Online Appendix

Firm expectations about production and prices: Facts, determinants, and effects*

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A.1 Expectation errors

Table A.1: Definitions of qualitative expectation errors

Source	Agg. realization	Expectation error	Production		Prices	
	$x^i_{t,h} = f(\varsigma^i_{t,h})$	$e^i_{t,h} = f(x^i_{t,h}, x^i_{t,h\|t})$	μ	σ	μ	σ
Nerlove (1983)	$\text{sgn}(\varsigma^i_{t,h})$	$\text{sgn}(x^i_{t,h} - x^i_{t,h\|t})$	-0.05	0.65	-0.04	0.65
Bachmann et al. (2013)	$\varsigma^i_{t,h}$	0 if $\text{sgn}(x^i_{t,h}) = \text{sgn}(x^i_{t,h\|t})$ $\frac{1}{h}(x^i_{t,h} - x^i_{t,h\|t})$ else	-0.03	0.35	-0.02	0.24
Massenot and Pettinicchi (2018)	$\frac{1}{h}\varsigma^i_{t,h}$	$x^i_{t,h} - x^i_{t,h\|t}$	-0.04	0.53	-0.09	0.41

Notes: schemes for the computation of expectation errors from qualitative surveys like the BEP. Realizations for one month are denoted by $x^i_{t,1} \in \{-1, 0, +1\}$, expectations for h months ahead are denoted by $x^i_{t,h|t} \in \{-1, 0, +1\}$. To account for the difference in reference periods and the qualitative nature, schemes first aggregate monthly realizations over h months and then compare aggregate realizations to expectations. Aggregate realizations $x^i_{t,h}$ are based on the sum of monthly changes over h months $\varsigma^i_{t,h} = \sum_{j=1}^{h} x^i_{t+j,1}$. Nerlove (1983) and Kawasaki and Zimmermann (1986) set $x^i_{t,h}$ to missing when there are opposite signs in the sum. sgn denotes the sign function and returns 1,0, or -1. The last four columns report the mean (μ) and standard deviation (σ) for expectation errors in the BEP.

Table A.1 summarizes the main approaches of earlier work using the ifo Survey. The survey asks for the expected change of a variable (production, prices, business situation, etc.) in the next h months, compared to now. We therefore define as $x^i_{t,h|t}$ the expectation of firm i in month t regarding the change of the firm-specific variable x^i from month t to the period from month $t+1$ until $t+h$. It can take the values -1 (expected decrease), 0 (no expected change), or 1 (expected increase). The realized change—as reported by the firm—of variable x^i from month $t-1$ to month t is denoted by $x^i_{t,1}$. Aggregating changes over the h months in question yields $\varsigma^i_{t,h} = \sum_{j=1}^{h} x^i_{t+j,1}$. Different studies have used different ways how to define a forecast error $e^i_{t,h}$ based on transformations $x^i_{t,h} = f(\varsigma^i_{t,h})$ of $\varsigma^i_{t,h}$, where $x^i_{i,h}$ is the respective definition of the aggregate realization over the h months. Nerlove (1983) and

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Kawasaki and Zimmermann (1986) compare the sign of $\varsigma^i_{t,h}$ with that of the expectation $x^i_{t,h|t}$. In their definition, the firm has made no expectation error if the two signs align. Otherwise, there is a forecast error that can be positive or negative (-1 or 1). Bachmann et al. (2013) proceed in a slightly different way. They too assign no expectation error if the sign of the aggregate realization $\varsigma^i_{t,h}$ equals that of the expectation $x^i_{t,h|t}$. In case signs differ, however, they quantify the expectation error by assigning the monthly average of the difference between the aggregate realization $\varsigma^i_{t,h}$ and the expectation $x^i_{t,h|t}$. It can therefore take values between $\pm(h+1)/h$. Massenot and Pettinicchi (2018) define the expectation error as the difference between the monthly average of the aggregate realization $\varsigma^i_{t,h}/h$ and the expectation $x^i_{t,h|t}$, such that the error may take values between -2 and 2. Note that with this definition, the error is zero only if the realization of the change takes the expected value in each of the h months.

Yet, the mean and the standard deviation of the expectation errors for production and prices, based on the BEP, are fairly comparable across definition, see the right panels of Table A.1. Moreover, the empirical correlations between the values of the aggregate realization are equal to or above 0.98, while the correlations between expectation errors are at least 0.84. The means of the expectation errors for production and prices, independent of the definition, are close to zero.

A.2 Additional figures and tables

Table A.2: Relevant questions from the ifo Survey

Label	Name	Question	Possible answers
Q1	Realized Production	Tendencies in the previous month: Our domestic production activities with respect to product XY have	increased [1] not changed [0] decreased [-1]
Q2	Expected Production	Expectations for the next 3 months: Our domestic production activity regarding good XY will probably	increase [1] not change [0] decrease [-1]
Q3	Realized Prices	Tendencies in the previous month: Taking changes of terms and conditions into account, our domestic sales prices (net) for product XY have been	increased [1] not changed [0] decreased [-1]
Q4	Expected Prices	Expectations for the next 3 months: Taking changes of conditions into account our domestic sales prices (net) for XY will probably be	rising [1] not changing [0] falling [-1]

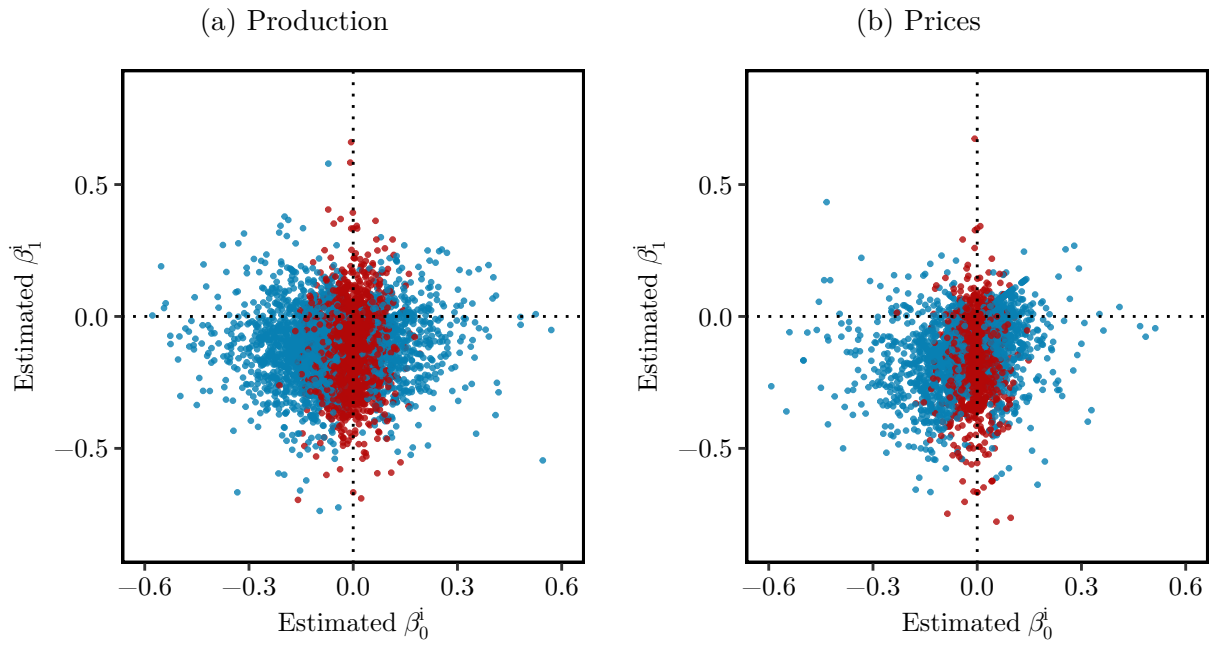
Notes: most recent formulation of the survey questions taken from the EBDC Questionnaire manual.

Table A.3: Summary statistics on firm-level average forecast errors

		Production			Prices		
Grouped by	Group	N	Median	% insig.	N	Median	% insig.
Sector	Chemical	226	-0.0087	83.19	226	-0.0048	78.32
	Electrical	599	-0.0194	78.80	600	-0.0101	82.00
	Food	277	-0.0198	80.51	278	-0.0092	81.29
	Furniture	242	-0.0187	74.79	237	-0.0084	83.97
	Glass	288	-0.0201	76.04	294	-0.0102	79.25
	Leather	63	-0.0111	73.02	62	0.0064	77.42
	Machine	772	-0.0155	80.83	766	-0.0032	84.20
	Metal	612	-0.0129	78.43	583	-0.0104	79.59
	Oil	14	-0.0275	92.86	13	-0.0000	92.31
	Paper	710	-0.0248	75.49	700	-0.0269	72.86
	Rubber	333	-0.0171	76.58	328	-0.0146	79.57
	Textile	315	-0.0261	73.33	329	-0.0108	82.37
	Vehicle	130	0.0031	74.62	128	-0.0021	82.03
	Wood	209	-0.0333	76.56	207	-0.0210	69.08

Notes: estimation of firm-level average forecast errors, entries above provide summary statistics for the estimates for different subgroups of firms. N denotes the number of firms in each group. Sectors are from Bachmann et al. (2019).

Figure A.1: Point estimates for constant and slope



Notes: estimation of equation (4) on firm-level observations. Horizontal axis: estimates of β_0^i; vertical axis: estimates of slope coefficient β_1^i. Colors indicate if the constant is significantly different from 0 (blue) or not (red) at the 5% level. Plot shows values within the 99.95 quantiles.

Table A.4: Summary statistics on firm-level average squared forecast errors

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Sector	Chemical	226	0.1279	0.1152	226	0.0783	0.0498
	Electrical	599	0.1195	0.1083	600	0.0474	0.0332
	Food	277	0.1314	0.1262	278	0.0588	0.0329
	Furniture	242	0.1353	0.1281	237	0.0406	0.0292
	Glass	288	0.1209	0.1073	294	0.0586	0.0349
	Leather	63	0.1127	0.1052	62	0.0490	0.0357
	Machine	772	0.1209	0.1058	766	0.0477	0.0319
	Metal	612	0.1301	0.1156	583	0.0625	0.0354
	Oil	14	0.1054	0.0788	13	0.1557	0.1086
	Paper	710	0.1321	0.1243	700	0.0692	0.0521
	Rubber	333	0.1369	0.1289	328	0.0695	0.0473
	Textile	315	0.1203	0.1118	329	0.0618	0.0330
	Vehicle	130	0.1185	0.1065	128	0.0422	0.0283
	Wood	209	0.1400	0.1299	207	0.0739	0.0496

Notes: estimation of firm-level average squared forecast errors, entries above provide summary statistics for the estimates for different subgroups of firms. N denotes the number of firms in each group. Sectors are from Bachmann et al. (2019).

Table A.5: Definition of variable blocks

Block	Variable	Description	Frequency	Periods
Survey	Business Situation		monthly	t to t-3
	Realized Production		monthly	t to t-2
	Expected Production		monthly	t-1 to t-3
	Realized Prices		monthly	t to t-2
	Orders		monthly	t to t-3
	Foreign Orders		monthly	t to t-3
	Demand		monthly	t to t-2
	Capacity		monthly	t-1 to t-3
	Expected Prices		monthly	t-1 to t-3
	Employees		annual	
	Avg. Business Situation	two-digit sector level	monthly	t
	Sectoral Fixed Effects			
Fundamentals	Financing Coefficient	$\frac{\text{Liabilities - Provisions}}{\text{Equity + Provisions}}$	annual	
	Debt Share	$\frac{\text{Total debt}}{\text{Assets}}$	annual	
	Total Assets		annual	
Macro	PPI Growth	versus previous month	monthly	t-2
	CPI Growth	versus previous month	monthly	t-2
	Unemployment		monthly	t-1
	IP Growth	versus previous month	monthly	t-2

Notes: components of the three variable blocks considered as explanatory variables in the ordered probit. The survey and fundamental blocks are taken from Enders et al. (2021a).

Table A.6: Overreaction to firm-specific news

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Overall		4851	-0.1121	-0.1089	4851	-0.1070	-0.0820
Number of Employees	Fewer than 50	236	-0.1050	-0.1041	236	-0.1029	-0.0777
	50-199	156	-0.0844	-0.0660	156	-0.1108	-0.0827
	200-499	78	-0.0918	-0.0825	78	-0.1059	-0.0739
	500-999	22	-0.1586	-0.1721	22	-0.0826	-0.0693
	More than 1000	5	-0.1433	-0.1833	5	-0.0751	-0.0736
Employees (Quartile)	First Quartile	124	-0.0964	-0.0971	124	-0.1047	-0.0878
	Second Quartile	124	-0.1158	-0.1160	124	-0.1025	-0.0647
	Third Quartile	124	-0.0816	-0.0555	124	-0.1139	-0.0907
	Fourth Quartile	125	-0.1029	-0.1042	125	-0.0978	-0.0667
Sales (Quartile)	First Quartile	107	-0.0989	-0.1029	107	-0.1234	-0.0912
	Second Quartile	112	-0.1016	-0.0846	112	-0.0983	-0.0642
	Third Quartile	109	-0.0999	-0.0903	109	-0.1080	-0.0940
	Fourth Quartile	110	-0.1060	-0.1047	110	-0.1087	-0.0659
Total Assets (Quartile)	First Quartile	130	-0.0962	-0.0955	130	-0.1107	-0.0840
	Second Quartile	131	-0.0979	-0.0987	131	-0.1131	-0.0829
	Third Quartile	130	-0.0954	-0.0870	130	-0.0932	-0.0675
	Fourth Quartile	131	-0.1146	-0.1071	131	-0.1129	-0.0730
Location	Eastern Germany	2203	-0.1121	-0.1099	2203	-0.1060	-0.0806
	Western Germany	1198	-0.1055	-0.1025	1198	-0.1081	-0.0824
Sector	Chemical	271	-0.1113	-0.1105	271	-0.1025	-0.0718
	Electrical	515	-0.1147	-0.1131	515	-0.1078	-0.0876
	Food	358	-0.1092	-0.1108	358	-0.1043	-0.0786
	Furniture	238	-0.1082	-0.1018	238	-0.1117	-0.0817
	Glass	262	-0.1090	-0.0980	262	-0.1170	-0.0931
	Leather	86	-0.1309	-0.1266	86	-0.0880	-0.0523
	Machine	646	-0.1185	-0.1111	646	-0.1088	-0.0813
	Metal	719	-0.1073	-0.1105	719	-0.1052	-0.0773
	Oil	11	-0.0541	-0.0443	11	-0.1178	-0.0508
	Paper	574	-0.1111	-0.1060	574	-0.1102	-0.0892
	Rubber	343	-0.1167	-0.1097	343	-0.1125	-0.0885
	Textile	265	-0.1042	-0.0924	265	-0.1064	-0.0825
	Vehicle	144	-0.1113	-0.1172	144	-0.1042	-0.0755
	Wood	248	-0.1263	-0.1272	248	-0.1042	-0.0862

Notes: estimation of equation (4) on firm-level observations. Entries provide summary statistics for the slope estimates based for different subgroups of firms. N denotes the number of firms in each group. When grouping by location, we only consider firms that joined the ifo Survey after the German reunification.

Table A.7: Summary statistics firm-level constant estimates

		Production			Prices		
Grouped by	Group	N	Mean	Median	N	Mean	Median
Overall		4851	-0.0317	-0.0263	4851	-0.0093	0.0056
Number of Employees	Fewer than 50	236	-0.0236	-0.0155	236	0.0005	0.0062
	50-199	156	-0.0237	-0.0274	156	0.0048	0.0133
	200-499	78	0.0068	-0.0023	78	0.0065	0.0094
	500-999	22	-0.0200	-0.0299	22	-0.0004	-0.0071
	More than 1000	5	-0.0148	-0.0344	5	-0.0132	-0.0090
Employees (Quartile)	First Quartile	124	-0.0232	-0.0103	124	-0.0057	0.0053
	Second Quartile	124	-0.0240	-0.0188	124	0.0092	0.0123
	Third Quartile	124	-0.0242	-0.0264	124	0.0011	0.0115
	Fourth Quartile	125	-0.0032	-0.0232	125	0.0058	0.0099
Sales (Quartile)	First Quartile	107	-0.0192	0.0000	107	0.0002	0.0052
	Second Quartile	112	-0.0258	-0.0111	112	0.0032	0.0079
	Third Quartile	109	-0.0127	-0.0150	109	0.0024	0.0103
	Fourth Quartile	110	-0.0311	-0.0325	110	-0.0095	0.0065
Total Assets (Quartile)	First Quartile	130	-0.0196	0.0002	130	-0.0058	0.0051
	Second Quartile	131	-0.0270	-0.0220	131	0.0018	0.0105
	Third Quartile	130	-0.0104	-0.0153	130	0.0107	0.0134
	Fourth Quartile	131	-0.0311	-0.0265	131	-0.0092	0.0093
Location	Eastern Germany	2203	-0.0256	-0.0208	2203	-0.0060	0.0070
	Western Germany	1198	-0.0373	-0.0303	1198	-0.0126	0.0038
Sector	Chemical	271	-0.0446	-0.0291	271	-0.0162	0.0060
	Electrical	515	-0.0435	-0.0315	515	-0.0113	0.0051
	Food	358	-0.0225	-0.0230	358	-0.0070	0.0046
	Furniture	238	-0.0269	-0.0231	238	-0.0113	0.0076
	Glass	262	-0.0343	-0.0128	262	-0.0097	0.0056
	Leather	86	-0.0395	-0.0264	86	-0.0120	0.0113
	Machine	646	-0.0239	-0.0230	646	-0.0052	0.0046
	Metal	719	-0.0303	-0.0231	719	-0.0104	0.0057
	Oil	11	0.0085	-0.0230	11	0.0035	0.0185
	Paper	574	-0.0322	-0.0304	574	-0.0119	0.0032
	Rubber	343	-0.0318	-0.0265	343	-0.0123	-0.0000
	Textile	265	-0.0370	-0.0276	265	-0.0067	0.0065
	Vehicle	144	-0.0360	-0.0332	144	-0.0096	0.0021
	Wood	248	-0.0317	-0.0233	248	-0.0063	0.0100

Notes: summary statistics for the estimates of the constant from the forecaster-by-forecaster regressions in equation (4) for different groups of firms. When grouping by location we only consider firms that joined the ifo Survey after the German reunification.

Table A.8: Predictability of expectation errors

		Production			Prices		
Variable	Timing	estimate	t-value	p-value	estimate	t-value	p-value
Constant		0.022	1.22	0.22	0.037***	3.14	0.00
IP growth	real-time	0.424*	1.93	0.05	0.165	1.58	0.11
Unemployment rate	t-1	0.002	1.16	0.24	−0.001	-0.86	0.39
PPI growth	t-2	0.005	0.23	0.82	0.036***	3.61	0.00
CPI growth	t-2	−0.016	-1.07	0.29	−0.007	-1.00	0.32
	t	0.012***	3.97	0.00	−0.258***	-81.95	0.00
Expectation about own	t-1	−0.001	-0.39	0.70	0.055***	21.63	0.00
prices	t-2	−0.010***	-3.87	0.00	0.010***	4.23	0.00
	t-3	−0.010***	-3.30	0.00	0.001	0.26	0.79
	t	−0.301***	-94.38	0.00	0.002	1.22	0.22
Expectation about own	t-1	0.041***	15.97	0.00	−0.001	-0.78	0.43
production	t-2	0.007**	2.52	0.01	−0.001	-0.89	0.37
	t-3	−0.004	-1.26	0.21	0.000	-0.19	0.85
	t	0.007**	2.48	0.01	0.004**	2.21	0.03
Reported business	t-1	−0.004*	-1.93	0.05	0.000	-0.17	0.87
situation	t-2	0.004*	1.77	0.08	0.002	1.21	0.23
	t-3	0.019***	5.95	0.00	0.001	0.74	0.46
	t	−0.020***	-7.01	0.00	−0.011***	-6.23	0.00
Reported backlog of	t-1	0.001	0.49	0.63	0.000	0.25	0.80
orders	t-2	0.004**	1.97	0.05	0.000	0.30	0.76
	t-3	−0.007***	-2.85	0.00	−0.001	-0.73	0.47
	t	0.038***	12.22	0.00	0.003	1.58	0.12
most recent reported	t-1	0.025***	8.98	0.00	0.003*	1.75	0.08
change in production	t-2	0.021***	7.83	0.00	0.004**	2.43	0.02
	t-3	0.023***	7.63	0.00	0.001	0.52	0.60
	t	−0.003	-1.11	0.27	0.060***	16.43	0.00
most recent reported	t-1	−0.003	-1.35	0.18	0.038***	13.73	0.00
change in prices	t-2	0.000	-0.08	0.93	0.033***	12.65	0.00
	t-3	−0.003	-0.91	0.36	0.041***	12.20	0.00
	t	0.048***	16.18	0.00	0.010***	5.45	0.00
Reported change in	t-1	0.023***	9.39	0.00	0.004**	2.45	0.01
demand	t-2	0.014***	6.09	0.00	0.002	1.24	0.22
	t-3	0.006**	2.14	0.03	0.001	0.89	0.38
R^2		0.172			0.170		

Notes: predictive regressions for forecast errors for prices and production. For IP growth we use real-time data for the seasonally and calendar adjusted industrial production and compute monthly growth rates that are also reported in the press releases of DESTATIS. We assume that firms update their information set on the day after the release. Since 2005 firms may complete the survey online. Only for these firms the day of completion is known, which is the sample used for this exercise. One, two, and three stars (*) correspond to significance on the 10, 5, and 1 percent significance levels.