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Demand or Supply? Price Adjustment during the COVID-19 Pandemic

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ABSTRACT

Demand or Supply? Price Adjustment during the COVID-19 Pandemic*

We study price-setting behavior in German firm-level survey data to infer the relative importance of supply and demand during the Covid-19 pandemic. Supply and demand forces coexist, but demand shortages dominate in the short run. A reported negative impact of Covid-19 on current business is associated with a rise in the probability to decrease prices up to eleven percentage points. These results imply a role for aggregate demand stabilization policy to buffer the economic consequences of Covid-19 while containing the pandemic.

JEL Classification: E31, E32, H50, E60, D22

Keywords: producer price setting, supply, demand, COVID-19, fiscal policy

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1 Introduction

As the Covid-19 pandemic is disrupting economies across the globe, policymakers are in search for suitable stabilization policy measures. The scope and design of effective policy hinges on the channels through which the pandemic affects economic activity. On the one hand, policymakers must consider measures that shield productive capacity going forward to weather disruptions in the supply of goods and services. On the other hand, policymakers must consider demand stimulus measures to address potential demand shortages. Demand deficiencies can arise from actual and expected income risk and higher economic uncertainty (Bayer et al., 2019); materialize as a consequence of sectoral disruptions (Guerrieri et al., 2020), input-output propagation (Baqae and Farhi, 2020), or health risks (Eichenbaum et al., 2020). The relative importance of supply and demand forces during the Covid-19 crisis therefore is a key input to effective policy.

This paper is the first, to our best knowledge, to study firm-level producer price-setting data during the Covid-19 recession to inform this debate. Prices reflect shifts in demand and supply and thus are ideally suited to infer their relative importance. Given demand, a reduction in the supply of goods and services generates inflation. Holding production constant, demand shortages lead to disinflation.

The main result is that supply and demand forces coexist, but demand shortages dominate in the short run. In a regression of planned price changes on the reported impact of Covid-19 on current business, we estimate that a strongly negative impact is associated with a substantial rise of up to eleven percentage points in the probability to decrease prices, net of a rich set of controls.

Our empirical analysis exploits unique firm-level data from the German ifo Business Climate Survey (ifo-BCS). The ifo-BCS is a monthly, mostly qualitative, firm-level survey among a representative sample of roughly 6,000 German firms. Relevant for this paper are its regular questions about price setting and additional information on firm-specific economic activity that allow to control for other determinants of price-setting behavior. A recent supplement contains questions related the Covid-19 pandemic. Among other things, firms in the survey assess the impact of the Covid-19 pandemic on their current business situation. About 80% of all firms in the survey report adverse effects, while approximately 10% report positive effects. The effects of supply and demand also vastly differ with impact. Supply reductions, which we proxy for using a supplemental survey question about the lack of intermediate inputs/final goods, are prevalent across all firms. Order backlogs, our proxy variable for demand, are low in almost all negatively affected firms and high in those positively affected.

We focus on *planned* price changes to alleviate potential concerns because certain goods and services are temporarily not available or transferable during the Covid-19 pandemic. This reduction in product variety matters for welfare (Jaravel and O’Connell, 2020). In the case of the German economy, changes in consumption expenditure patterns are less of a concern. Cavallo (2020) finds that official inflation figures are biased upward by only 0.09 percentage points after accounting for changes in consumption baskets. We obtain similar results when we use realized price changes.

We show that firms differentially affected by Covid-19 display very similar dynamics in planned price changes up to March 2020, when the pandemic reached the German economy (Buchheim et al., 2020b). Relative to firms with no or only weak impact of Covid-19, we estimate a substantial rise of up to eleven percentage points in the probability of planned price decreases associated with a strong negative impact, and a concurrent decline in the probability of planned price increases. Conversely, positively affected firms display an approximately ten percentage point higher chance of planned price increases and are less likely to plan price decreases. Since the vast majority of firms report negative effects due to Covid-19, the sectoral frequency of planned price decreases is predicted to increase up to about five percentage points. The frequency of planned price increases is predicted to decline, if anything. These findings suggest a dominant role for demand also at the aggregate level.¹

The coexistence of supply and demand extends to price-setting behavior. If we condition estimates on our proxy variables for supply and demand, supply-chain disruptions and high order backlogs reduce disinflationary pressures while low order backlogs are reinforcing. The average effect, however, shows demand shortages to dominate over supply reductions. Lastly, we confirm the co-existence of supply and demand in price-setting behavior using independent information on the subjective reasons for the adverse effects of Covid-19 given in the survey.

This reduced-form evidence complements a body of quantitative work that highlights the importance of weak demand during the Covid-19 recession (Eichenbaum et al., 2020; Guerrieri et al., 2020; Caballero and Simsek, 2020; Baqaee and Farhi, 2020). Brinca et al. (2020) estimate sectoral labor supply and demand shocks for the US economy and find that supply dominate demand forces. We are not aware of other empirical work on producer price setting at large during the Covid-19 crisis. Cabral and Xu (2020) study pricing of several goods such as face masks. Dietrich et al. (2020) document an increase in consumer price inflation expectations in March 2020. Early contributions on expenditures patterns during the Covid-19 crisis include Cavallo (2020); Baker et al. (2020); Carvalho

¹German producer prices decreased by 0.8% in March 2020, 1.9% in April, and 2.2% in May year-on-year.

et al. (2020). These authors show strong behavioral responses in US consumer expenditure patterns, mirroring to some extent the heterogeneity in price-setting decision in the present article. Finally, we relate to contributions that study the firm-level impact of the Covid-19 crisis. Bartik et al. (2020), Hassan et al. (2020), and Buchheim et al. (2020a) are examples.

The remainder of this paper is as follows. Section 2 explains the data and provides a battery of descriptive statistics. Section 3 estimates econometrically the relation between the impact of Covid-19 and planned price changes, on average and conditioning on proxy variables for demand and supply. Section 4 discusses the implications of our results.

2 Data and Descriptive Evidence

The main data source is the ifo Business Climate Survey (ifo-BCS), a monthly survey among a representative sample of German firms.² We limit the analysis to the manufacturing (IBS-IND, 2020), services (IBS-SERV, 2020), and retail/wholesale (IBS-TRA, 2020) industries.³ The survey is mostly qualitative, including questions about firms' business situation and expectations, factors related to the supply and demand of goods and services, as well as planned and realized price changes. Since March 2020, the survey questionnaire includes supplemental questions related to the Covid-19 pandemic.⁴ The calculation of descriptive statistics in this section uses a sample of 6,081 firms (2,175 in manufacturing, 2,101 in services, and 1,805 in retail/wholesale), surveyed in April and May 2020. The following section relies on a longer sample, running from 2018:M01 to 2020:M05, to precisely estimate time-invariant determinants of price-setting behavior.

2.1 Covid-19 Impact in the ifo Business Climate Survey

Since April 2020, the ifo-BCS asks firms to assess the impact of Covid-19 on their business situation on a seven-point scale ranging from -3 "negative" to $+3$ "positive". Table 2 shows summary statistics for each Covid-19 impact category, which we refer to as "strongly negative" (-3), "negative" (-2), "weakly negative" (-1), and "no impact" (0), with analogous labels for the positive categories. First, the bottom panel documents sub-

²The ifo-BCS provides the basis for the ifo Business Climate Index, the most recognized leading indicator of the German business cycle. See Sauer and Wohlrabe (2020) for a detailed documentation. Sauer and Wohlrabe (2019) show that survey questionnaires are predominantly filled out by senior management such as firm owners, members of the executive board, or department heads.

³We leave out firms in construction and insurance. Data harmonization across sectors follows Link (2020).

⁴Online Appendix A.1 presents translations of all survey questions used in this paper.

stantial heterogeneity in *Covid-19 impact*. In April and May 2020, 33% of all firms report a strongly negative impact, 24% are negatively affected, while 11% experience no impact. On the other hand, a smaller share of in total 10% tells of at least weakly positive effects. In the empirical analysis below, we group observations in the positive or strongly positive categories (+2 or +3) and those in the weak or no impact categories (−1, 0, or +1). The latter group will serve as our base category and aggregation ensures a sufficient number of observations in each cell once we control for additional variables.

Second, the top panel shows that the share of firms that report positive business conditions increases monotonically with *Covid-19 impact*, and vice versa (bar one exception). A similar pattern emerges for business expectations. Note that business situation and business expectations are not sufficient to explain *Covid-19 impact*. Some firms with no or positive impact report contemporaneously negative business conditions and expectations, while others with no or negative impact report positive business conditions and expectations. Hence, *Covid-19 impact* captures independent information specific to the pandemic.

Third, manufacturing capacity utilization in April 2020 on average strongly decreased year-on-year in negatively affected firms, and increased in positively affected firm. For instance, manufacturing firms hit hardest operate at about 54% of potential.

Fourth, the April survey questionnaire asked firms about the expected percent change in revenues due to the Covid-19 crisis. As the top panel shows, this figure decreases with *Covid-19 impact* and strongly negatively affected firms on average expect a 37% fall.

Tables A.1–A.3 in the Online Appendix present descriptive evidence by sector. The hardest hit firms are in services, as are the least firms for which *Covid-19 impact* is positive. Unsurprisingly, the most negatively affected services sectors include travel arrangement and reservation services, the hospitality sector, and entertainment industries.⁵ Retail firms are on average more adversely affected than firms in wholesale, while a share of 17% reports positive impact, reflecting mostly grocery stores. Most adversely affected sectors in manufacturing include the leather industry, beverage manufacturing, furniture, and motor vehicles.

Table 1 correlates *Covid-19 impact* with several proxy variables for supply and demand. First, in April 2020 more than 40% of manufacturing firms in each negative category lacked intermediate products, and about 50% of retail and wholesale firms in each negative category reported supply shortages of final goods. These shares decrease as *Covid-19 impact* becomes weaker but increase again in positively affected firms, consistent with the notion of excess demand of these firms. Second, negative *Covid-19 impact* is also associated with a higher frequency of business closures.

⁵For brevity, we omit these tabulations of *Covid-19 impact* by two-digit WZ08 industries.

Table 1 – Summary Statistics: Proxy Variables for Supply and Demand by *Covid-19 Impact*

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
<i>Panel A: Manufacturing</i>								
Lack of Intermediate Inputs	0.451	0.456	0.418	0.297	0.365	0.485	0.625	0.426
	0.498	0.499	0.494	0.458	0.485	0.508	0.5	0.495
Business Closure	0.255	0.127	0.046	0.007	0.025	0.037	0	0.126
	0.436	0.333	0.21	0.084	0.158	0.189	0	0.332
Low Order Backlog	0.844	0.668	0.318	0.09	0.051	0.123	0.049	0.535
	0.363	0.471	0.466	0.287	0.221	0.331	0.218	0.499
High Order Backlog	0.027	0.035	0.102	0.243	0.325	0.494	0.683	0.099
	0.162	0.183	0.302	0.43	0.47	0.503	0.471	0.299
<i>Panel B: Retail/Wholesale</i>								
Lack of Final Good Supply	0.497	0.548	0.533	0.368	0.566	0.61	0.661	0.523
	0.5	0.498	0.5	0.485	0.498	0.491	0.477	0.5
Business Closure	0.443	0.237	0.174	0.135	0.124	0.114	0.139	0.268
	0.497	0.426	0.379	0.343	0.331	0.319	0.347	0.443
Low Order Backlog	0.851	0.625	0.387	0.174	0.133	0.093	0.141	0.533
	0.357	0.484	0.487	0.379	0.34	0.291	0.349	0.499
High Order Backlog	0.024	0.045	0.105	0.151	0.266	0.399	0.592	0.119
	0.153	0.208	0.307	0.359	0.443	0.491	0.493	0.324
<i>Panel C: Services</i>								
Business Closure	0.244	0.047	0.036	0.028	0.027	0.02	0	0.11
	0.43	0.211	0.187	0.166	0.164	0.14	0	0.313
Low Order Backlog	0.929	0.624	0.179	0.054	0.021	0.039	0.314	0.503
	0.257	0.485	0.383	0.227	0.144	0.196	0.471	0.5
High Order Backlog	0.015	0.042	0.179	0.365	0.448	0.647	0.543	0.142
	0.122	0.201	0.383	0.482	0.499	0.483	0.505	0.349

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact* and industry. Row variables are indicators for lack of intermediate inputs/final good supply, business closure, and high/low order backlog from the ifo-BCS. In retail/wholesale orders are assessed relative to the previous year. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translation of all corresponding survey questions. Sample: 2020:M04 for lack of supply measures, and 2020:M04–2020:M05 for business closure and orders.

Third, *Covid-19 impact* also correlates with orders. As much as 93% of all strongly negatively affected firms report a low order backlog. On the other hand, more than half of all strongly positively affected firms report a high order backlog.⁶

In sum, *Covid-19 impact* appears to capture shifts in both supply and demand due to the Covid-19 crisis. Although their relative importance is hard to gauge from Table 1, fewer orders appear more prevalent in (strongly) negatively affected firms than supply-chain disruptions or business closures, suggesting a dominating role for demand deficiencies. This conclusion is also supported by independent evidence from the June 2020 online portion of the survey that asked firms about the subjective reasons for the adverse effects of Covid-19. Specifically, the question asks to assess the adverse effects of financing conditions, labor input, supply-chain disruptions, government containment regulations, and demand (domestic and foreign, separately) due to the Covid-19 crisis. Possible answers categories, on scale from one to five, include “no effect” (0) to “large adverse effect” (+5). To capture their relative importance at the firm level, we compare each subjective reason relative to the firm mean of all those remaining. The results, presented in Table A.5 in the Online Appendix, show that firms predominantly suffer from demand deficiencies, the relevance of which increases with negative *Covid-19 impact*.

2.2 Covid-19 Impact and Price-Setting Behavior

The ifo-BCS contains a question on whether firms plan to increase, decrease, or leave unchanged their prices over the following three months, as well as a similar question on price realizations in the preceding month.⁷ The difference between the frequency of planned price increases and the frequency of planned price decreases very closely moves with actual producer price inflation, with correlation coefficients as high as 0.75.⁸ Reflecting an earlier-starting decline in economic activity, the frequency of planned and

⁶Table A.4 in the Online Appendix provides additional descriptives corroborating that *Covid-19 impact* correlates with supply and demand factors. Moreover, in March 2020 firms were asked about the determinants by which Covid-19 affected their business. On average, 34% of firms stated negative effects due to intermediate input supply-chain disruptions and individual survey responses strongly predict negative *Covid-19 impact*, reported for the first time in the subsequent month. Similarly, disruptions in the delivery or sales of final goods are also more frequent in negative categories. In turn, we do not find a clear relationship between *Covid-19 impact* and a firms’ reliance on imported intermediates or production constraints due to a lack of material, both elicited in April 2020.

⁷The ifo-BCS question on realized price changes is used in several articles. [Bachmann et al. \(2019\)](#) study the relation between uncertainty and price setting, [Balleer et al. \(2017\)](#) investigate the link between financial constraints and price setting, [Link \(2019\)](#) examines the effect of the 2015 minimum wage introduction on firms’ price setting, and [Balleer and Zorn \(2019\)](#) study the response of producer prices to monetary policy shocks.

⁸See Figure A.1 in the Online Appendix for a time series plot.

realized price increases falls throughout 2019 while the frequency of planned and realized price decreases climbed. These trends strongly accelerated after March 2020, when the German government implemented strict measures to prevent the spread of Covid-19. The timing of abrupt movements in price change frequencies is in line with [Buchheim et al. \(2020b\)](#), who show that most firms in the ifo-BCS were unexpectedly hit by the Covid-19 crisis after filling in the March 2020 survey questionnaires.⁹

The mid-panel of Table 2 documents the relationship between *Covid-19 impact* and price-setting behavior. About 16.4% of firms changed prices in March and April, where 9.6% of firms decreased and 6.8% of firms increased prices. Firms strongly affected by Covid-19, both negatively and positively, change their prices more frequently than mildly affected firms. The frequency of price increases rises with *Covid-19 impact*, while the frequency of price decreases falls. Looking ahead, about 23.8% of firms plan to change prices in the following three months, where 10.2% of firms plan to increase and 13.6% of firms plan to decrease prices. Hence, firms overall tend to decrease prices more often at the onset of the Covid-19 crisis and also plan to decrease prices more frequently going forward. These price-setting patterns are prevalent in all sectors, in particular in retail/wholesale, presumably reflecting the fact that sales are more common in this sector.¹⁰

To summarize, there is large heterogeneity in firms' price-setting behavior that correlates with *Covid-19 impact*. Positively affected firms tend to increase their prices, while negatively affected firms tend to decrease their prices. These patterns are consistent with the notion that demand deficiencies dominate the adverse impact of Covid-19. The fact that there are many more firms for which *Covid-19 impact* is negative suggests that downward price movements prevail at the aggregate level.

⁹In early March, only a few German counties were strongly affected by Covid-19. Subsequently, infection rates increased exponentially resulting in nation-wide school closures on March 13 and a nation-wide curfew on March 22. [Buchheim et al. \(2020b\)](#) document that firms' business outlook decreased strongest after March 13. Since roughly three out of four survey respondents filled in their survey questionnaire before, April 2020 is the first month in which the majority of survey respondents report reactions to the Covid-19 crisis.

¹⁰See Tables A.1 to A.3 in the Online Appendix.

Table 2 – Summary Statistics by *Covid-19 Impact*

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
Positive Business Conditions	0.008	0.039	0.208	0.524	0.593	0.793	0.865	0.188
	0.091	0.194	0.406	0.5	0.492	0.406	0.343	0.391
Negative Business Conditions	0.907	0.545	0.138	0.038	0.029	0.029	0.059	0.467
	0.29	0.498	0.345	0.19	0.168	0.167	0.235	0.499
Positive Business Expectations	0.12	0.115	0.097	0.09	0.167	0.288	0.336	0.122
	0.326	0.319	0.296	0.286	0.373	0.453	0.474	0.327
Negative Business Expectations	0.743	0.673	0.541	0.3	0.252	0.217	0.229	0.581
	0.437	0.469	0.498	0.458	0.434	0.413	0.421	0.493
Capacity Utilization (Mfg., in %)	54.432	70.4	79.662	85	87.901	81.333	84.5	71.439
	20.279	18.1	15.404	13.676	12.244	21.674	19.527	20.864
Cap. Util. (Mfg., y-o-y, in pp)	-27.414	-13.911	-4.776	-0.222	4.538	0.132	11.176	-11.954
	21.945	16.839	14.354	13.885	10.335	18.177	11.254	20.222
Expected Revenue Change (in %)	-37.144	-22.966	-12.743	-6.321	-1.912	-0.233	8.909	-21.941
	21.726	13.487	9.756	9.021	9.614	14.76	51.618	20.763
Planned Price Increase	0.089	0.076	0.095	0.107	0.182	0.212	0.312	0.102
	0.284	0.266	0.294	0.309	0.387	0.409	0.464	0.303
Planned Price Decrease	0.219	0.143	0.091	0.044	0.042	0.044	0.05	0.136
	0.414	0.35	0.288	0.205	0.201	0.206	0.219	0.342
Planned Price Change	0.308	0.219	0.187	0.151	0.224	0.256	0.362	0.238
	0.462	0.414	0.39	0.358	0.418	0.437	0.482	0.426
Price Increase	0.041	0.051	0.057	0.079	0.168	0.189	0.321	0.068
	0.199	0.219	0.232	0.27	0.374	0.392	0.468	0.252
Price Decrease	0.154	0.099	0.057	0.041	0.045	0.041	0.062	0.096
	0.361	0.298	0.232	0.199	0.208	0.199	0.242	0.295
Price Change	0.195	0.149	0.114	0.121	0.213	0.23	0.383	0.164
	0.396	0.356	0.318	0.326	0.41	0.422	0.487	0.371
Observations	3623	2596	2400	1254	553	317	223	10966
Percent	33.04	23.67	21.89	11.44	5.04	2.89	2.03	100

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact*. Row variables are indicators for positive/negative business conditions/expectations or planned/realized price increases/decreases/changes, capacity utilization, year-on-year change in capacity utilization, and expected percentage changes in revenue due to Covid-19 from the ifo-BCS. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translations of all corresponding survey questions. Sample: 2020:M04–2020:M05, and 2020:M04 for capacity utilization in manufacturing and expected revenue changes.

3 Econometric Analysis

3.1 Average Effects of Covid-19 Impact on Planned Price Adjustments

This section formally explores differences in planned price changes across *Covid-19 impact* categories while controlling for other determinants of price-setting behavior. The focus on planned price changes helps to overcome potential issues due to certain goods and services being temporarily unavailable or not transferable.¹¹

First, we estimate the following regression, separately for each month-year t between 2018:M01 and 2020:M05:¹²

$$Y_{i,t} = \delta_{-3} \mathbb{1}(Covid_{i,04/20} = -3) + \delta_{-2} \mathbb{1}(Covid_{i,04/20} = -2) + \delta_{\{2,3\}} \mathbb{1}(Covid_{i,04/20} = 2 \vee 3) + \alpha_s + X'_{i,t-3} \beta + u_{i,t} \quad (1)$$

Here, $Y_{i,t}$ refers to an indicator for planned price increases or decreases over the following three months for firm i . In addition to dummy variables for the grouped *Covid-19 impact* categories as of 2020:M04, we include two-digit WZ08 industry fixed effects (α_s), and separate indicators for positive and negative responses to the questions about business situation, business expectations, and orders, each lagged by three months and collected in $X_{i,t-3}$, to control for past economic activity of firms.

Figure 1 shows the time series of the frequency of planned price increases and decreases for each *Covid-19 impact* category, net of controls.¹³ In every month, the difference between each line relative to the group of firms with weak or no *Covid-19 impact* corresponds to the estimated coefficient δ_i , with $i = -3, -2, \{2;3\}$, from Equation (1). The frequency-weighted average of all lines in a given month equals the month's sample average.

Planned price changes display similar pre-trends across *Covid-19 impact* categories. The left panel of Figure 1 shows that the frequency of planned price decreases displays essentially identical dynamics across impact categories prior to 2020:M03, indicated by the vertical red line, when measures to prevent the spread of Covid-19 were installed (see Footnote 9). Likewise, the right panel shows that the frequency of planned price increases displays similar dynamics across impact categories prior to 2020:M03. This suggests that these similar trends would have continued in the absence of the Covid-19 pandemic.

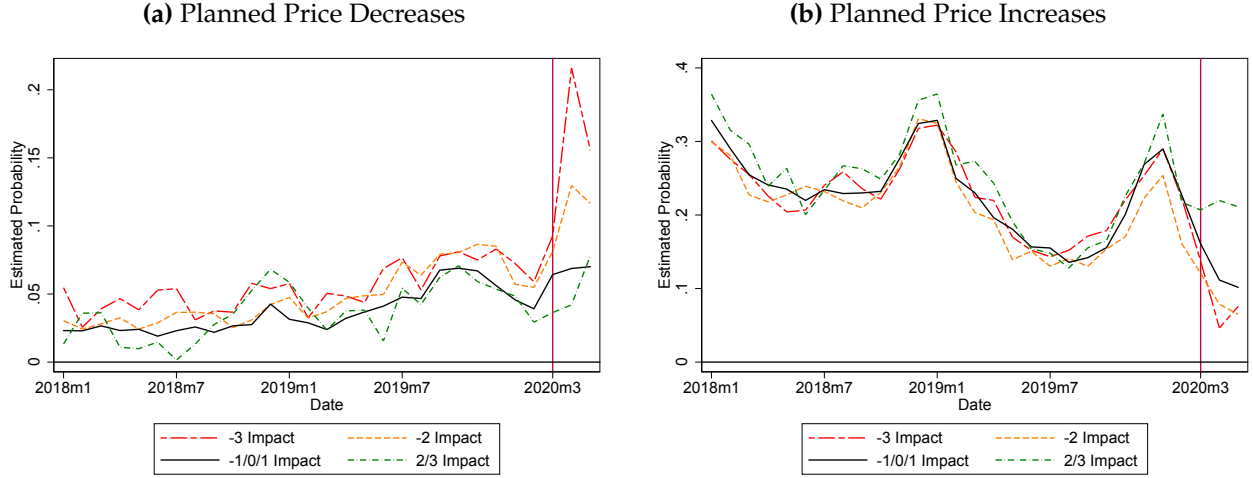
However, we observe that price-setting behavior of firms in different *Covid-19 impact* categories is highly heterogeneous after 2020:M03. The frequency of planned price de-

¹¹We obtain similar results when we use realized price changes. See Table A.7 in the Online Appendix.

¹²On June 6, 2020 the German government unexpectedly announced a temporary reduction of the value added tax rate effective July through December 2020. We deliberately exclude 2020:M06 survey data in the main analysis to isolate the impact of Covid-19 on price-setting behavior.

¹³See Yagan (2015) for a similar approach in a different context.

Figure 1 – Effects of *Covid-19 Impact* on Planned Price Adjustment



Notes: This figure shows the time series of the frequency of planned price decreases (left) and price increases (right) for each grouped *Covid-19 impact* category as of 2020:M04, net of controls. In every month, the difference between each line relative to firms with weak or no impact corresponds to the estimated coefficient δ_i , $i = -3, -2, \{2, 3\}$ from Equation (1). The frequency-weighted average of all lines in a given month equals the month's sample average. Sample: 2018:M01–2020:M05.

creases skyrockets for strongly negatively affected firms, rapidly rises for firms with negative impact, and remains at similar levels for positively affected firms. There is no comparable spike in the frequency of planned price increases that would suggest upward price pressure during the Covid-19 pandemic. The frequency of planned price increases remains at similar levels for firms with positive impact and falls for those with (strongly) negative impact. Overall, this suggests a strongly disinflationary effect of *Covid-19 impact*.

Next, we exploit the panel dimension of the ifo-BCS and the timing of events to account for level differences, seasonality, and business cycle movements observable in Figure 1, i.e., slight upward and downward trends in planned price decreases and increases, respectively, consistent with the cooling of the German economy during this period. We estimate the following regression on the sample 2018:M01 to 2020:M05:

$$Y_{i,t} = \delta_{-3} \mathbb{1}(Covid_{i,t} = -3) + \delta_{-2} \mathbb{1}(Covid_{i,t} = -2) + \delta_{\{2,3\}} \mathbb{1}(Covid_{i,t} = 2 \vee 3) + \alpha_s + X'_{i,t-3} \beta + \gamma_t + u_{i,t} \quad (2)$$

We set the grouped *Covid-19 impact* categories to zero for all observations prior to 2020:M04. Relative to Equation (1), we augment month-year fixed effects γ_t .

Table 3 shows results. Columns 1, 4, and 7 contain, for completeness, estimation results when only the *Covid-19 impact* category indicators are included in the regression. Columns 2, 5, and 8 show estimates based on Equation (2). Columns 3, 6, and 9 use firm fixed effects instead of industry fixed effects.

Table 3 – Effects of the Covid-19 Pandemic on Planned Price Adjustment

	Planned Price Decrease			Planned Price Increase			Planned Price Change		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Covid-19 Impact:</i>									
Strongly Neg.	0.16*** (0.0075)	0.11*** (0.0093)	0.10*** (0.0085)	-0.13*** (0.0056)	-0.017** (0.0084)	-0.012 (0.0089)	0.031*** (0.0086)	0.095*** (0.012)	0.091*** (0.012)
Negative	0.086*** (0.0074)	0.052*** (0.0090)	0.047*** (0.0082)	-0.14*** (0.0058)	-0.015* (0.0082)	-0.0041 (0.0087)	-0.057*** (0.0089)	0.037*** (0.012)	0.043*** (0.012)
Positive	-0.0096 (0.0092)	-0.030*** (0.011)	-0.024** (0.011)	0.033 (0.021)	0.10*** (0.023)	0.077*** (0.021)	0.023 (0.021)	0.070*** (0.024)	0.053** (0.022)
Observations	152612	129295	129104	152612	129295	129104	152612	129295	129104
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes	No	No	Yes	No
Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Notes: This table reports estimates from linear regressions of indicators for planned price decreases/increases/changes on indicators for *Covid-19 impact* categories, based on Equation (2). *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS, which we group and label “Strongly Negative” (-3), “Negative” (-2), and “Positive” (+2 and +3), and the base category “Weak/No Impact” (-1, 0, or +1). Control variables include separate indicators for positive and negative responses to the questions about business situation, business expectations and orders, all lagged by three months. Appendix A.1 provides translations of all corresponding survey questions. Industry fixed effects are at the two-digit WZ08 level. Time fixed effects are at the month-year level. Standard errors in parentheses are clustered at the firm level. Sample: 2018:M01–2020:M05. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

On the one hand, firms reporting a negative impact of Covid-19 tend to lower prices. Column 2 of Table 3 shows that the probability of planned price decreases spikes by eleven percentage points for firms strongly negatively affected, relative to the base category of weak or no *Covid-19 impact*. For negatively affected firms, the probability of planned price decreases rises about five percentage points. By contrast, positively affected firms experience a decline in the chance of planned price decreases by three percentage points. All estimates are statistically significant and economically large compared to the unconditional two-digit sectoral frequency of planned price decreases of 3.7 percent and within-sector standard deviation equal 3.4 percentage points in the period 2018:M01–2019:M12. Column 3 shows that the estimates are largely unaffected by the inclusion of firm fixed effects.

On the other hand, negative *Covid-19 impact* is associated with less frequent price increases. Column 5 and 6 provide the corresponding effects on the probability of planned price increases. (Strongly) Negatively affected firms display an approximately two percentage points lower chance of planned price increases. By contrast, firms that report a positive impact on their business situation show a ten percentage points rise in the probability of planned price increases, relative to the unconditional two-digit sectoral frequency of 21.2 percent and within-sector standard deviation equal 9.2 percentage points in 2018:M01–2019:M12.

(Strongly) negative *Covid-19 impact* is associated with higher probability of planned price decreases across all sectors (see Columns 1 and 5 in Table 4 below). The effects are slightly weaker in manufacturing, possibly reflecting the presence of long-term contracts between buyers and suppliers. Positive *Covid-19 impact* does not display any significant differences in planned price adjustments in services, presumably because of only very few observations as Section 2 discusses. Positively affected firms plan fewer price decreases in the manufacturing industry while they plan to increase their prices in the retail/wholesale sector.

Overall, prices become more flexible across all *Covid-19 impact* categories. Columns 8 and 9 of Table 3 show that in firms with strongly negative impact, the probability of planned price changes increases by about ten percentage points, reflecting the increased likelihood of planned price decreases. The same is true for firms negatively affected by Covid-19, which increase the chance of planned price changes by about four percentage points. The probability of planned price changes for firms with positive impact rises by about seven percentage points, reflecting an increase in the probability of planned price increases. Again, these estimates are economically sizable compared to the unconditional two-digit sectoral frequency of planned price change of 24.9 percent and within-sector standard deviation equal 8.9 percentage points in the period 2018:M01–2019:M12.

These results remain robust in three alternative specifications addressing potential concerns.¹⁴ First, we restrict the sample to complete price spells and add dummy variables to control for Taylor pricing, i.e., price changes that occur in fixed time intervals (e.g., every six months, see [Lein, 2010](#) and [Bachmann et al., 2019](#)). Second, respondents may also consider realized price changes in answering the survey question on *Covid-19 impact*. Consequently, *Covid-19 impact* would be lower if prices decreased for a given change in output. This concern is partly alleviated by using planned price changes instead of realized price changes. Moreover, we estimate Equation (2) on a subsample of firms which did not change prices in the current month. Third, the sharp decline in oil prices during the Covid-19 crisis might also lead to significantly lower producer prices, potentially affecting the results in Table 3. We address this concern by including time-by-industry fixed effects at the two-digit WZ08 level which flexibly control for each sector's reliance on oil. In all of these alternative specifications, the main results remain robust.

¹⁴We present results for these robustness checks in Table A.6 in the Online Appendix.

3.2 Supply and Demand Effects in Planned Price Adjustments

We further explore the role of supply and demand in price-adjustment patterns using additional survey responses from the ifo-BCS as proxy variables. In negative *Covid-19 impact* categories, we expect prices to increase (or decrease less strongly) if supply-side forces are strong. Conversely, we expect prices to decrease in particular if demand-side effects are important. In positive categories, we expect prices to increase with higher chances in the presence of excess demand.

Let $SDshift_{i,t}$ denote an indicator for a proxy variable of a given supply- or demand-side force. We extend Equation (2) as follows:

$$\begin{aligned}
 Y_{i,t} = & \eta_{-3,0} \mathbb{1}(Covid_{i,t} = -3) + \eta_{-3,1} \mathbb{1}(Covid_{i,t} = -3 \wedge SDshift_{i,t} = 1) \\
 & + \eta_{-2,0} \mathbb{1}(Covid_{i,t} = -2) + \eta_{-2,1} \mathbb{1}(Covid_{i,t} = -2 \wedge SDshift_{i,t} = 1) \\
 & + \eta_{\{2,3\},0} \mathbb{1}(Covid_{i,t} = 2 \vee 3) + \eta_{\{2,3\},1} \mathbb{1}((Covid_{i,t} = 2 \vee 3) \wedge SDshift_{i,t} = 1) \\
 & + \alpha_s + X'_{i,t-3} \beta + \gamma_t + u_{i,t}
 \end{aligned} \tag{3}$$

All coefficients are again estimated relative to the base group of not or weakly affected firms and thus can be directly compared to the results in Table 3. We estimate Equation (3) using the proxy variables for supply and demand summarized in Table 1, one at a time. In particular, to proxy for demand shifts, we use information about firms' order backlog. This variable is observed in every month and all survey questionnaires for each sector. To proxy for negative supply shifts, we use information about the lack of intermediate or final goods elicited in 2020:M04 for the manufacturing and retail/wholesale industries. We carry forward these responses to 2020:M05. Since the specific questions we use slightly differ across survey questionnaires for each sector, and to allow (coarsely) for heterogeneity across industries, we provide separate results for the manufacturing, retail/wholesale, and services industries in the following

Table 4 reports estimates. Since interactions are identified off of variation *within Covid-19 impact* categories *and* industries, some of the results lack sufficient statistical power as cell sizes become small. We concentrate on those cases where we obtain significant results.

Planned price decreases are less likely if firms face supply reductions. Columns 2 and 6 of Table 4 show that strongly negatively affected retail/wholesale firms with no supply-chain disruptions are eighteen percentage points more likely to plan price decreases and about nine percentage points less likely to plan price increases compared to firms in the base group. If firms in this *Covid-19 impact* category report a concurrent lack of final goods supply, the likelihood of planned price decreases falls by around eight percentage points

Table 4 – Supply and Demand Effects of the Covid-19 Pandemic on Planned Price Adjustment

	Planned Price Decrease				Planned Price Increase			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: <i>Manufacturing</i>								
Strongly Neg.	0.086***	0.081***	0.054*	0.090***	-0.0081	-0.0019	0.0049	-0.0097
Negative	0.050***	0.024	0.062***	0.060***	-0.010	-0.021	-0.0053	-0.0098
Positive	-0.060***	-0.075**	-0.053**	-0.063**	0.069*	0.048	0.050	0.034
Strongly Neg. × Supply ⁻		-0.022				-0.0096		
Negative × Supply ⁻		0.016				0.035*		
Positive × Supply ⁻		0.014				0.0036		
Strongly Neg. × Demand ⁻			0.042				-0.016	
Negative × Demand ⁻			-0.0080				-0.0066	
Positive × Demand ⁻			-0.039				0.23	
Strongly Neg. × Demand ⁺				-0.018				0.073
Negative × Demand ⁺				-0.082**				0.0028
Positive × Demand ⁺				0.013				0.068
Observations	44579	31199	44006	44006	44579	31199	44006	44006
Panel B: <i>Retail/Wholesale</i>								
Strongly Neg.	0.14***	0.18***	-0.021	0.15***	-0.062***	-0.086***	0.032	-0.064***
Negative	0.048***	0.065**	-0.0080	0.051***	-0.027	-0.040	-0.0049	-0.029
Positive	-0.021	-0.017	-0.037**	-0.010	0.11***	0.052	0.12***	0.028
Strongly Neg. × Supply ⁻		-0.079**				0.066***		
Negative × Supply ⁻		-0.033				0.025		
Positive × Supply ⁻		-0.012				0.10		
Strongly Neg. × Demand ⁻			0.20***				-0.11***	
Negative × Demand ⁻			0.091***				-0.034	
Positive × Demand ⁻			0.14*				-0.025	
Strongly Neg. × Demand ⁺				-0.22***				0.14
Negative × Demand ⁺				-0.059				0.062
Positive × Demand ⁺				-0.024				0.20***
Observations	38563	34851	38389	38389	38563	34851	38389	38389
Panel C: <i>Services</i>								
Strongly Neg.	0.11***		0.096**	0.11***	0.0056		-0.0043	0.0074
Negative	0.063***		0.044**	0.068***	-0.025*		-0.034*	-0.023*
Positive	-0.00086		-0.022	0.020	0.039		0.0092	0.11*
Strongly Neg. × Demand ⁻			0.018				0.013	
Negative × Demand ⁻			0.033				0.016	
Positive × Demand ⁻			0.14				0.21*	
Strongly Neg. × Demand ⁺				-0.058				0.018
Negative × Demand ⁺				-0.11***				-0.030
Positive × Demand ⁺				-0.035				-0.12
Observations	46153		45753	45753	46153		45753	45753
Controls	yes	yes	yes	yes	yes	yes	yes	yes
Time FE	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE	yes	yes	yes	yes	yes	yes	yes	yes

Notes: This table reports estimates from linear regressions of indicators for planned price decreases/increases on indicators for *Covid-19 impact* categories and interaction terms with proxy variables for supply and demand, based on Equation (3), separately for each sector. Columns 1 and 5 repeat the baseline estimates based on Equation (2). *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS, which we group and label “Strongly Negative” (-3), “Negative” (-2), and “Positive” (+2 and +3), and the base category “Weak/No Impact” (-1, 0, or +1). *Supply⁻* is an indicator for the lack of intermediate/final goods. *Demand⁻* and *Demand⁺* are indicators for low and high order backlog, respectively. Control variables include separate indicators for positive and negative responses to the questions about business situation, business expectations and orders, all lagged by three months. Appendix A.1 provides translations of all corresponding survey questions. Industry fixed effects are at the two-digit WZ08 level. Time fixed effects are at the month-year level. Standard errors are clustered at the firm level. Sample: 2018:M01–2020:M05. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

and that of planned price increases rises by seven percentage points. The likelihood of price decreases still rises in these firms, but by less than in absence of supply-chain disruptions.

Disinflationary pressures are reinforced by negative demand shifts and attenuated by positive demand shifts. Again, this pattern is most pronounced in retail/wholesale. The estimated effects of (strongly) negative *Covid-19 impact* in this sector is entirely driven by firms that report a concurrent low order backlog. See Columns 3 and 7 of Table 4. These firms are at least nine percentage points more likely than weakly or not affected firms to plan price decreases and as much as eleven percentage points less likely to plan price increases. Conversely, the probability to plan price decreases falls in negatively affected firms across all sectors in the presence of positive demand shifts, as Column 4 shows.

An alternative specification corroborates the co-existence of supply and demand in firms' planned price changes. We regress planned price changes on the subjective reasons for the adverse effects of Covid-19 from the June 2020 survey questionnaire, discussed at end of Section 2.1. Again, to capture their relative importance at the firm level, we compare the survey responses for each subjective reason relative to the firm mean of all those remaining. We impute these subjective reasons backward to 2020:M04 and 2020:M05 and estimate Equation (2), separately for each of the six subjective reasons, replacing *Covid-19 impact*. Table A.8 in the Online Appendix confirms that adverse demand effects are associated with a higher probability of price decrease and lower probability of price increases. Conversely, adverse supply effects due to reductions in labor input and supply-chain disruptions are associated with fewer planned price decreases.

4 Implications

The main estimates from Columns 3 and 6 in Table 3 imply that (strongly) negative *Covid-19 impact* is associated with a five (eleven) percentage points increase in the probability of planned price decreases, relative to weak or no *Covid-19 impact*. The vast majority of all survey respondents report adverse effects, which Table 1 shows to correlate with proxy variables for both supply and demand. Taken together, these results highlight the importance of weak demand during the Covid-19 pandemic. Otherwise, a reduction in supply would reverse the observed price-setting behavior, with higher probability of price increases associated with negative *Covid-19 impact*.

This finding is in line with other articles that emphasize differential effects of economic shocks on demand during the Covid-19 crisis. First, higher economic uncertainty might adversely affect the demand for durables relative to non-durables (see Bayer et al.,

2019, in a non-Covid-19 related context). Second, demand deficiencies are expected to be large in firms particularly exposed through their position in the input-output network (Baqae and Farhi, 2020; Barrot et al., 2020). Third, demand deficiencies are larger for goods that are mostly complements to other goods and services (Guerrieri et al., 2020). Finally, Covid-19 itself may reduce the demand for certain goods for which consumption is associated with health risks (Eichenbaum et al., 2020). Our results provide reduced-form evidence for differential demand shortages across firms consistent with each of these channels.

Weak demand is also important at the aggregate level in this body of quantitative work, a finding we confirm empirically. To reach this conclusion, we integrate the estimated effects on planned price adjustments at the sector level, separately for price increases and decreases, and take into account the observed heterogeneity in planned price changes.¹⁵ We pool all observations in 2020:M04 and 2020:M05 and use frequency weights to aggregate estimates for each *Covid-19 impact* category. The frequency of price decreases is predicted to increase by 2.8, 5.4, and 5.3 percentage points in manufacturing, retail/wholesale and services, respectively. These figures are economically large. In manufacturing, for example, this change corresponds to a one standard deviation increase in the frequency of planned price decreases. The frequency of planned price increases is predicted to increase by no more than 0.5 percentage points in manufacturing and slightly declines in retail/wholesale and services.¹⁶

At the same time, the results of this paper do not rule out negative supply forces, for instance, drops in labor input or supply-chain disruptions. Rather, the estimates we represent show that demand is *on average* more important than supply. Indeed, Section 3.2 showed that price-adjustment patterns move in the expected direction in the presence of supply shortages. Brinca et al. (2020) also provide evidence for the co-existence of supply and demand forces in United States hours worked. Unlike these authors, we find that on average demand deficiencies dominate over supply forces.

Our findings suggest a role for policy to stabilize aggregate demand while containing the Covid-19 pandemic. Monetary policy, constrained by the effective lower bound, seems an unlikely candidate. Moreover, even if there was policy room, the higher fre-

¹⁵Since our estimated effects are identified off of the response of each *Covid-19 impact* category relative to the base category of no or weak impact, the level effect is not identifiable. Thus, to aggregate our estimates we implicitly assume that the base impact category is unaffected. Following Nakamura and Steinsson (2018), this approach is common in the macroeconomic literature using cross-sectional variation for identification. Indeed, Figure 1 showed that planned price decreases in this category remain almost unchanged post-March 2020.

¹⁶In Balleer et al. (2020), we use these aggregated estimates to predict a decline in inflation by 1.5 percentage points relative to the counterfactual of no Covid-19 pandemic. This forecast does not incorporate the temporary reduction in the German value-added tax rate effective July 2020, which very likely will reduce inflation even further.

quency of price changes implies greater aggregate price flexibility such that monetary stimulus becomes less effective. Hence, fiscal policy appears a more promising candidate. Since the impact of Covid-19 is strongly negative in the vast majority of firms and displays differential effects even within sectors, our results caution against the use of industrial policy to buffer aggregate demand shortages.

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A Online Appendix

Figure A.1 – Planned Price Changes and Producer Price Inflation



Notes: The figure plots time series of the monthly realized change in producer price indices from the German Federal Statistical Office (Destatis) relative to three months before (dashed orange line; right axis) against the mean of three-months ahead planned price changes from the ifo-BCS, weighted by representative weights included in the ifo-BCS (solid black line; left axis) for the samples of (a) manufacturing, (b) wholesale, (c) retail (incl. car sellers) industries. Destatis does not provide a monthly producer price index for services, hence not displayed here. All series are seasonally adjusted.

Table A.1 – Summary Statistics by Covid-19 Impact: Manufacturing

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
Positive Business Conditions	0.012	0.035	0.189	0.51	0.577	0.78	0.854	0.161
	0.109	0.183	0.391	0.501	0.496	0.416	0.358	0.368
Negative Business Conditions	0.877	0.556	0.166	0.048	0.026	0.073	0.049	0.471
	0.329	0.497	0.372	0.214	0.159	0.262	0.218	0.499
Positive Business Expectations	0.147	0.123	0.088	0.096	0.121	0.284	0.31	0.125
	0.354	0.329	0.284	0.295	0.327	0.454	0.468	0.33
Negative Business Expectations	0.678	0.655	0.584	0.356	0.318	0.247	0.19	0.586
	0.468	0.476	0.493	0.479	0.467	0.434	0.397	0.493
Expected Revenue Change (in %)	-30.892	-21.628	-13.565	-7.284	-0.412	0.818	29.095	-18.493
	16.748	12.586	9.711	8.582	9.371	16.779	71.065	18.19
Planned Price Increase	0.039	0.039	0.067	0.074	0.133	0.159	0.22	0.058
	0.194	0.193	0.25	0.263	0.341	0.367	0.419	0.233
Planned Price Decrease	0.197	0.148	0.101	0.06	0.025	0.024	0.049	0.134
	0.398	0.356	0.302	0.238	0.158	0.155	0.218	0.34
Planned Price Change	0.236	0.187	0.168	0.134	0.158	0.183	0.268	0.191
	0.425	0.39	0.374	0.341	0.366	0.389	0.449	0.393
Price Increase	0.027	0.037	0.045	0.066	0.108	0.117	0.2	0.045
	0.161	0.188	0.208	0.249	0.312	0.324	0.407	0.208
Price Decrease	0.102	0.095	0.056	0.038	0.025	0	0.033	0.076
	0.303	0.293	0.229	0.192	0.157	0	0.183	0.266
Price Change	0.129	0.132	0.101	0.104	0.133	0.117	0.233	0.122
	0.335	0.338	0.301	0.306	0.341	0.324	0.43	0.327
Observations	1159	1129	891	420	158	82	42	3881
Percent	29.86	29.09	22.96	10.82	4.07	2.11	1.08	100

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact* for the subset of manufacturing firms. Row variables are indicators for positive/negative business conditions/expectations or planned/realized price increases/decreases/changes, and expected percentage changes in revenue due to Covid-19 from the ifo-BCS. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translations of all corresponding survey questions. Sample: 2020:M04–2020:M05, and 2020:M04 for expected revenue changes.

Table A.2 – Summary Statistics by Covid-19 Impact: Retail/Wholesale

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
Positive Business Conditions	0.011	0.034	0.129	0.404	0.56	0.78	0.917	0.196
	0.105	0.181	0.336	0.492	0.497	0.415	0.277	0.397
Negative Business Conditions	0.905	0.569	0.151	0.045	0.036	0.011	0.007	0.47
	0.293	0.496	0.359	0.208	0.187	0.105	0.083	0.499
Positive Business Expectations	0.07	0.08	0.085	0.08	0.112	0.286	0.326	0.103
	0.255	0.272	0.279	0.271	0.317	0.453	0.471	0.304
Negative Business Expectations	0.819	0.702	0.61	0.379	0.285	0.242	0.222	0.619
	0.385	0.458	0.488	0.486	0.452	0.429	0.417	0.486
Expected Revenue Change (in %)	-32.336	-24.274	-13.515	-8.462	-5.793	-7.6	-10.625	-22.961
	19.252	14.13	9.189	8.923	10.943	9.434	10.468	17.93
Planned Price Increase	0.127	0.163	0.175	0.175	0.249	0.268	0.357	0.175
	0.333	0.37	0.381	0.381	0.433	0.444	0.481	0.38
Planned Price Decrease	0.281	0.151	0.12	0.061	0.065	0.055	0.056	0.166
	0.45	0.358	0.325	0.239	0.248	0.228	0.231	0.372
Planned Price Change	0.408	0.314	0.295	0.236	0.314	0.322	0.413	0.341
	0.492	0.464	0.457	0.425	0.465	0.469	0.494	0.474
Price Increase	0.063	0.087	0.113	0.17	0.221	0.236	0.389	0.123
	0.243	0.282	0.316	0.376	0.416	0.426	0.489	0.328
Price Decrease	0.184	0.121	0.1	0.102	0.064	0.055	0.069	0.127
	0.388	0.327	0.3	0.303	0.246	0.229	0.255	0.333
Price Change	0.247	0.208	0.212	0.272	0.285	0.291	0.458	0.249
	0.432	0.406	0.409	0.446	0.452	0.456	0.5	0.433
Observations	1088	737	546	266	249	184	144	3214
Percent	33.85	22.93	16.99	8.28	7.75	5.72	4.48	100

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact* for the subset of retail/wholesale firms. Row variables are indicators for positive/negative business conditions/expectations or planned/realized price increases/decreases/changes, and expected percentage changes in revenue due to Covid-19 from the ifo-BCS. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translations of all corresponding survey questions. Sample: 2020:M04–2020:M05, and 2020:M04 for expected revenue changes.

Table A.3 – Summary Statistics by Covid-19 Impact: Services

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
Positive Business Conditions	0.003	0.051	0.271	0.591	0.664	0.86	0.676	0.207
	0.054	0.22	0.445	0.492	0.474	0.351	0.475	0.406
Negative Business Conditions	0.934	0.505	0.104	0.026	0.021	0.02	0.27	0.461
	0.249	0.5	0.306	0.161	0.142	0.141	0.45	0.499
Positive Business Expectations	0.138	0.137	0.113	0.09	0.308	0.3	0.405	0.136
	0.345	0.344	0.316	0.287	0.463	0.463	0.498	0.343
Negative Business Expectations	0.737	0.673	0.464	0.222	0.123	0.08	0.297	0.545
	0.44	0.469	0.499	0.416	0.33	0.274	0.463	0.498
Expected Revenue Change (in %)	-46.096	-23.712	-11.571	-4.462	0.386	10.688	2.722	-24.608
	24.02	14.004	9.988	9.13	6.895	8.623	39.016	24.403
Planned Price Increase	0.1	0.046	0.076	0.1	0.124	0.098	0.235	0.086
	0.3	0.21	0.264	0.3	0.331	0.3	0.431	0.28
Planned Price Decrease	0.189	0.126	0.066	0.024	0.021	0.039	0.029	0.112
	0.392	0.332	0.248	0.152	0.143	0.196	0.171	0.316
Planned Price Change	0.289	0.173	0.141	0.123	0.145	0.137	0.265	0.198
	0.453	0.378	0.349	0.329	0.353	0.348	0.448	0.399
Price Increase	0.033	0.029	0.034	0.043	0.127	0.102	0.143	0.039
	0.179	0.169	0.181	0.203	0.334	0.306	0.355	0.195
Price Decrease	0.161	0.08	0.034	0.014	0.028	0.041	0.057	0.085
	0.368	0.271	0.181	0.119	0.166	0.2	0.236	0.279
Price Change	0.194	0.109	0.068	0.057	0.155	0.143	0.2	0.124
	0.395	0.312	0.252	0.233	0.363	0.354	0.406	0.33
Observations	1376	730	963	568	146	51	37	3871
Percent	35.55	18.86	24.88	14.67	3.77	1.32	0.96	100

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact* for the subset of services firms. Row variables are indicators for positive/negative business conditions/expectations or planned/realized price increases/decreases/changes, and expected percentage changes in revenue due to Covid-19 from the ifo-BCS. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translations of all corresponding survey questions. Sample: 2020:M04–2020:M05, and 2020:M04 for expected revenue changes.

Table A.4 – Summary Statistics by *Covid-19 Impact*: Additional Supply and Demand Indicators

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
<i>Panel A: Manufacturing</i>								
Lack of Material	0.247	0.248	0.201	0.131	0.202	0.239	0.2	0.22
	0.432	0.432	0.401	0.338	0.404	0.431	0.41	0.414
Distorted Supply Chain of Interm. Prod.	0.41	0.328	0.274	0.185	0.253	0.227	0.056	0.31
	0.492	0.47	0.447	0.389	0.438	0.424	0.236	0.463
Distorted Supply Chain of Final Prod.	0.201	0.182	0.144	0.079	0.067	0.114	0.056	0.158
	0.402	0.387	0.352	0.271	0.251	0.321	0.236	0.364
Cost Increase of Interm. Prod./Raw Material	0.124	0.1	0.079	0.074	0.107	0.114	0.056	0.098
	0.33	0.301	0.271	0.263	0.311	0.321	0.236	0.298
Dependance on Imports	0.549	0.532	0.541	0.455	0.516	0.576	0.688	0.532
	0.498	0.5	0.499	0.5	0.504	0.502	0.479	0.499
Dependance on Imports from China	0.368	0.33	0.309	0.208	0.242	0.364	0.375	0.318
	0.483	0.471	0.463	0.407	0.432	0.489	0.5	0.466
Dependance on Imports from Italy	0.297	0.311	0.287	0.24	0.242	0.303	0.188	0.289
	0.457	0.464	0.453	0.429	0.432	0.467	0.403	0.453
Demand Reduction	0.482	0.391	0.24	0.132	0.173	0.136	0.056	0.327
	0.5	0.489	0.427	0.34	0.381	0.347	0.236	0.469
Lack of Orders	0.803	0.663	0.339	0.089	0.071	0.152	0.15	0.51
	0.398	0.473	0.474	0.285	0.259	0.363	0.366	0.5
<i>Panel B: Retail/Wholesale</i>								
Distorted Supply Chain of Interm. Prod.	0.419	0.401	0.427	0.202	0.317	0.29	0.255	0.38
	0.494	0.491	0.496	0.404	0.468	0.458	0.44	0.486
Distorted Supply Chain of Final Prod.	0.211	0.169	0.147	0.03	0.059	0.081	0.078	0.155
	0.408	0.375	0.355	0.172	0.238	0.275	0.272	0.362
Cost Increase of Interm. Prod./Raw Material	0.147	0.123	0.164	0.081	0.178	0.097	0.078	0.137
	0.355	0.328	0.372	0.274	0.385	0.298	0.272	0.344
Dependance on Imports	0.595	0.586	0.62	0.609	0.587	0.649	0.556	0.598
	0.491	0.493	0.486	0.49	0.494	0.48	0.501	0.49
Dependance on Imports from China	0.321	0.32	0.358	0.345	0.254	0.26	0.333	0.321
	0.467	0.467	0.48	0.478	0.437	0.441	0.475	0.467
Dependance on Imports from Italy	0.314	0.315	0.347	0.282	0.369	0.416	0.397	0.33
	0.465	0.465	0.477	0.452	0.484	0.496	0.493	0.47
Demand Reduction	0.614	0.384	0.271	0.152	0.158	0.081	0.039	0.39
	0.487	0.487	0.446	0.36	0.367	0.275	0.196	0.488
Lack of Orders	0.623	0.691	0.478	0.2	0.104	0.07	0	0.495
	0.485	0.463	0.501	0.404	0.308	0.258	0	0.5
<i>Panel C: Services</i>								
Demand Reduction	0.686	0.414	0.222	0.078	0.098	0.25	0.313	0.4
	0.464	0.493	0.416	0.27	0.3	0.452	0.479	0.49
Lack of Orders	0.673	0.623	0.296	0.091	0.03	0	0.167	0.457
	0.469	0.485	0.457	0.288	0.173	0	0.383	0.498

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact*. Row variables are indicators for distorted supply chain of intermediate products, distorted supply chain of final products, cost increase of intermediate prod./raw material and demand reduction due to the COVID-19 pandemic that are only available in 2020:M03 and are imputed to *Covid-19 impact* in 2020:M04. Further indicator row variables: “lack of material” (firms that are constrained in production due to lack of material), dependance on imports, dep. on imports from China/Italy and “lack of orders” (firms that are constrained in production due to lack of orders) are only available in 2020:M04. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translations of all corresponding survey questions.

Table A.5 – Summary Statistics by *Covid-19 Impact*: Subjective Reasons for Adverse Effects

	<i>Covid-19 Impact</i>							Total
	-3	-2	-1	0	1	2	3	
<i>Panel A: Manufacturing</i>								
Severity of Adverse Effects due to:								
Finances/Liquidity	-0.036	-0.355	-0.612	-0.747	-0.503	-0.579	-0.685	-0.372
	1.434	1.33	1.159	0.981	1.115	1.06	1.004	1.302
Domestic Demand	1.421	1.14	0.77	0.376	0.31	0.187	0.008	0.999
	0.98	1.059	1.026	1.082	1.185	1.161	1.378	1.111
Foreign Demand	1.228	1.039	0.853	0.632	0.774	0.391	0.238	0.98
	1.207	1.281	1.188	1.217	1.201	1.18	1.081	1.243
Labor Supply	-0.964	-0.79	-0.503	-0.357	-0.477	-0.553	-0.315	-0.71
	1.172	1.006	0.999	0.904	0.989	0.876	1.087	1.067
Goods Supply	-0.776	-0.473	-0.245	0.063	0.026	0.519	0.7	-0.405
	1.092	1.05	1.069	0.948	1.122	1.179	1.409	1.115
Regulations	-0.872	-0.561	-0.263	0.032	-0.129	0.034	0.054	-0.491
	1.222	1.163	1.122	1.082	0.999	1.102	1.425	1.2
<i>Panel B: Retail/Wholesale</i>								
Severity of Adverse Effects due to:								
Finances/Liquidity	-0.028	-0.413	-0.606	-0.62	-0.693	-0.789	-0.836	-0.399
	1.423	1.265	1.005	0.858	1.143	0.921	0.9	1.241
Domestic Demand	1.131	0.883	0.585	0.18	0.111	0.039	-0.359	0.688
	1.09	1.228	1.169	1.039	1.253	1.201	1.036	1.232
Foreign Demand	-0.585	-0.102	-0.054	-0.209	-0.235	-0.195	-0.622	-0.307
	1.901	1.717	1.464	1.215	1.416	1.332	0.993	1.649
Labor Supply	-0.761	-0.444	-0.431	-0.187	-0.285	-0.182	0.019	-0.477
	1.189	1.072	1.044	0.947	1.054	0.993	1.136	1.119
Goods Supply	-0.003	0.075	0.285	0.313	0.656	0.88	1.301	0.259
	1.192	1.181	1.114	0.91	1.148	1.17	1.143	1.199
Regulations	0.245	0.002	0.222	0.524	0.445	0.246	0.496	0.235
	1.394	1.272	1.324	1.111	1.257	1.064	1.271	1.307
<i>Panel C: Services</i>								
Severity of Adverse Effects due to:								
Finances/Liquidity	0.438	0.016	-0.436	-0.301	-0.439	-0.303	-0.037	-0.007
	1.289	1.317	1.042	0.814	0.731	0.945	1.33	1.215
Domestic Demand	1.152	1.186	0.632	0.057	0.056	0.184	0.007	0.81
	1.085	1.126	1.094	0.744	0.9	1.048	1.144	1.134
Foreign Demand	0.342	0.089	-0.053	-0.149	-0.192	-0.205	-0.259	0.094
	1.665	1.605	1.233	0.856	0.993	0.885	1.08	1.438
Labor Supply	-0.943	-0.487	-0.171	-0.085	-0.019	-0.238	0.185	-0.491
	1.376	1.222	0.973	0.862	0.799	0.899	1.177	1.221
Goods Supply	-1.262	-0.738	-0.268	0.037	0.155	0.151	-0.126	-0.652
	1.36	1.116	0.964	0.852	0.969	0.802	1.017	1.252
Regulations	0.274	-0.067	0.296	0.441	0.439	0.411	0.23	0.246
	1.36	1.282	1.102	0.98	1.166	0.931	1.043	1.23

Notes: This table depicts means and standard deviations (smaller numbers below) by *Covid-19 impact*. Row variables are indicators with respect to the severity of supply- and demand-sided adverse effects elicited in June 2020 in the ifo-BCS on a five-digit scale between “no adverse effects” and “large adverse effects” and imputed to *Covid-19 Impact* in April/May 2020. To achieve relative adverse effects, the mean of the remaining measures is subtracted from the respective variable. *Covid-19 Impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS. Appendix A.1 provides translations of all corresponding survey questions. Sample of *Covid-19 Impact*: 2020:M04–2020:M05.

Table A.6 – Effects of the Covid-19 Pandemic on Planned Price Adjustment: Robustness

	Planned Price Decrease				Planned Price Increase			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Covid-19 Impact:</i>								
Strongly Neg.	0.10*** (0.0085)	0.17*** (0.032)	0.10*** (0.0095)	0.071*** (0.0087)	-0.012 (0.0089)	-0.076** (0.031)	-0.021** (0.0096)	-0.0038 (0.010)
Negative	0.047*** (0.0082)	0.11*** (0.037)	0.050*** (0.0086)	0.023*** (0.0081)	-0.0041 (0.0087)	-0.0034 (0.032)	-0.0083 (0.0088)	0.0030 (0.0099)
Positive	-0.024** (0.011)	-0.045 (0.040)	-0.022* (0.012)	-0.027** (0.011)	0.077*** (0.021)	0.15*** (0.058)	0.069*** (0.022)	0.044* (0.023)
Observations	129104	37780	128961	126462	129104	37780	128961	126462
Time FE	Yes	Yes	No	Yes	Yes	Yes	No	Yes
Taylor Dummies	No	Yes	No	No	No	Yes	No	No
Time X Industry FE	No	No	Yes	No	No	No	Yes	No
No Concurrent Price Change	No	No	No	Yes	No	No	No	Yes

Notes: This table reports estimates from linear regressions of indicators for planned price decreases/increases on indicators for *Covid-19 impact* categories, based on Equation (2). Columns (1) and (5) show baseline results (equivalent to columns (3) and (6) in Table 3). Columns (2) and (6) show results with Taylor Dummies, Columns (3) and (7) show results with Time fixed effects at the level of two-digit industries, and Columns (4) and (8) show results using only observations where firms hold prices constant in 2020:M04/M05. *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS, which we group and label “Strongly Negative” (-3), “Negative” (-2), and “Positive” (+2 and +3), and the base category “Weak/No Impact” (-1, 0, or +1). Control variables include separate indicators for positive and negative responses to the questions about business situation, business expectations and orders, all lagged by three months. Appendix A.1 provides translations of all corresponding survey questions. Industry fixed effects are at the two-digit WZ08 level. Time fixed effects are at the month-year level. Standard errors in parentheses are clustered at the firm level. Sample: 2018:M01–2020:M05. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7 – Effects of the Covid-19 Pandemic on Realized Price Adjustment

	Realized Price Decrease			Realized Price Increase			Realized Price Change		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>Covid-19 Impact:</i>									
Strongly Neg.	0.088*** (0.0071)	0.046*** (0.0088)	0.037*** (0.0080)	-0.095*** (0.0044)	-0.028*** (0.0072)	-0.0098 (0.0077)	-0.0069 (0.0081)	0.018 (0.011)	0.027*** (0.010)
Negative	0.044*** (0.0071)	0.027*** (0.0088)	0.019** (0.0080)	-0.094*** (0.0048)	-0.019*** (0.0070)	-0.0043 (0.0076)	-0.050*** (0.0082)	0.0082 (0.011)	0.015 (0.010)
Positive	-0.0023 (0.012)	-0.0093 (0.014)	-0.0094 (0.014)	0.043** (0.020)	0.067*** (0.021)	0.024 (0.022)	0.041* (0.023)	0.058** (0.025)	0.015 (0.024)
Observations	127218	110866	110610	127218	110866	110610	127218	110866	110610
Controls	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Time FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Industry FE	No	Yes	No	No	Yes	No	No	Yes	No
Firm FE	No	No	Yes	No	No	Yes	No	No	Yes

Notes: This table reports estimates from linear regressions of indicators for realized price decreases/increases/changes on indicators for *Covid-19 impact* categories, based on Equation (2). *Covid-19 impact* measures the impact of Covid-19 on the current business situation on a seven-point scale from -3 (“negative”) to +3 (“positive”) in the ifo-BCS, which we group and label “Strongly Negative” (-3), “Negative” (-2), and “Positive” (+2 and +3), and the base category “Weak/No Impact” (-1, 0, or +1). Control variables include separate indicators for positive and negative responses to the questions about business situation, business expectations and orders, all lagged by three months. Appendix A.1 provides translations of all corresponding survey questions. Industry fixed effects are at the two-digit WZ08 level. Time fixed effects are at the month-year level. Standard errors in parentheses are clustered at the firm level. Sample: 2018:M01–2020:M05. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.8 – Effects of Subjective Reasons of Covid-19 Impact on Planned Price Adjustment

	Planned Price Decrease		Planned Price Increase		Planned Price Change	
	(1)	(2)	(3)	(4)	(5)	(6)
Severity of Adverse Effects due to:						
Finances/Liquidity	-0.0035 (0.0043)	0.0031 (0.0038)	-0.00068 (0.0034)	0.0029 (0.0037)	-0.0042 (0.0050)	0.0061 (0.0050)
Domestic Demand	0.016*** (0.0040)	0.014*** (0.0035)	-0.0075* (0.0040)	-0.0034 (0.0041)	0.0084 (0.0051)	0.011** (0.0051)
Foreign Demand	0.0086*** (0.0033)	0.0054* (0.0030)	-0.010*** (0.0029)	-0.0047 (0.0032)	-0.0017 (0.0041)	0.00070 (0.0041)
Labor Supply	-0.0060 (0.0042)	-0.0078** (0.0038)	0.0060 (0.0039)	0.0022 (0.0042)	0.000027 (0.0053)	-0.0056 (0.0054)
Goods Supply	-0.014*** (0.0040)	-0.015*** (0.0038)	0.013*** (0.0040)	0.0087** (0.0041)	-0.0012 (0.0052)	-0.0062 (0.0053)
Regulations	-0.0041 (0.0037)	-0.0022 (0.0034)	0.0048 (0.0035)	-0.0033 (0.0036)	0.00067 (0.0047)	-0.0054 (0.0046)
Observations	80965	80893	80965	80893	80965	80893
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	No	Yes	No	Yes	No
Firm FE	No	Yes	No	Yes	No	Yes

Notes: This table reports estimates from linear regressions of indicators for planned price decreases/increases/changes on subjective reasons data for the adverse effects of Covid-19. The June 2020 ifo-BCS survey questionnaire asks firms for the adverse effects of financing conditions, labor input, supply-chain disruptions, government containment regulations, and demand (domestic and foreign, separately) due to the Covid-19 crisis. Possible answers categories, on scale from one to five, include “no effect” (0) to “large adverse effect” (+5). We compare each reason relative to the firm mean of those remaining, impute backward to 2020:M04 and 2020:M05, and run separate regressions for each. Control variables include separate indicators for positive and negative responses to the questions about business situation, business expectations and orders, all lagged by three months. Appendix A.1 provides translations of all corresponding survey questions. Industry fixed effects are at the two-digit WZ08 level. Time fixed effects are at the month-year level. Standard errors in parentheses are clustered at the firm level. Sample: 2018:M01–2020:M05. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.1 Overview of Survey Questions

A.1.1 Regular Questions in the ifo-BCS

The following set of questions, which are asked regularly on a monthly basis in the Ifo-BCS, are used in this paper (English translation of German original).¹

Q1: Planned Price Changes:

Expectations for the next 3 months: The prices of our goods/service will [1] increase, [0] stay the same, or [-1] decrease.

Q2: Realized Price Changes:²

During the last month, the domestic (net) sales price [1] increased, [0] stayed the same, or [-1] decreased.

Q3: Order Backlog/Demand:³

We evaluate our backlog of orders as [1] comparatively large, [0] sufficient (typical for the season), or [-1] too small.

Q4: Current Business Situation:

We evaluate our current business situation as [1] good, [0] satisfactory, or [-1] bad.

Q5: Expected Business Situation:

Expectations for the next six months: our business situation will be [1] more favorable, [0] stay approximately the same, or [-1] more unfavorable.

Q6: Capital Utilization [Manufacturing only, quarterly frequency]:

The utilization of our capacities is currently (normal full utilization = 100%):
 30% 40% ... 70% 75% ... 100% if more than 100%: ___ %

Q7: Constraints to Production/Business Activity [quarterly frequency]:

¹In the manufacturing survey, firms are asked for assessments regarding specific products. During the time period used, the survey only covers the main product of each firm and the special questions related to the Covid-19 pandemic described below always refer to the firm as a whole. Hence, we use the terms “firms” and “(main) products” interchangeably in this paper. See [Link \(2020\)](#) for a detailed discussion.

²In the ifo-BCS covering manufacturing and services firms, Q2 on realized price changes has been asked in the online panel since 2020:M04, only.

³In the ifo-BCS on the retail/wholesale industries, Q3 is related relative to the situation one year before.

Our production/business activity is currently constrained:

yes no

If yes, by the following factors: lack of demand

lack of material/intermediates

... [Multiple additional options, not used in this paper]

A.1.2 Supplemental Questions Related to the Covid-19 Crisis

The wording of the special questions related to the COVID crisis in the ifo-BCS were as follows:⁴

SQ1 COVID-19 Impact [asked in Apr, May, and June 2020]:

Do you realize an effect of the Corona pandemic on your current business situation? Is this effect negative or positive?

negative -3 -2 -1 0 +1 +2 +3 positive

SQ2 Shortage of Supply [asked in online panel of manufacturing and retail/wholesale industries in April 2020, only]:

[Manufacturing:] Are you currently affected by problems with a shortage of supply of important intermediate goods from within Germany or abroad?

[Retail/Wholesale:] Are you currently affected by problems with a shortage of supply of important goods from within Germany or abroad?

Yes No

SQ3 Expected Revenue Change due to COVID Crisis [asked in April 2020]:

Which effect of the Corona pandemic on your turnover do you expect in the current year?

Increase of ___ % No effect Decline of ___ %

SQ4 Business Closure [asked in April and May 2020]:

Which measures has your firm taken in response to the Covid-19 pandemic?

Business closures⁵ ... [Multiple additional options, not used in this paper]

⁴Due to space limitations on the paper-based questionnaires, some questions were only asked in the online panel of the ifo-BCS that was used by more than 75% of the survey participants.

⁵Choices slightly differed between industry-specific surveys. Manufacturing: "plant closures/stop of production"; Retail/Wholesale: "Closure of sales/business outlets"; Services: "business closures".

SQ5 Importance of Intermediates from Abroad [asked in April 2020; online panel of manufacturing industries only]:

a) Did you rely on important shipments of goods from abroad before the Corona pandemic?

Yes No b) If yes, did those important shipments originate from China, Italy, or any other heavily affected country?

China Italy Other countries: _____

SQ6 Adverse Effect of COVID Crisis [asked June 2020 in online panel]:

Due to the COVID-19 crisis, we are currently experiencing adverse effects in the following areas:

a) Finances (e.g. liquidity):

No adverse effects Large adverse effects

b) Domestic Market (e.g. demand, order situation):

No adverse effects Large adverse effects

c) Foreign Market (e.g. demand, order situation):

No adverse effects Large adverse effects

d) Personnel (e.g. absences, exemptions, shortage):

No adverse effects Large adverse effects

e) Purchasing (e.g. supply chains, warehousing):

No adverse effects Large adverse effects

f) Regulations by Government (e.g. closures, hygiene concepts):

No adverse effects Large adverse effects

SQ7 [asked in March 2020]:

If you experience negative effects due to the COVID-19 pandemic on your business, which are those?

- Declining demand
- Impairment of business operations of foreign subsidiaries
- Delay/cancellation of shipments of intermediate goods or raw materials
- Delay/cancellation of shipments of final goods
- Increasing prices for intermediate goods or raw materials
- Decline of production
- Necessity for increased stock-keeping
- Delay/cancellation of business trips
- Others, in particular: _____