUR 2 million and up to EUR 10 million
- More than EUR 10 million and up to EUR 50 million
- More than EUR 50 million
- Don't know
- Refused

ASK ALL

45. **How much did the company spend on wages in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**?** SINGLE CODE ONLY

- WRITE IN AMOUNT
- Don't know
- Refused

ASK IF DON'T KNOW AT Q46

46. **Was it approximately…?** SINGLE CODE ONLY

- ADD APPROPRIATE BANDS DEPENDING ON SIZE OF COMPANY

ASK ALL

47. **Taking into account all sources of income in** [ADD AS APPROPRIATE **2015** OR **the 2015/16 financial year** OR **the 2014/15 financial year**]**, did your company generate a profit or loss before tax, or did you break even?** SINGLE CODE ONLY

- Profit
- Loss
- Break even
- Don't know
- Refused

ASK IF GENERATED A PROFIT/LOSS AT Q48

48. **If you don't mind me asking, approximately how much** [ADD AS APPROPRIATE **profit/loss**] **before tax did you make as a percent of your turnover?** ADD AS NECESSARY **I can assure that that your answer will be treated as confidential and remain anonymous.** SINGLE CODE ONLY

- Under 2%
- 2% to 4%
- 5% to 9%
- 10% to 14%
- 15% or more
- Don't know
- Refused

ASK ALL

49a. **How do you expect the outcome of the UK referendum on EU membership to affect your investment activities in the coming year?** [INTERVIEWER ADD IF NECESSARY: **The outcome of the UK referendum in June 2016 was for the UK to leave the European Union**] READ OUT A TO E. SINGLE CODE ONLY.

- A. Very positively
- B. Fairly positively
- C. Make no difference
- D. Fairly negatively
- E. Very negatively
- Don't know
- Refused

SECTION I: ONLINE AND RECONTACT

ASK ALL WITH INVESTMENT PRIORITY IN THE NEXT THREE YEARS (CODE 1 TO 3) AT Q25

49.   **We would like to email you a link to a short online survey to complete any time in the few weeks. Would you be happy for me to do this now [AT/CY/CZ/DE/SE/SK: in the next 2-3 days] if I can take your email address?**

IF NECESSARY: **The survey will ask you to choose between different hypothetical financing offers so the EIB can assess how businesses evaluate the attractiveness of different financing offers.   It should only take 5-10 minutes to complete.**

- o   Yes (email address: _____)
- o   No

ASK ALL
51. This survey will be repeated in the next one to two years. Your input is an important part of the findings that the European Investment Bank uses to inform its policies towards improving access to investment for companies like yours. May Ipsos/we contact you for your views on this topic again? SINGLE CODE ONLY

- o   Yes
- o   No

ASK IN ALL COUNTRIES EXCEPT GERMANY
52. Finally, I mentioned earlier that with your consent the EIB Group would email you a summary of the research findings for your country. Please confirm whether you would like to receive this report, and for Ipsos to let the EIB know you took part in the survey?

IF NECESSARY: **Your survey answers and email address will not be linked but your email address will be passed to the EIB Group in order that they can send you the report.**

- o   Yes (same email address as QXX)
- o   Yes (different email address: _____)
- o   No

ASK IN GERMANY
53. Finally, I mentioned earlier that with your consent we would email you a summary of the research findings for your country. Would you like to receive this report?

- o   Yes (same email address as QXX)
- o   Yes (different email address: _____)
- o   No

THANK AND CLOSE