Sudden Stop: When Did Firms Anticipate the Potential Consequences of COVID-19?

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June 28, 2021

COVID-19 hit firms by surprise. In a high frequency, representative panel of German firms, the business outlook declined and business uncertainty increased only at the time when the spread of the COVID-19 pandemic led to domestic policy changes: The announcement of nation-wide school closures on March 13 was followed by the largest change in business perceptions by far. In contrast, the data provides no evidence for the relevance of other potential sources of information on business perceptions: Firms did not learn from foreign policy measures, even if they relied on inputs from China or Italy. The local, county-level spread of COVID-19 cases affected expectations and uncertainty, albeit to a much lesser extent than the domestic policy changes.

Keywords: expectations, uncertainty, policy, COVID-19, firms.

JEL Classification: E66, E32, H32, D22, D84

1. Introduction

After an initial outbreak in China in late December 2019, the COVID-19 pandemic started spreading around the world by mid-February 2020. As the pandemic progressively spread from China to further countries, firms in the rest of the world could, in principle, account for the possibility that the pandemic would spill over to other economies, affecting their own production and demand. Did firms anticipate this possibility, enabling them to take precautionary measures, or were firms unexpectedly hit by the crisis when it reached their domestic market? At what point did firms start to realize that they would be affected by the pandemic?

This paper tackles these questions using panel data from a representative and large German business survey. We show that, despite the previous spread in Asia, the COVID-19 crisis hit German firms almost completely by surprise. Based on detailed information on the day of filling the survey, businesses report a worsening outlook and increasing uncertainty only after the beginning of March, when the curfew in Northern Italy was imposed and the first schools were closed in Germany leaving firms with very little time to take preventive measures. The largest drop of business expectations and the largest increase in uncertainty follows after March 13, when the German government announced a nation-wide school closure. In combination, these two events were followed by an unprecedented drop in the business outlook of at least two standard deviations, and a comparably large increase in business uncertainty.

In contrast to the salient timing of European policy measures that were gradually imposed as the pandemic moved closer to the domestic market, other potential sources of information about the severity of the COVID-19 crisis seem to have at best small effects on expectations and uncertainty. The spread of COVID-19 cases at the firm's location has some explanatory power, but the overall magnitude is small relative to timing effects. Also, whether or not firms are exposed to trade, especially with China or Italy, the countries most prevalent in the news about the pandemic, appears to be comparatively unrelated to business expectations or uncertainty. There is suggestive evidence, however, that large firms have been able to learn from the international policy developments regarding COVID-19, possibly reflecting their superior information processing capabilities.

Our results further imply that firms were rather late in recognizing the severe consequences of the COVID-19 pandemic on their businesses. Although the pandemic was already dominating the

news and stock prices had already started to drop in mid-February, firms' perceptions plummeted upon the announcement—and not in anticipation—of strict domestic policy measures that were taken in light of the skyrocketing number of infections in mid-March. Horse races that compare the development of business perceptions in response to the policy events and the dynamics of overall infections, stock prices, and Covid-19 related media coverage, respectively, support this observation.

These results suggest that the "closeness" of the pandemic to the home market as proxied by policy events in Asia, Italy, and Germany was the main cause of the heightened uncertainty and sluggish short-run economic development induced by COVID-19 that have been described—but not explained—by Altig et al. (2020) for the US and the UK.[1] By highlighting the crucial role of domestic events for firms' expectations—and the smaller, but significant impact of the local COVID-19 spread—, our work provides new evidence that the experiences of economic agents are a prime source for their expectations.[2] Here, our work is the first to show how local developments matter for firms' expectations, as the effect of experience on expectations has thus far been documented primarily for households (see, e.g., Ehrmann and Tzamourani, 2012; Malmendier and Nagel, 2016; Cavallo et al., 2017; Kuchler and Zafar, 2019).[3]

In a broader sense, this paper contributes to the evidence on firms' expectations and decision making during the COVID-19 crisis (e.g., Balleer et al., 2020; Bartik et al., 2020; Buchheim et al., 2020; Hassan et al., 2020). This literature, however, is predominantly concerned with firms' responses to the crisis along different dimensions. As such, it does not consider the determinants of firms' expectations before the crisis hit the domestic market, which is at the heart of this paper.

We proceed as follows. Section 2 describes the firm-level survey data as well as the data on salient events and the local spread of COVID-19 across Germany. Section 3 presents the main results and Section 4 relates the role of COVID-19-related policy measures for firms' perceptions to the role of the overall dynamics of infections, stock prices, and media reports. Section 5 concludes.

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[1]Relatedly, Balduzzi et al. (2020) examine the role of credit constraints in explaining changes in expectations and plans of Italian firms between two survey waves in mid-January and late-March/early-April 2020. Moreover, Giglio et al. (2021) and Fetzer et al. (2020) document changes in economic beliefs and anxiety among retail investors and households, respectively.

[2]In this respect, our findings are in line with Castriota et al. (2020) who document that the demand for both national news and local news of Italian households is more responsive to the epidemiological development at the national rather than at the local level.

[3]Notably, the focus here is on how current experiences shape current expectations. This is distinct from the large literature showing the effect of lifetime experiences on preferences or decision making, even for professionals (see, e.g., Kaustia and Knüpfer, 2008; Greenwood and Nagel, 2009; Chiang et al., 2011; Malmendier et al., 2021).

2. Data and Empirical Strategy

ifo Business Survey The main data source of this paper is the ifo Business Survey (IBS). The IBS is a long-standing monthly panel, which aims to be representative of the German economy. Every month approximately 9,000 survey participants from firms in manufacturing, services, construction, wholesale, and retail assess various dimensions of their business activities, including their current and expected business conditions for the next six months and their uncertainty associated with these expectations.[4] *Inter alia*, the survey provides the basis for the ifo Business Climate Index, the most recognized leading indicator of the German business cycle as it has been repeatedly shown to closely track and forecast the German economy (e.g., Lehmann and Reif, 2020).[5] Apart from this, the micro data of the IBS have been extensively used for recent economic research (e.g., Bachmann et al., 2013, 2019; Enders et al., 2019, 2020; Huber, 2018; Link, 2019).

We use the responses of firms that filled the survey online between January and April 2020 and harmonize the data following Link (2020). The overall sample encompasses 19,273 firm responses. To get a sense for the monthly responses, consider the April wave: Here, our sample includes 4,867 firms, with 1,694 firms in manufacturing, 363 in construction, 1,132 in retail and wholesale, and 1,678 in the remaining service industries. The median firm in the sample has 40 employees, while 10% (5%) of firms employ more than 400 (1000) workers. Moreover, we obtained access to the exact return date of each survey questionnaire as well as information on the location of the firm at the county level. This data is used to merge the IBS to data on the local spread of COVID-19 as described below. As the survey usually runs during the first three weeks of each month, we lack observations for each months' final week.

Our main variables of interest are firms' current realized business conditions, expectations for the next six months, and firms' perceived uncertainty in predicting their future business development.

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[4]According to a meta-study by Sauer and Wohlrabe (2019), the survey is usually answered by senior management such as firm owners, members of the executive board, or department heads.

[5]In addition, Lehmann (2020) provides a detailed documentation of the very high forecasting power of IBS-based indicators with respect to aggregate administrative data including GDP, industrial production, employment, investment, exports, and prices. Further, Figure A1 in Appendix A illustrates the quality of the survey as a leading indicator for the German economy by showing that the aggregated survey responses concerning firms' current businesses in manufacturing closely track the short-term fluctuations in manufacturing value added. Also, see Sauer and Wohlrabe (2020) for details on the survey and additional, extensive evidence on the quality of the survey questions as leading indicators for various official statistics, as well as details on the sample composition, sample attrition, and representativeness.

Specifically, firms answer these questions on a *quantitative* scale ranging between 0 and 100.[6] Appendix Table A1 shows summary statistics for the main outcome variables for each survey month between January and April 2020.

In addition to these standard questions, the April 2020 wave of the IBS contained a series of additional COVID-19-related questions including a question on the expected impact of the crisis on firms' revenues in the year 2020 indicated as a percentage increase/decrease.[7] Moreover, manufacturing firms were asked whether they were depending on important input goods from abroad before the pandemic. Firms answering in the affirmative were asked a follow-up question on whether they were depending on shipments from China, Italy, or another severely affected country. In addition, we use information on the firm-specific export share from the September 2018 wave of the IBS.[8]

Timing of COVID-19 Containment Measures and Infection Data We assess the relevance of several channels through which the spread of COVID-19 may have affected firms' perceptions. First, firms' expectations may be informed by salient news about policy measures both abroad and in Germany. As the policy measures were imposed in response to the severity of the pandemic in the respective region, these policy events proxy how close the pandemic was to the domestic market of German firms at a specific point in time. Specifically, we define time indicator variables for all firms replying to the IBS in the period between two salient policy events. These salient policy events are a subset of COVID-19 related policies (shutdown or quarantine measures) that are selected according to the following protocol: (i) Order shutdown events in Asia, Italy, and Germany according to their severity—i.e., the geographical unit affected (local, state/province, or nation-wide shutdown)—and according to distance from Germany. (ii) Select a new event if it is either more severe than the past event or closer to Germany. Table 1 provides an overview of these policy events, the associated time intervals, and the number of firms replying to the IBS in each

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[6]The survey respondents choose an integer between 0 and 100 by clicking on a visual analogue scale ranging between "[0] bad" and "[100] good" current conditions, "[0] more unfavorable" and "[100] more favorable" expectations, and "[0] low" and "[100] high" uncertainty. The wording of all survey questions used in this paper are listed and translated to English in Appendix C. The survey also elicits business conditions and expectations on a three point scale, encoded as "more unfavorable" (-1), "roughly the same" (0) or "more favorable" (1). As our findings are similar when using these variables, we only focus on results for the more detailed scale.

[7]These revenue expectations provide an additional way to understand the quantitative implications of changes in business assessments. Figure A3 shows that there is a linear relation between the drop in the realized business conditions between January and April 2020 and the expected revenue decline.

[8]To maintain sample size, we set the export share to the average of the two-digit industry if missing. The results do not depend on this choice.

Table 1: Intervals between Major Policy Events and Number of Firms in IBS

	Start Date	End Date	Obs in IBS
Baseline period	Jan 1	Jan 21	4392
Wuhan lockdown (CHN)	Jan 22	Feb 3	354
Diamond Princess quarantine (JPN)	Feb 4	Feb 15	3879
Hubei hard curfew (CHN)	Feb 16	Feb 21	897
Municipalities lockdown (ITA)	Feb 22	Feb 29	0
Regional curfew (ITA)	Mar 1	Mar 4	1376
Local school closure (GER)	Mar 5	Mar 7	966
Northern Italy curfew (ITA)	Mar 8	Mar 9	757
Nation-wide curfew (ITA)	Mar 10	Mar 12	564
Nation-wide school closure (GER)	Mar 13	Mar 21	1017
Nation-wide curfew (GER)	Mar 22	Apr 14	3829
Lockdown easing announced (GER)	Apr 15	Apr 24	1155

Notes: This table shows different periods of the COVID-19 crisis defined as the interval between major policy events and indicates the number of firms that responded to the IBS in the respective period.

interval.

Second, firms may perceive the COVID-19 pandemic as more severe if it spread more strongly through their region. The regional exposure varied strongly across Germany as COVID-19 was, at least initially, predominately spread at specific events, such as a carnival celebration in the state of North-Rhine Westphalia, and by tourists returning from skiing vacations. We assess the exposure of firms to the local spread by merging them to the official daily data on the number of infections at the county level provided by the Robert Koch Institute, the German government agency and research institute responsible for disease control and prevention.[9]

Empirical Strategy   To assess the determinants of German firms' perceptions in the first months of the COVID-19 pandemic, we estimate the following empirical model

$$Y_{i,t} = \sum_{k=1}^{11} \beta_k \times 1[t \in \text{time interval } k] + \sum_{m=2}^{4} ln(\text{COVID-19 cases}_{c,t}) \times 1[t \in \text{month } m]$$

$$+ ln(\text{Employees}_i) + \alpha_c + \alpha_s + \varepsilon_{i,t}.$$

Specifically, we regress the different measures for firm i's business outlook $Y_{i,t}$ (current and expected business conditions and business uncertainty, respectively) on the above-described COVID-19 time

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[9]Infection data are obtained from https://npgeo-corona-npgeo-de.hub.arcgis.com.

Figure 1: Effect of COVID-19 on Business Conditions, Expectations, and Uncertainty
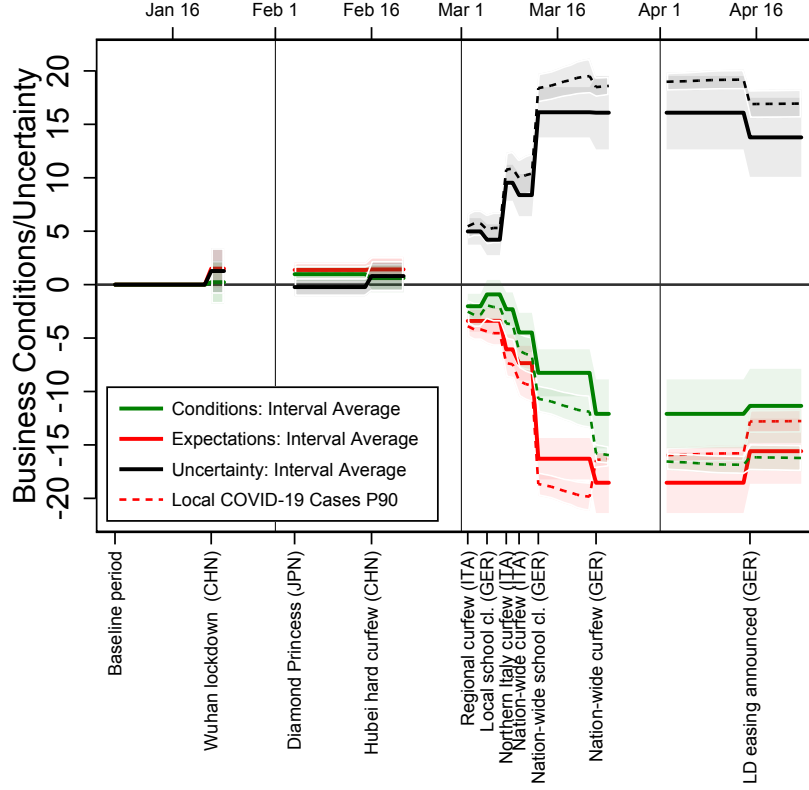
Notes: The solid lines show the effect of COVID-19-related policy measures on firms' business outlook and uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 70 two-digit industries. The effects are estimated relative to the baseline period before January 22. The dashed lines add the predicted effect of the local COVID-19 cases for a firm at the 90th percentile of cases at a given date. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds. Fore the corresponding estimates, see Table 2.

indicator variables summarized in Table 1, leaving out the period until January 21 as baseline period. Estimations also account for the number of COVID-19 cases (in logs) in a firm's county c at the day of answering the survey t. Given that salient news about the local spread of COVID-19 may have had a different impact on firms' perceptions at different phases of the pandemic, we interact this variable with three indicator variables roughly corresponding to the calendar months February, March, and April.[10] In addition, we control for firm size based on the number of employees (in logs) and include fixed effects at the levels of counties c and two-digit industries s.

3. Results

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[10]As the time interval "Nation-wide curfew (GER)" spans from March 22 to April 14, the third interval already starts on March 22. Importantly, the results are robust to the choice of these intervals.

Table 2: Effect of COVID-19 on Business Conditions, Expectations, and Uncertainty

	Business Conditions (1)	Business Expectations (2)	Business Uncertainty (3)
Time indicators (baseline period: Jan 1 - Jan 21):			
Wuhan lockdown (CHN)	0.26	1.53	1.30
	(1.22)	(1.07)	(1.30)
Diamond Princess quarantine (JPN)	0.97**	1.38***	-0.22
	(0.48)	(0.42)	(0.51)
Hubei hard curfew (CHN)	0.58	1.40*	0.86
	(0.81)	(0.72)	(0.87)
Regional curfew (ITA)	-2.00***$_{+++}$	-3.38***$_{+++}$	4.99***$_{+++}$
	(0.71)	(0.62)	(0.76)
Local school cl (GER)	-0.90	-3.37***	4.21***
	(0.82)	(0.72)	(0.88)
Northern Italy curfew (ITA)	-2.28**	-6.04***$_{+++}$	9.55***$_{+++}$
	(0.96)	(0.85)	(1.02)
Nation-wide curfew (ITA)	-4.45***$_{+}$	-7.32***	8.41***
	(1.12)	(0.99)	(1.20)
Nation-wide school cl (GER)	-8.19***$_{+++}$	-16.22***$_{+++}$	16.19***$_{+++}$
	(1.33)	(1.18)	(1.43)
Nation-wide curfew (GER)	-11.97***$_{+}$	-18.34***	16.06***
	(1.96)	(1.72)	(2.09)
LD easing announced (GER)	-11.22***	-15.43***$_{+++}$	13.73***$_{+++}$
	(2.11)	(1.85)	(2.25)
ln(Covid Cases County) $\times\ 1(t \in 04$ Feb, 21 Feb)	1.78	1.85	-1.95
	(1.44)	(1.27)	(1.54)
ln(Covid Cases County) $\times\ 1(t \in 03$ Mar, 21 Mar)	-0.75**	-0.73**	0.66*
	(0.33)	(0.29)	(0.35)
ln(Covid Cases County) $\times\ 1(t \in 22$ Mar, 23 Apr)	-0.76**	0.39	0.48
	(0.33)	(0.29)	(0.35)
ln(Employees)	0.81***	0.26***	0.53***
	(0.11)	(0.10)	(0.12)
Constant	49.39***	48.84***	53.43***
	(0.54)	(0.48)	(0.58)
Observations	17938	17959	17960
R^2	0.259	0.218	0.231
County FE	yes	yes	yes
Industry FE (2 digit)	yes	yes	yes

Notes: This table summarizes the effect of COVID-19 on firms' business conditions, business expectations and business uncertainty which are elicited on a visual analogue scale between 0 and 100. The period indicators are defined in Table 1. Data on the county-level counts of COVID-19 cases are received from the Robert Koch Institute and interacted with dummies for different phases of the pandemic. Further controls include the log number of employees and fixed effects at the levels of counties and 70 two-digit industries. Robust standard errors in parantheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. The "+"-subscripts indicate whether the coefficients referring to the respective time indicator are statistically different from the coefficient of the previous time period at the following significance levels: $_{+++}$ p<0.01, $_{++}$ p<0.05, $_{+}$ p<0.1.

Main Findings Figure 1 summarizes the main findings with respect to the effect of the COVID-19 pandemic on business conditions, business expectations, and business uncertainty since January 2020. The full set of estimated coefficients is also shown in Table 2 along with information on whether the coefficient is significantly different from the previous period.[11] Confidence intervals are depicted at the 90% level.

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[11]Table B1 in the Appendix shows that the results are unchanged if we use firm fixed effects instead of county and industry fixed effects.

The spread of COVID-19 throughout Far East Asia and the severe lockdown measures in China had no discernible effect on the current and expected business conditions of German firms and were not reflected by any increase in uncertainty until the end of February. Business conditions and expectations only started to depreciate significantly once the infection rates in Europe increased and Italy implemented shutdown measures by the beginning of March. This was accompanied by a significant increase in business uncertainty. Along with the rapid spread of the virus and the implementation of various containment measures in subsequent weeks, firms' business outlook rapidly deteriorated, reaching unprecedentedly low levels by the end of March. The strongest plunge in expectations followed after the German government announced nation-wide school closures on March 13, which likewise led to a substantial increase in uncertainty. The implementation of a nation-wide curfew on March 22 was followed by a further decline in firms' outlook.[12] After April 15, when a first easing of the severity of restrictions was announced, all measures of the business outlook improved only slightly, but stayed close to their historically bad levels.

Firms located in regions with higher infection numbers reported significantly worse business conditions and expectations as well as higher uncertainty during March, as shown by the dashed lines. Compared to the timing effects of salient policy events, however, the magnitude of the local spread of COVID-19 infections is relatively small. In April, business conditions of firms in highly-affected regions remained comparatively worse, while the influence of the local spread on expectations and uncertainty turned insignificant, see Table 2.

Overall, both realized and expected business conditions showed an unprecedented drop within only a few weeks of time. Relative to the month before, average business conditions and expectations deteriorated by at least two and four standard deviations, respectively. Meanwhile, uncertainty increased by a similar magnitude.[13]

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[12] Figure A2 in Appendix A illustrates the substantial magnitude with which firms reassessed their business outlook in March 2020. Panel (a) shows that the combined drop in business conditions and expectations in March as well as the jump in uncertainty puts an end to the relatively uneventful period between 2017 and 2019 (the dates for which the measures we used are included in all surveys of the IBS). For the manufacturing sector, for which this survey measure is available from 2005 onward, Panel (b) shows that the March 2020 drop in current business conditions and expectations is about half as steep as the respective combined decline during the entire financial crisis of 2008/9.

[13] The standard deviation of monthly means of realized and expected business conditions amounted to 2.8 and 3.3 between 2017 and 2019 when the respective questions were asked in all subsamples of the IBS. For the period 2005 to 2019, when the data is only available in the subset of manufacturing firms, the standard deviation is 5.6 and 4.0, respectively. The standard deviation of the time series of average uncertainty since the introduction of the survey question in 2017 is 2.9.

Figure 2: Effect of COVID-19 on Business Outlook and Uncertainty in Different Industries
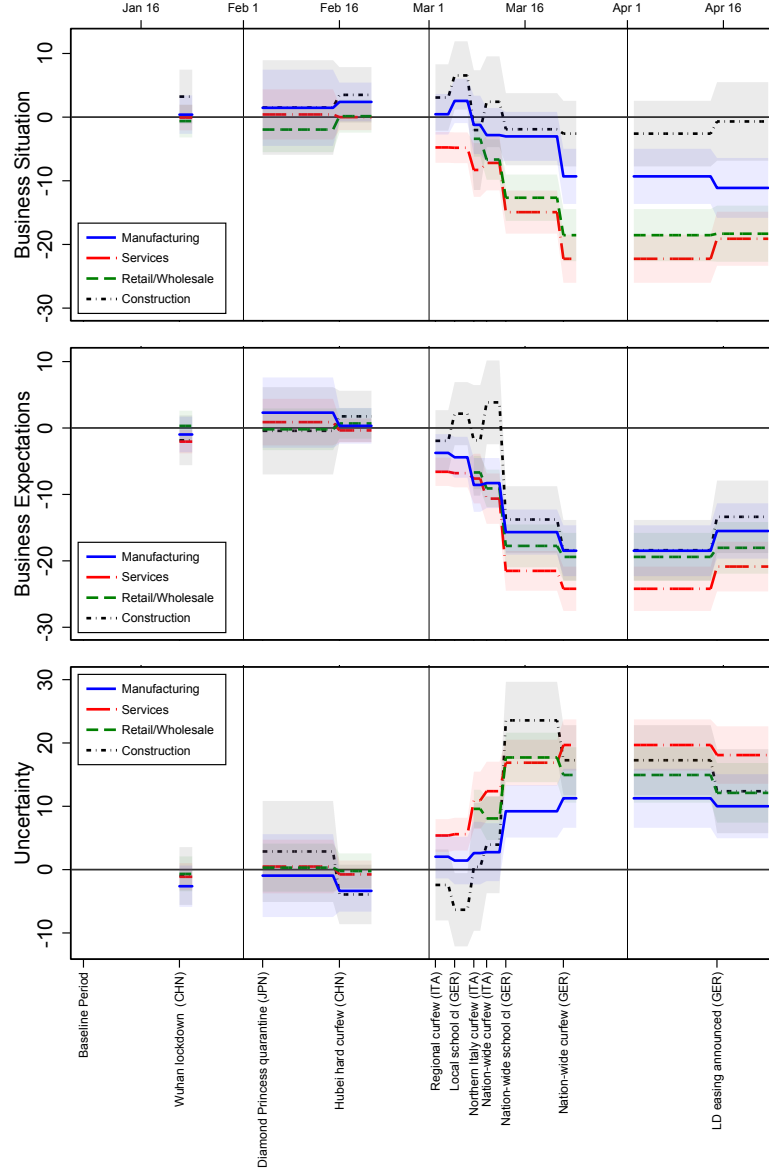
Notes: The solid lines show the effect of COVID-19-related policy measures on firms' business outlook and uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 70 two-digit industries. The effects are estimated relative to the baseline period before January 22 and separately for firms in manufacturing, services, retail/wholesale, and construction industries. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

Heterogeneity between Sectors   Overall, firms' perceptions and uncertainty followed a similar time path in the manufacturing, services, and retail industries (see Figure 2), though at different magnitudes. In all three sectors, expectations and conditions strongly deteriorated during March, with the service sector experiencing the strongest plunge. This is consistent with the differential

impact of the lockdown in these sectors.[14] Since many businesses in the service sector were obliged to cease any in-person client interaction during the lockdown, the larger magnitude of adverse effects does not come as a surprise. Also, business conditions in the service sector began to worsen already in early March, possibly reflecting a growing reluctance of consumers to spend. In contrast, the business expectations and uncertainty of construction firms were largely unaffected until mid-March, but strongly deteriorated after nation-wide school closure was announced on March 13 as well.

Effect on Expectations of Positively Affected Firms While firms' business outlook plummeted across the vast majority of industries, a small share of firms benefited from the COVID-19 crisis. We categorize firms as advantaged if they expected positive overall revenue effects of the crisis in a special survey question in April. According to this metric, only 4.9% of all firms benefited from the crisis. Unsurprisingly, the vast majority of these firms operate in the food and pharmaceutical industries, are supermarkets, or are active in the information technology or telecommunication services. The differential effects displayed in Figure 3 demonstrate that firms in advantaged sectors reported strongly appreciated business conditions throughout almost all time periods relative to the levels before January 22, whereas conditions for the remaining firms strongly deteriorated. In parallel, business expectations of advantaged firms only appreciated during February and stayed relatively flat during March and April, which possibly reflects that firms expect the positive effects on their businesses to be temporary. Business uncertainty also did not increase for firms that benefit from the crisis, except for the period before the nation-wide curfew in Germany (see Appendix Figure B1). Once it became evident that these firms were not restricted during the curfew, uncertainty dropped to pre-crisis levels.

International Trade Links Next, we examine whether expectations differ for firms that are internationally connected. The hypothesis is that the perceptions of import- and export-dependent firms deteriorate earlier, as China—the origin of the pandemic—and Italy—one of the most affected

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[14]Appendix Table A2 presents summary statistics of the expected effect of the COVID-19 pandemic on firms' revenues in 2020 that is elicited in a special IBS question in April 2020. In line with Figure 2, the median manufacturing firm is more negatively affected by the pandemic (expecting a revenue loss of 15%) compared to the median construction firm (losses of 10%), while services and retail/wholesale firms were more strongly affected by the lockdown (median expected revenue loss of 20%, each). See Buchheim et al. (2020) for a more detailed description of the impact of the shutdown at the levels of firms and industries.

Figure 3: Effect of COVID-19 on Business Expectations and Conditions: Positively Affected Firms
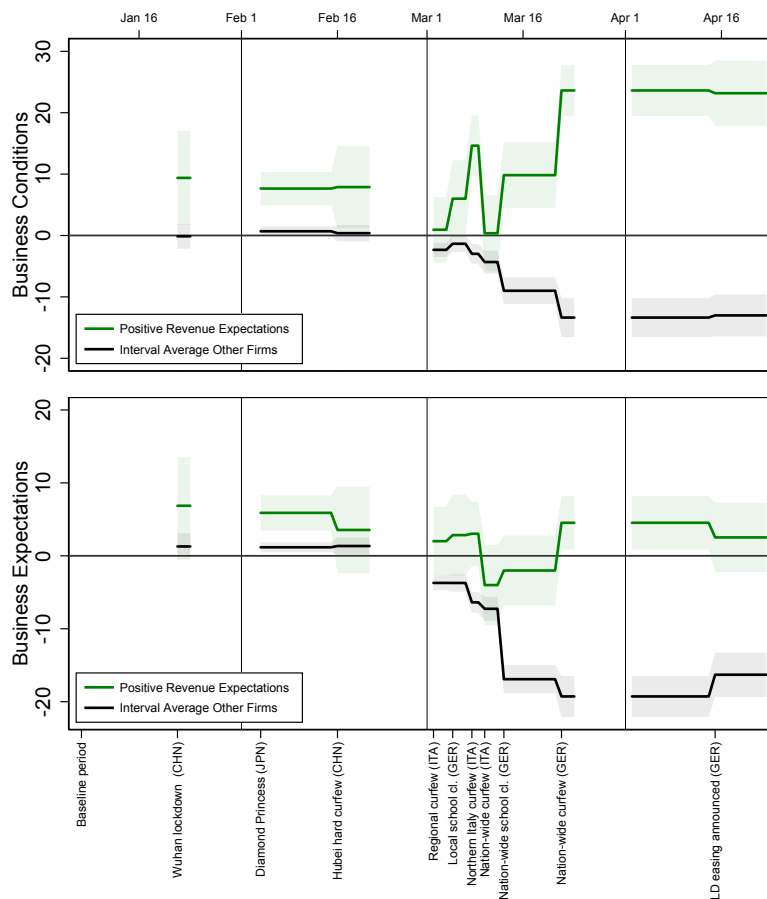
Notes: The solid lines show the effect of COVID-19-related policy measures on firms' realized and expected business conditions after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 70 two-digit industries. The effects are estimated relative to the baseline period before January 22 for two groups: firms that report in April 2020 to expect a positive effect of the COVID-19 crisis on their total revenues in 2020 (4.9% of all firms) and all other firms. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

countries early on—are important markets for German firms. To investigate this hypothesis, we assess whether responses of manufacturing firms differ between firms that were relying on imports of intermediate goods before the COVID-19 pandemic and firms that did not.[15]

Figure 4 shows that, contrary to the hypothesis, firms' expectations are, throughout February, virtually identical for firms that strongly depended on intermediates from abroad and for firms that did not. This is although the shutdown in China already affected Chinese exports at that time.[16]

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[15]In the April 2020 wave of the IBS, the subset of manufacturing firms was asked whether they depended on important intermediaries from abroad in general as well as from China, Italy, or any other country that was strongly affected by the COVID-19 pandemic before the crisis. Empirically, we interact these dummy variables on import dependency with the time intervals.

[16]The same holds for firms' business conditions. The results are available upon request.

Figure 4: Effect of COVID-19 on Expectations: Role of Dependency on Imported Intermediates
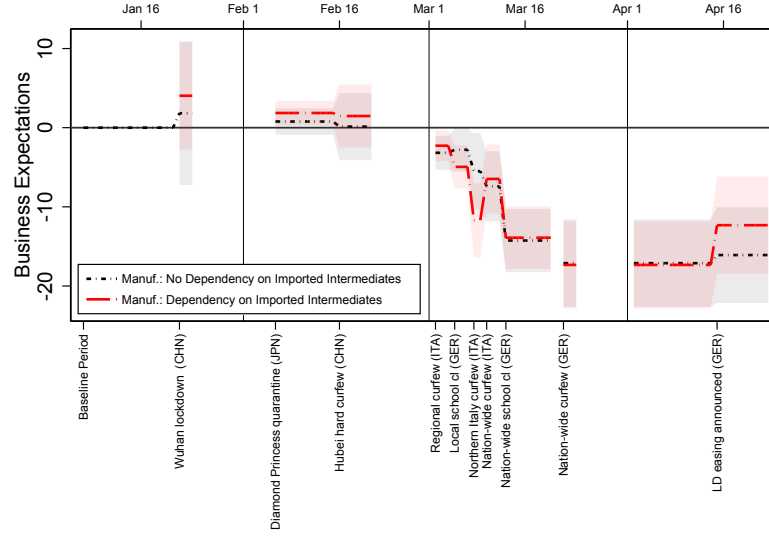
Notes: The solid lines show the effect of COVID-19-related policy measures on manufacturing firms' expected business conditions after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 22 two-digit industries. The effects are estimated relative to the baseline period before January 22. Firms are grouped according to their dependency on important intermediates from abroad prior to the crisis. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds. For the corresponding estimates, see Appendix Table B2.

What is more, the result also holds for the subset of firms that depend on important intermediates from China specifically (see Appendix Figure B3). Hence, firms failed to anticipate negative effects of the pandemic before it had reached Europe, even if they could have learned about them from their suppliers.

In early March, the expectations of import-dependent firms suffered a slightly stronger decline that is only close to significance (*t*-statistic: 1.56). With increasing restrictions in Italy, expectations of firms depending on Italian intermediates started to drop approximately one week ahead of those of other firms (see Appendix Figure B3). No difference remained from mid-March onwards.

Finally, import-dependent firms did not face a higher level of uncertainty throughout the first months of the pandemic although trade restrictions were implemented in the wake of the pandemic (see Figure B2 in the Appendix).

A similar picture arises when using exports as a measure of firms' trade integration—and the potential ability to learn from their buyers. In a first step, we estimate the average dynamics of business expectations and uncertainty for firms with a *firm specific* export share above and below the export exposure of the median firm. The results displayed in Appendix Figure B4 show that

the developments of business expectations and uncertainty do not differ at all between firms in both groups. The same picture emerges when accounting specifically for exports to China. Here, there is no firm-level information available, so that we compute the ratio of the export value to China to total revenues at the 4-digit industry level.[17] The results, shown in Appendix Figure B5, suggest that a higher export exposure to China did not help firms to be informed about the potential effects of the pandemic on their businesses either: Business expectations and uncertainty in industries with high and low exposure to China develop mostly in parallel. If anything, firms with *low* exposure to Chinese exports display *higher* uncertainty following the times after the Hubei lockdown, but this difference is not statistically significant.

Overall, the findings suggest that German firms failed to anticipate the crisis until the pandemic reached their domestic market, even if they had the opportunity to learn from their trade partners, being it their suppliers or their customers.

Firm Size One reason for our finding thus far—that the looming pandemic was only affecting firms' business outlook when it reached the domestic market—may be that our sample comprises mostly of small firms, for which only domestic developments matter and which generally do not have the capacity to process the effects of international developments on their businesses. To evaluate this hypothesis, we test whether small and large firms differ in when they expected the potential effects of COVID-19 (and the corresponding policy measures) on their businesses. To this end, we estimate the dynamics of business expectations and uncertainty separately for small firms (firms with less than 40 employees, the median), medium-sized firms (firms with weakly more than 40 and less than 419 employees, the 90th percentile) and large firms (with weakly more than 419 employees). The results in Figure 5 indicate that large firms might have been concerned about the potential effects of COVID-19 on their businesses earlier: Their expectations are slightly more pessimistic and their uncertainty is slightly larger compared to small and medium-sized firms already after the imposed curfew in the Chinese Hubei province on February 16th. This is consistent with Hassan et al. (2020) who show that concerns about COVID-19 emerged in earnings calls of listed firms starting in February 2020.

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[17]Both the industry-specific export values and revenues are obtained from the German Statistical Office.

Figure 5: Role of Firm Size for Business Expectations and Uncertainty
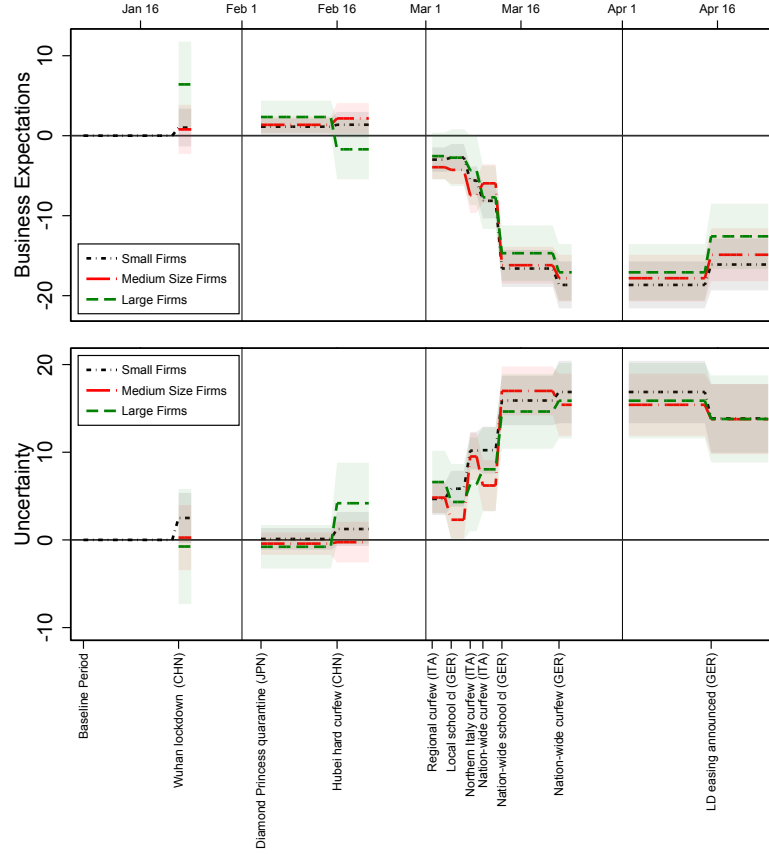
Notes: The solid lines show the effect of COVID-19-related policy measures on firms' business uncertainty after controlling for the local spread interacted with month dummies and fixed effects at the levels of counties and 70 two-digit industries. The effects are estimated relative to the baseline period before January 22 for three groups according to firm size. "Small Firms" employ less than the median number of 40 employees; "Large Firms" employ more than the 90th percentile of 419 employees; the remaining are depicted as "Medium Size Firms". The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

4. Discussion: News about Policy Measures vs. Concurrent Developments

The results presented above demonstrate that German firms were unexpectedly hit by the COVID-19 pandemic when it reached their domestic market. The results also showed that the additional effect of the local spread of COVID-19 on a firm's county on business perceptions was relatively small. However, it is impossible to clearly identify whether the policy measures affected expectations directly or indirectly given the simultaneity of a multitude of events. In this section, we discuss the role of several potential information sources regarding the pandemic that might have affected the changes in firms' perceptions.

Figure 6: Concurrent Events during the COVID-19 Pandemic in Germany
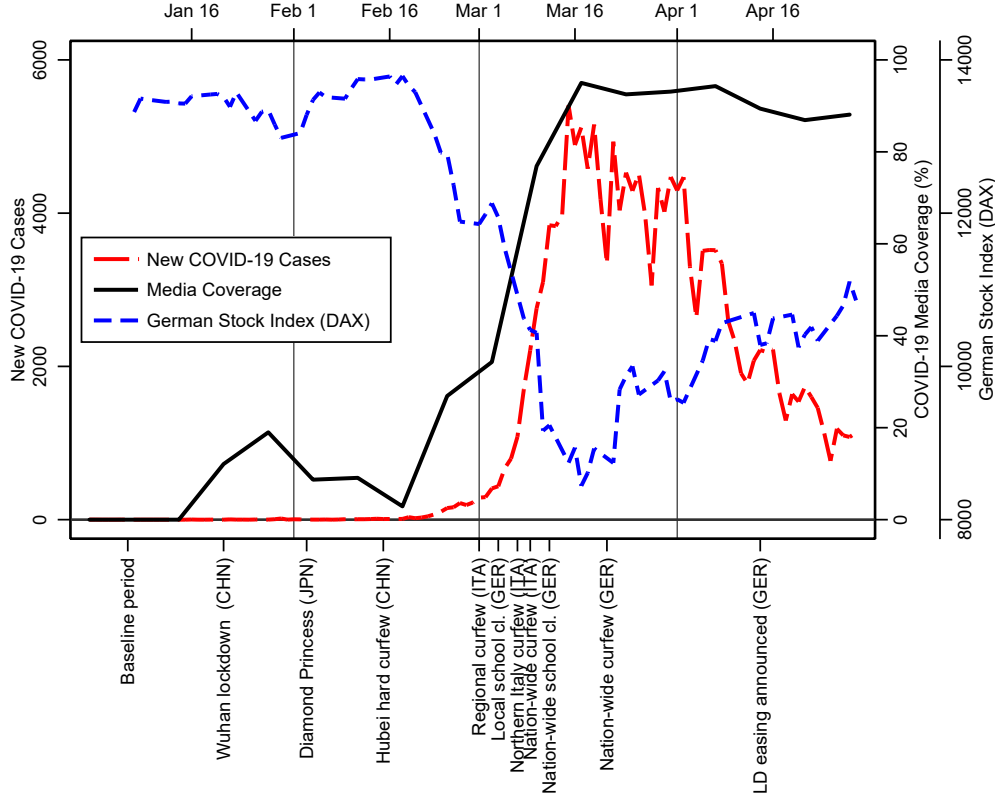
Notes: The dashed red line displays the number of daily COVID-19 infections in Germany over time as provided by the Robert Koch Institute (left axis). The solid black line depicts the share of COVID-19-related news relative to the total broadcasting time of six German news broadcasts as documented in Weiss et al. (2020) and described in Footnote 18 (right axis). The dashed blue line depicts the development of the main German stock market index (DAX; right axis).

Overall Infections in Germany In principle, the estimated effect of domestic policy measures could be fully driven by the contemporaneous increase in the number of COVID-19 infections in Germany. As shown in Figure 6, the number of new infections exponentially increased during the first two weeks of March reaching a maximum of more than 5,000 daily cases on March 16. During the subsequent curfew, the number of infections steadily decreased and reached a level of approximately 1,000 daily cases by the end of April. This dynamic of infections is in line with deteriorating business perceptions and increasing uncertainty in the first weeks of March documented in Figure 1. However, business perceptions further deteriorated after the nation-wide curfew announced on March 22, even though the number of infections was already decreasing at this point in time. A horse-race between the time intervals following policy events and the total number of infections in Columns 2, 6, and 10 in Appendix Table B3 further shows that the number

of infections does not have any additional explanatory power for firms' business perceptions and uncertainty. In turn, the estimated effects of the policy events are largely unaffected, although they are less precisely estimated given the strong correlation between infections and the timing of policy events. This suggests—but is no hard proof—that firms' business perceptions reacted more strongly due to potential economic consequences associated with the policy measures than to the number of infections *per se*.

Media Coverage A related question is how the development of firms' perceptions corresponds to the coverage of COVID-19-related news in German media. Even though media coverage is highly endogenous to the pandemic situation, this comparison provides an indication for whether firms responded relatively early or late compared to information generally available in the media. Figure 6 shows that COVID-19-related topics already made up a substantial share of 10 to 20% of overall broadcasting time of the main German news broadcasts in late-January and early-February without any detectable effect on firms' business perceptions and uncertainty—even among firms that were more exposed to Asia via international trade links as shown in Figure 4 and Appendix Figures B3, B4, and B5.[18] During the four weeks between mid-February and mid-March when COVID-19 increasingly spread in Italy and (with some delay) in Germany, COVID-19-related news gradually pushed all other issues out of the news. Hence, the increase in media coverage, if anything, appears to have taken place *earlier* than the deterioration of firms' business perceptions and uncertainty that showed the largest drop following the school closure announced on March 13.

Having in mind that horse-race regressions between highly correlated variables can only be interpreted cautiously, Columns 3, 7, and 11 in Appendix Table B3 show the results of regressing firms' perceptions on both the policy intervals and COVID-19-related news coverage. For the case of current business conditions, media coverage has a statistically significant negative coefficient ($p < 0.1$). What is more, though, there are still significant drops in perceived business conditions and expectations and jumps in uncertainty after the school closures on March 13 and stays significantly negative after the start of the nation-wide lockdown on March 22 ($p < 0.1$). In combination with the dynamics of news coverage in Figure 6, this thus suggests that firms reacted later to the

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[18] The data on media coverage are obtained from Weiss et al. (2020) and measure the weekly average of the share of COVID-19-related news relative to the total broadcasting time (excl. opener, weather forecast, and end titles) of the six German news broadcasts with highest average viewer levels (*Tagesschau 20 Uhr*, *heute 19 Uhr*, *RTL aktuell*, *Sat.1 Nachrichten*, *Tagesthemen*, and *heute journal*) excluding special news broadcasts on COVID-19.

pandemic than the news coverage.

Stock Market Developments   Given that stock prices reflect equilibrium expectations of financial market participants about the future development of the German economy at each point in time, comparing the developments of firms' expectations and the German stock market provides indication for whether German firms anticipated the adverse effects of the crisis earlier or later than the market. Figure 6 shows that the DAX—the most important German stock market index—dropped by 39 percentage points between February 17 and March 18. The two largest drops of the DAX occured on March 9 and 12 when the Italian curfew and the German school closures effective at the subsequent day were announced, respectively. While these drops in the stock market coincide with the development of firms' expectations and uncertainty, the cumulative drop in the DAX of more than 15 percentage points between February 17 and March 6 (a Friday), that is of equal size as the cumulative drop between March 9 and 12, is hardly reflected in firms' expectations and uncertainty. Moreover, the announcement of the nation-wide curfew for Germany on March 22 affected firms' business outlook, but had no discernible effect on stock prices. This suggests that firms were recognizing the severe consequences of the COVID-19 pandemic on their businesses later than stock market participants.

A similar picture arises from the horse-race regressions reported in Appendix Table B3. Given that stock prices primarily reflect market-expectations it is not surprising that variation in stock prices are strongly correlated with business expectations (Column 8), while only explaining little variation in current business conditions over and above the timing of policy events (Column 4). By construction, the coefficients with respect to the time intervals reflect the residual variation in firms' expectations after controlling for the information embodied in stock prices. In the case of business expectations, these coefficients are significantly positive during the time intervals between the regional curfew in Northern Italy on March 1 and when schools were closed in Germany on March 13. Hence, firms' expectations were relatively more optimistic than they would have been if they followed the same path as stock prices. Following the nation-wide school closure on March 13, this gap turns insignificant suggesting that firms' expectations and the expectations of the stock market were more strongly aligned.

Taken together, these observations suggest that German firms were very late in recognizing

the severe consequences of the COVID-19 pandemic on their businesses. Although the pandemic was already dominating the news and stock prices had already started to drop, firms' perceptions plummeted upon the announcement—and not in anticipation—of strict policy measures that were taken in light of the skyrocketing number of infections in mid-March. In consequence, firms were left with very little time to prepare for the lockdown.

5. Conclusion

Based on a large and representative survey of German firms, this paper examines the point in time when firms became aware of the adverse economic implications of the COVID-19 pandemic. We show that firms were unexpectedly hit by the COVID-19 pandemic when it reached Europe, leaving firms with little time to prepare for the lockdown. While large firms display small reactions to the spread of the pandemic in Asia, business outlooks in general only began to worsen in March, when Italy imposed its first regional curfew and first schools were closed in Germany. Once the crisis reached their domestic market, firms' business outlook uniformly and rapidly deteriorated across March, with the strongest plunge occurring after the German government had announced a nation-wide school closure on March 13. Both business conditions and business expectations then stabilized on historically low levels in April.

Other channels through which the COVID-19 pandemic may affect firms' business outlook play a minor role. While the spread of COVID-19 infections in a firms' county exhibits a negative effect on firms' business outlook, the magnitude of effects is by far smaller than that of timing effects. Also, whether firms are exposed to trade via import or output linkages—particularly to and from China or Italy, the countries that were most prevalent in the news before the crisis reached the domestic market—has only limited explanatory power for business expectations and uncertainty.

References

ALTIG, D., S. R. BAKER, J. M. BARRERO, N. BLOOM, P. BUNN, S. CHEN, S. J. DAVIS, J. LEATHER, B. H. MEYER, E. MIHAYLOV, P. MIZEN, N. B. PARKER, T. RENAULT, P. SMIETANKA, AND G. THWAITES (2020): "Economic Uncertainty Before and During the COVID-19 Pandemic," *Journal of Public Economics.*

BACHMANN, R., B. BORN, S. ELSTNER, AND C. GRIMME (2019): "Time-Varying Business Volatility and the Price Setting of Firms," *Journal of Monetary Economics*, 101, 82–99.

BACHMANN, R., S. ELSTNER, AND E. R. SIMS (2013): "Uncertainty and Economic Activity: Evidence from Business Survey Data," *American Economic Journal: Macroeconomics*, 5, 217–49.

BALDUZZI, P., E. BRANCATI, M. BRIANTI, AND F. SCHIANTARELLI (2020): "The Economic Effects of COVID-19 and Credit Constraints: Evidence from Italian Firms' Expectations and Plans," *IZA Discussion Paper No. 13629.*

BALLEER, A., S. LINK, M. MENKHOFF, AND P. ZORN (2020): "Demand or Supply? Price Adjustment during the Covid-19 Pandemic," *CEPR Discussion Paper 14907.*

BARTIK, A. W., M. BERTRAND, Z. CULLEN, E. L. GLAESER, M. LUCA, AND C. STANTON (2020): "The Impact of COVID-19 on Small Business Outcomes and Expectations," *Proceedings of the National Academy of Sciences*, 117, 17656–17666.

BUCHHEIM, L., C. KROLAGE, J. DOVERN, AND S. LINK (2020): "Firm-level Expectations and Behavior in Response to the COVID-19 Crisis," *CESifo Working Paper 8304.*

CASTRIOTA, S., M. DELMASTRO, AND M. TONIN (2020): "National or Local? The Demand for News in Italy during COVID-19," *CESifo Working Paper No. 8699.*

CAVALLO, A., G. CRUCES, AND R. PEREZ-TRUGLIA (2017): "Inflation Expectations, Learning, and Supermarket Prices: Evidence from Survey Experiments," *American Economic Journal: Macroeconomics*, 9, 1–35.

CHIANG, Y.-M., D. HIRSHLEIFER, Y. QIAN, AND A. E. SHERMAN (2011): "Do Investors Learn from Experience? Evidence from Frequent IPO Investors," *The Review of Financial Studies*, 24, 1560–1589.

EHRMANN, M. AND P. TZAMOURANI (2012): "Memories of High Inflation," *European Journal of Political Economy*, 28, 174–191.

ENDERS, Z., F. HÜNNEKES, AND G. J. MÜLLER (2019): "Monetary Policy Announcements and Expectations: Evidence from German Firms," *Journal of Monetary Economics*, 108, 45–63.

ENDERS, Z., M. KLEEMANN, AND G. J. MÜLLER (2020): "Growth Expectations, Undue Optimism, and Short-run Fluctuations," *Review of Economics and Statistics*.

FETZER, T., L. HENSEL, J. HERMLE, AND C. ROTH (2020): "Coronavirus Perceptions and Economic Anxiety," *Review of Economics and Statistics*.

GIGLIO, S., M. MAGGIORI, J. STROEBEL, AND S. UTKUS (2021): "The Joint Dynamics of Investor Beliefs and Trading During the COVID-19 Crash," *Proceedings of the National Academy of Sciences*, 118.

GREENWOOD, R. AND S. NAGEL (2009): "Inexperienced Investors and Bubbles," *Journal of Financial Economics*, 93, 239–258.

HASSAN, T. A., S. HOLLANDER, L. VAN LENT, AND A. TAHOUN (2020): "Firm-Level Exposure to Epidemic Diseases: COVID-19, SARS, and H1N1," *NBER Working Paper 26971*.

HUBER, K. (2018): "Disentangling the Effects of a Banking Crisis: Evidence from German Firms and Counties," *American Economic Review*, 108, 868–898.

IBS-BAU (2020): *Ifo Business Survey Construction 1/1991 - 6/2020*, LMU-ifo Economics & Business Data Center, Munich, doi: 10.7805/ebdc-ibs-con-2020a.

IBS-IND (2020): *Ifo Business Survey Industry 1/1980 - 6/2020*, LMU-ifo Economics & Business Data Center, Munich, doi: 10.7805/ebdc-ibs-ind-2020a.

IBS-SERV (2020): *Ifo Business Survey Service Sector 10/2004 - 6/2020*, LMU-ifo Economics & Business Data Center, Munich, doi: 10.7805/ebdc-ibs-serv-2020a.

IBS-TRA (2020): *Ifo Business Survey Trade 1/1990 - 6/2020*, LMU-ifo Economics & Business Data Center, Munich, doi: 10.7805/ebdc-ibs-tra-2020a.

KAUSTIA, M. AND S. KNÜPFER (2008): "Do Investors Overweight Personal Experience? Evidence from IPO Subscriptions," *The Journal of Finance*, 63, 2679–2702.

KUCHLER, T. AND B. ZAFAR (2019): "Personal Experiences and Expectations about Aggregate Outcomes," *Journal of Finance*, 74, 2491–2542.

LEHMANN, R. (2020): "The Forecasting Power of the ifo Business Survey," *CESifo Working Paper No. 8291.*

LEHMANN, R. AND M. REIF (2020): "Tracking and Predicting the German Economy: ifo vs. PMI," *CESifo Working Paper No. 8145.*

LINK, S. (2019): "The Price and Employment Response of Firms to the Introduction of Minimum Wages," *CESifo Working Paper No. 7575.*

——— (2020): "Harmonization of the ifo Business Survey's Micro Data," *Journal of Economics and Statistics*, 240, 543–555.

MALMENDIER, U. AND S. NAGEL (2016): "Learning from Inflation Experiences," *Quarterly Journal of Economics*, 131, 53–87.

MALMENDIER, U., S. NAGEL, AND Z. YAN (2021): "The Making of Hawks and Doves," *Journal of Monetary Economics*, 117, 19–42.

SAUER, S. AND K. WOHLRABE (2019): "CEO or Intern – Who Actually Answers the Questionnaires in the ifo Business Survey?" *CESifo Forum*, 20, 29–31.

——— (2020): "ifo Handbuch der Konjunkturumfragen," *ifo Beiträge zur Wirtschaftsforschung.*

WEISS, H.-J., M. WAGNER, AND T. MAURER (2020): "Aktuelle Fernsehberichterstattung über die Corona-Krise," *Media Perspektiven 10-11/2020*, 591–598.

Appendix

A. Descriptive Statistics

Table A1: Summary Statistics

|	Min	Max	Overall Mean	SD	January Mean	SD	February Mean	SD	March Mean	SD	April Mean	SD
Business Conditions	0	100	47.55	23.94	52.68	21.44	53.74	21.09	47.35	23.00	36.64	25.92
Business Expectations	0	100	44.21	20.50	49.92	16.84	51.44	17.36	40.78	21.00	34.98	21.68
Business Uncertainty	0	100	62.56	25.02	55.64	22.48	55.12	23.10	65.42	25.29	73.70	24.24
ln(COVID-19 Cases in County)	0	8.59	1.89	2.58	0	0	0.06	0.28	1.60	1.65	5.84	1.08
ln(Employees)			3.96	1.76								
Dependency on Imports	0	1	0.57	0.49								
Dependency on Imports from Italy	0	1	0.32	0.47								
Dependency on Imports from China	0	1	0.32	0.47								
Expected COVID-19 Revenue Effect	-1	3	-0.20	0.21								
Observations	19,273				4,746		4,776		4,884		4,867	

Notes: This Table shows summary statistics of the IBS waves January through April 2020 that are used in our analyses. The data on the number of COVID-19 cases in each firm's county at the date of the survey response are obtained from the Robert Koch Institute. The *Expected COVID-19 Revenue Effect* and the different dummies on dependency on imports (manufacturing firms, only) are elicited in special IBS questions in April 2020. The wording of all IBS questions is listed in Appendix C.

Table A2: Expected Revenue Effect in 2020 due to COVID-19 Pandemic by Sector

|	Expected COVID-19 Revenue Effect		
	Mean	Median	SD
Manufacturing	-0.185	-0.15	0.180
Services	-0.244	-0.20	0.244
Retail/Wholesale	-0.195	-0.20	0.202
Construction	-0.109	-0.10	0.114

Notes: This Table presents summary statistics of the expected effect of the COVID-19 pandemic on firms' revenues in 2020 that is elicited in a special IBS question in April 2020. The wording of the survey question is listed in Appendix C.

Figure A1: Relationship b/w Mean Business Conditions and Output in Administrative Data

ρ=0.91
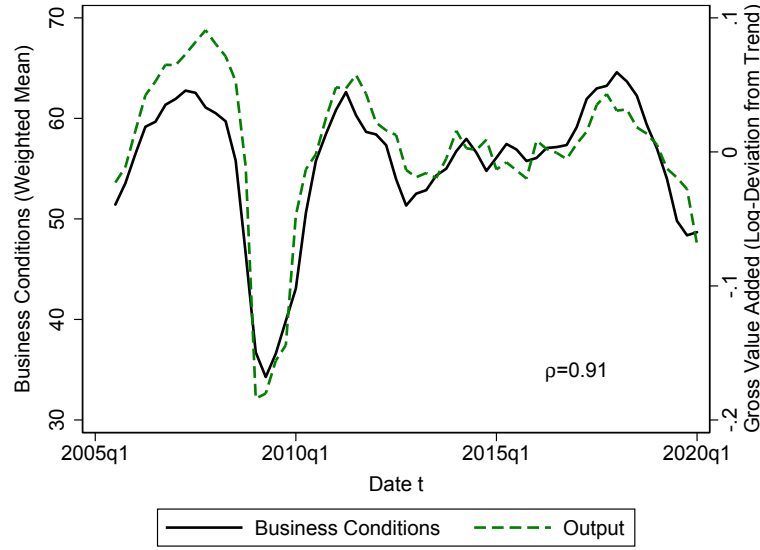
Notes: This figure displays the relationship between current business conditions of manufacturing firms as reported to the IBS on the quantitative scale between "[0] bad" and "[100] good" (black solid line, left axis) and gross value added in the manufacturing sector obtained from the German Federal Statistical Office (red dashed line, right axis). The IBS data are deseasonalized using month fixed effects at the two-digit industry level and aggregated to the level of the manufacturing sector by means of the same (firm and industry) weights that are used by the ifo Institute to calculate the ifo Business Climate Index. Then, the series of aggregate business conditions is transferred to quarterly frequency by taking means over the respective months. The quarterly output series is detrended using a HP-filter with $\lambda = 1600$.

Figure A2: Relationship b/w Expected and Realized Business Conditions
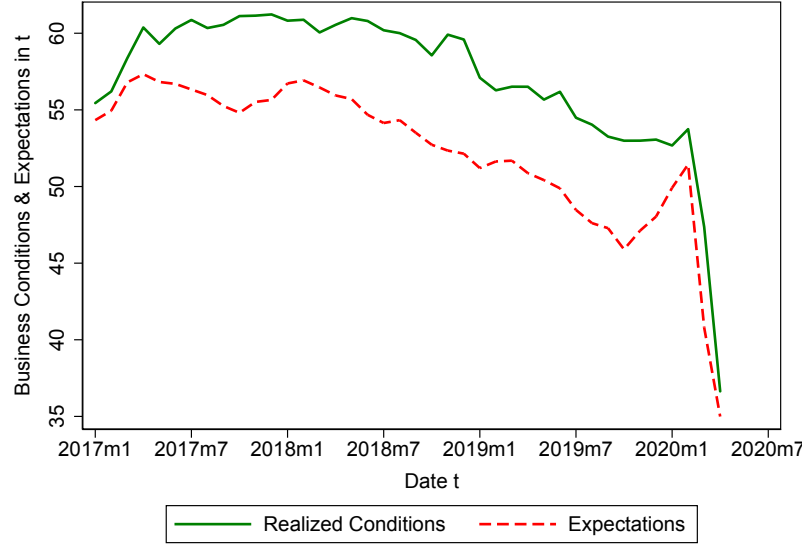
(a) Full Sample: 2017-
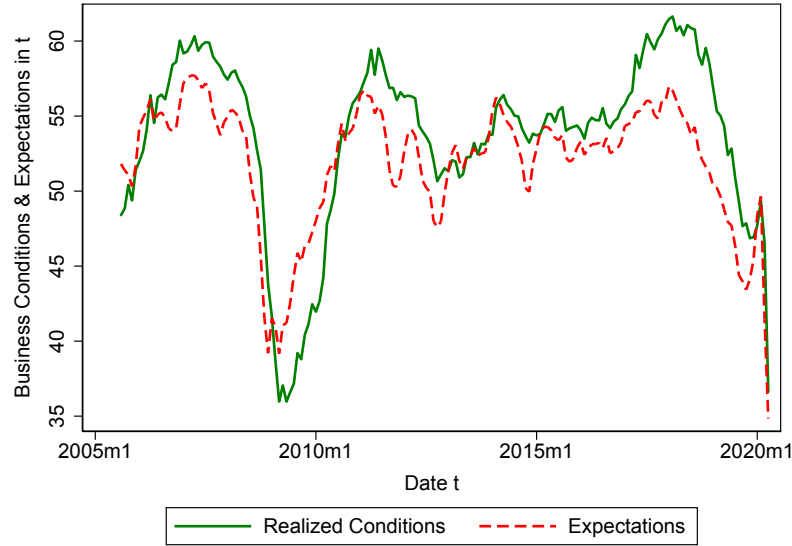
(b) Manufacturing Sample: 2005-

Notes: Panel (a) plots the time series of average expected business conditions for the next six months against average realized business conditions for the entire sample. The highest cross-correlation is between both series is at the third lead of expectations ($\rho = 0.96$). Panel (b) plots average expected and realized business conditions for the subset of manufacturing firms, for which these survey questions measure are already available from 2005 onward. The highest cross-correlation is between both series is at the third lead of expectations ($\rho = 0.93$).

Figure A3: Firm-Level Change in Business Conditions b/w 2020:M01 and M04 Vs. Expected Revenue Effect in 2020 due to COVID-19 Pandemic (as of 2020:M04)
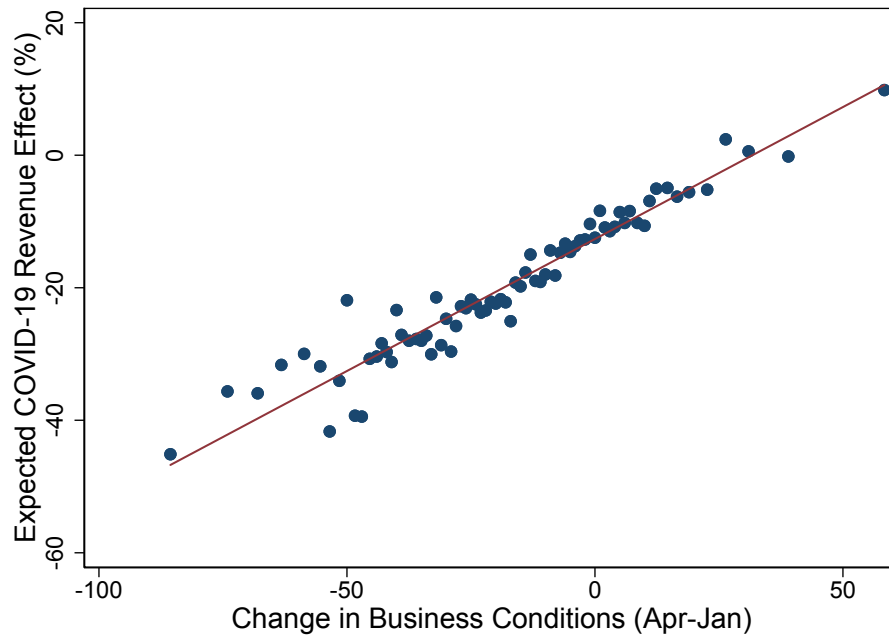
(a) Change in Business Conditions (Jan-Apr)

Notes: This Figure displays a the percentile averages of the firm-level change in business conditions between January and April 2020 against the percentile average of the expected effect of the COVID-19 pandemic on revenues in the year 2020 as elicited in April 2020 wave of the IBS.

B. Supplementary Tables and Figures

Table B1: Main Specification: Choice of Dimension of Fixed Effects

|	Business Conditions		Business Expectations		Business Uncertainty	
	(1)	(2)	(3)	(4)	(5)	(6)
Time indicators (baseline period: Jan 1 - Jan 21)						
Wuhan lockdown (CHN)	0.26	1.31	1.53	1.86*	1.30	-0.05
	(1.22)	(0.98)	(1.07)	(1.04)	(1.30)	(1.16)
Diamond Princess quarantine (JPN)	0.97**	1.05***	1.38***	1.61***	-0.22	-0.28
	(0.48)	(0.33)	(0.42)	(0.35)	(0.51)	(0.39)
Hubei hard curfew (CHN)	0.58	1.42**	1.40*	1.00	0.86	0.30
	(0.81)	(0.62)	(0.72)	(0.66)	(0.87)	(0.74)
Regional curfew (ITA)	-2.00***	-1.91***	-3.38***	-2.97***	4.99***	4.57***
	(0.71)	(0.51)	(0.62)	(0.54)	(0.76)	(0.60)
Local school cl (GER)	-0.90	-1.80***	-3.37***	-3.60***	4.21***	4.89***
	(0.82)	(0.59)	(0.72)	(0.63)	(0.88)	(0.70)
Northern Italy curfew (ITA)	-2.28**	-1.72**	-6.04***	-5.99***	9.55***	9.60***
	(0.96)	(0.69)	(0.85)	(0.73)	(1.02)	(0.82)
Nation-wide curfew (ITA)	-4.45***	-2.87***	-7.32***	-6.05***	8.41***	7.83***
	(1.12)	(0.83)	(0.99)	(0.87)	(1.20)	(0.97)
Nation-wide school cl (GER)	-8.19***	-7.86***	-16.22***	-15.76***	16.19***	14.58***
	(1.33)	(0.96)	(1.18)	(1.01)	(1.43)	(1.13)
Nation-wide curfew (GER)	-11.97***	-12.97***	-18.34***	-18.14***	16.06***	18.20***
	(1.96)	(1.36)	(1.72)	(1.44)	(2.09)	(1.60)
LD easing announced (GER)	-11.22***	-11.75***	-15.43***	-16.07***	13.73***	15.55***
	(2.11)	(1.48)	(1.85)	(1.57)	(2.25)	(1.75)
ln(Covid Cases County) $\times$ $1(t \in$ 04 Feb, 21 Feb)	1.78	1.45	1.85	1.27	-1.95	-1.56
	(1.44)	(1.00)	(1.27)	(1.05)	(1.54)	(1.18)
ln(Covid Cases County) $\times$ $1(t \in$ 03 Mar, 21 Mar)	-0.75**	-0.76***	-0.73**	-0.93***	0.66*	0.76***
	(0.33)	(0.23)	(0.29)	(0.24)	(0.35)	(0.27)
ln(Covid Cases County) $\times$ $1(t \in$ 22 Mar, 23 Apr)	-0.76**	-0.61***	0.39	0.45*	0.48	0.08
	(0.33)	(0.23)	(0.29)	(0.24)	(0.35)	(0.27)
ln(Employees)	0.81***	2.63**	0.26***	0.92	0.53***	2.67**
	(0.11)	(1.14)	(0.10)	(1.21)	(0.12)	(1.36)
Constant	49.39***	42.04***	48.84***	46.10***	53.43***	45.11***
	(0.54)	(4.56)	(0.48)	(4.83)	(0.58)	(5.41)
Observations	17938	17442	17959	17460	17960	17467
R^2	0.259	0.764	0.218	0.640	0.231	0.702
County FE	yes	no	yes	no	yes	no
Industry FE (2 digit)	yes	no	yes	no	yes	no
Firm FE	no	yes	no	yes	no	yes

Notes: This table summarizes the effect of COVID-19 on firms' business conditions, business expectations, and business uncertainty which are elicited on a visual analogue scale between 0 and 100. The period indicators are defined in Table 1. Data on the county-level counts of COVID-19 cases are received from the Robert Koch Institute and interacted with dummies for different phases of the pandemic. Further controls include the log number of employees and fixed effects at the levels of counties and 70 two-digit industries (odd columns) or firm fixed effects (even columns). Robust standard errors in parantheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Figure B1: Effect of COVID-19 on Uncertainty: Positively Affected Firms
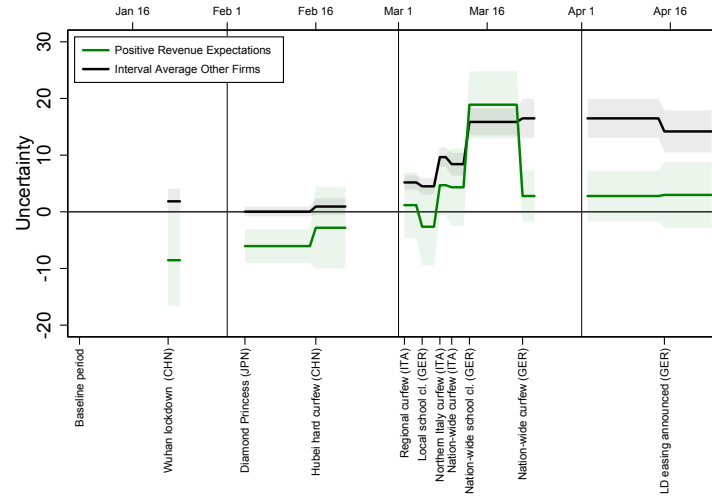
Notes: The solid lines show the effect of COVID-19-related policy measures on firms' business uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 70 two-digit industries. The effects are estimated relative to the baseline period before January 22 for two groups: firms that report in April 2020 to expect a positive effect of the COVID-19 crisis on their total revenues in 2020 (4.9% of all firms) and all other firms. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

Table B2: Manufacturing Firms: Results by International Trade Links

	Business Conditions		Business Expectations		Business Uncertainty	
	(1)	(2)	(3)	(4)	(5)	(6)
Time indicators (baseline period: Jan 1 - Jan 21):						
Wuhan lockdown (CHN)	2.51	18.33***	4.35	1.82	0.52	-2.52
	(3.16)	(6.18)	(2.80)	(5.50)	(3.27)	(6.24)
Diamond Princess quarantine (JPN)	1.86**	2.67**	1.30**	0.73	-0.98	-1.00
	(0.73)	(1.13)	(0.65)	(1.01)	(0.74)	(1.15)
Hubei hard curfew (CHN)	-0.37	0.82	0.52	0.06	2.31	2.29
	(1.80)	(2.90)	(1.59)	(2.58)	(1.83)	(2.93)
Regional curfew (ITA)	-0.24	-0.97	-2.84***	-3.22**	4.28***	3.27**
	(0.96)	(1.46)	(0.85)	(1.30)	(0.97)	(1.48)
Local school closure (GER)	1.60	2.70	-3.58***	-2.86*	3.22**	3.68*
	(1.28)	(1.88)	(1.14)	(1.67)	(1.30)	(1.90)
Northern Italy curfew (ITA)	-1.45	-0.69	-7.54***	-5.59*	5.68**	8.02**
	(2.23)	(3.28)	(1.98)	(2.92)	(2.28)	(3.32)
Nation-wide curfew (ITA)	-3.34	-1.99	-6.27***	-7.58***	5.80***	6.34**
	(2.07)	(3.03)	(1.84)	(2.70)	(2.10)	(3.06)
Nation-wide school closure (GER)	-3.50	-1.97	-14.03***	-14.55***	10.75***	10.41***
	(2.20)	(2.73)	(1.96)	(2.43)	(2.25)	(2.76)
Nation-wide curfew (GER)	-10.54***	-12.49***	-16.12***	-17.47***	16.99***	18.91***
	(3.57)	(3.77)	(3.17)	(3.36)	(3.62)	(3.80)
Lockdown easing announcement (GER)	-12.17***	-12.59***	-12.99***	-16.45***	15.52***	15.88***
	(3.86)	(4.12)	(3.43)	(3.68)	(3.92)	(4.16)
1(Dependency on imported intermediates)		-0.72		-1.20		2.54**
		(1.12)		(1.00)		(1.14)
Interaction effects: time indicators for firms depending on imported intermediates:						
Wuhan lockdown (CHN) × 1(Dep. imports)		-25.98***		2.23		4.00
		(7.74)		(6.89)		(7.95)
Diamond Pr. (JPN) × 1(Dep. imports)		-0.97		1.10		0.58
		(1.54)		(1.37)		(1.56)
Hubei curfew (CHN) × 1(Dep. imports)		-3.74		1.35		0.17
		(3.97)		(3.53)		(4.04)
Reg. curfew (ITA) × 1(Dep. imports)		1.50		0.89		1.46
		(1.91)		(1.70)		(1.93)
Local school cl. (GER) × 1(Dep. imports)		-1.99		-2.15		0.25
		(2.59)		(2.31)		(2.62)
Northern ITA curfew × 1(Dep. imports)		-5.03		-6.24		-0.60
		(4.48)		(3.98)		(4.52)
Nation-wide curfew (ITA) × 1(Dep. imports)		-3.75		0.97		-1.05
		(3.98)		(3.55)		(4.02)
Nation-wide school cl. (GER) × 1(Dep. imports)		-6.22**		0.36		4.52*
		(2.68)		(2.38)		(2.73)
Nation-wide curfew (GER) × 1(Dep. imports)		0.43		-0.22		0.03
		(1.54)		(1.37)		(1.56)
LD easing announcement (GER) × 1(Dep. imports)		-2.75		3.77*		4.31*
		(2.44)		(2.18)		(2.48)
Local spread of COVID-19:						
ln(COVID cases county) × $1(t \in 04$ Feb, 21 Feb$)$	4.69*	4.89*	1.55	2.33	2.86	0.83
	(2.71)	(2.95)	(2.40)	(2.62)	(2.75)	(2.98)
ln(COVID cases county) × $1(t \in 03$ Mar, 21 Mar$)$	-0.16	0.40	-0.70	-0.46	0.90	0.63
	(0.59)	(0.63)	(0.52)	(0.56)	(0.60)	(0.64)
ln(COVID cases county) × $1(t \in 22$ Mar, 23 Apr$)$	-0.01	0.31	0.35	0.62	-0.24	-0.62
	(0.62)	(0.64)	(0.55)	(0.57)	(0.63)	(0.64)
ln(Employees)	0.17	0.28	0.16	0.23	0.54***	0.42*
	(0.19)	(0.21)	(0.17)	(0.19)	(0.19)	(0.22)
Constant	46.73***	46.53***	47.48***	47.65***	59.82***	59.36***
	(1.05)	(1.26)	(0.93)	(1.12)	(1.07)	(1.28)
Observations	6,457	5,849	6,449	5,841	6,432	5,833
R^2	0.238	0.258	0.256	0.268	0.261	0.279
County FE	yes	yes	yes	yes	yes	yes
Industry FE (2 digit)	yes	yes	yes	yes	yes	yes
Sample of Firms	Manuf.	Manuf.	Manuf.	Manuf.	Manuf.	Manuf.

Notes: This table summarizes the effect of COVID-19 on manufacturing firms' business conditions, business expectations, and business uncertainty which are elicited on a visual analogue scale between 0 and 100. The period indicators are defined in Table 1. In Columns (2), (4), and (6) the period indicators are interacted with an indicator that equals one if the a firm reported to have been depending on imports of important intermediaries before the pandemic. Data on the county-level counts of COVID-19 cases are received from the Robert Koch Institute and interacted with dummies for different phases of the pandemic. Further controls include the log number of employees and fixed effects at the levels of counties and 70 two-digit industries. Robust standard errors in parantheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

Figure B2: COVID-19 Effect on Uncertainty: Role of Dependency on Imported Intermediates
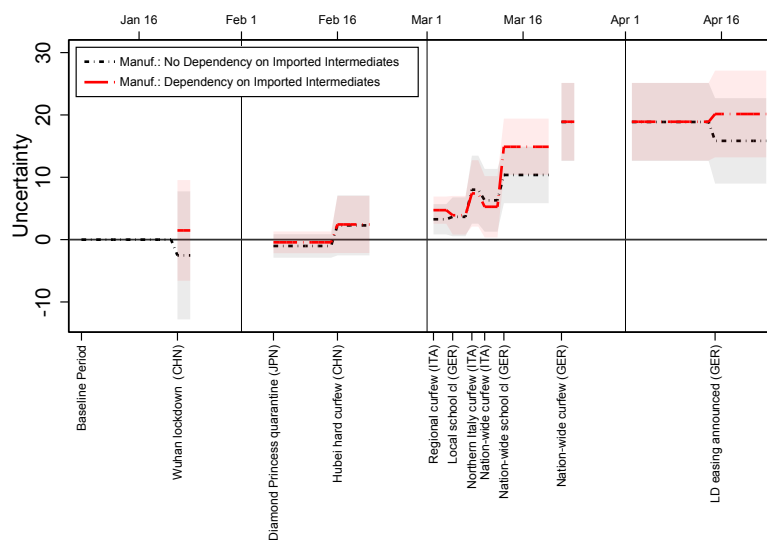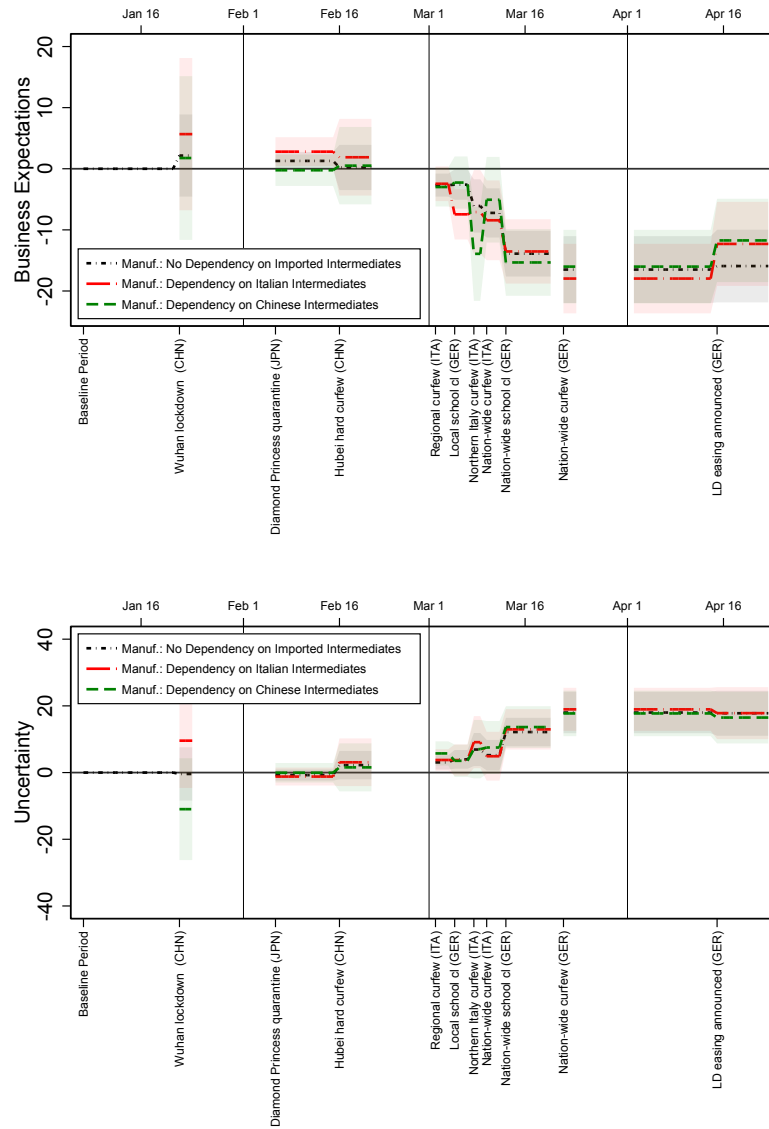

Notes: The solid lines show the effect of COVID-19-related policy measures on manufacturing firms' business uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 22 two-digit industries. The effects are estimated relative to the baseline period before January 22. Firms are grouped according to their dependency on important intermediates from abroad prior to the crisis. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds. The estimates refer to Appendix Table B2.

Figure B3: COVID-19 Effect on Expectations and Uncertainty: Role of Dependency on Intermediates from China or Italy

Notes: The solid lines show the effect of COVID-19-related policy measures on manufacturing firms' expected business conditions and uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 22 two-digit industries. The effects are estimated relative to the baseline period before January 22. Firms are grouped according to their dependency on important intermediates from China or Italy prior to the crisis. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

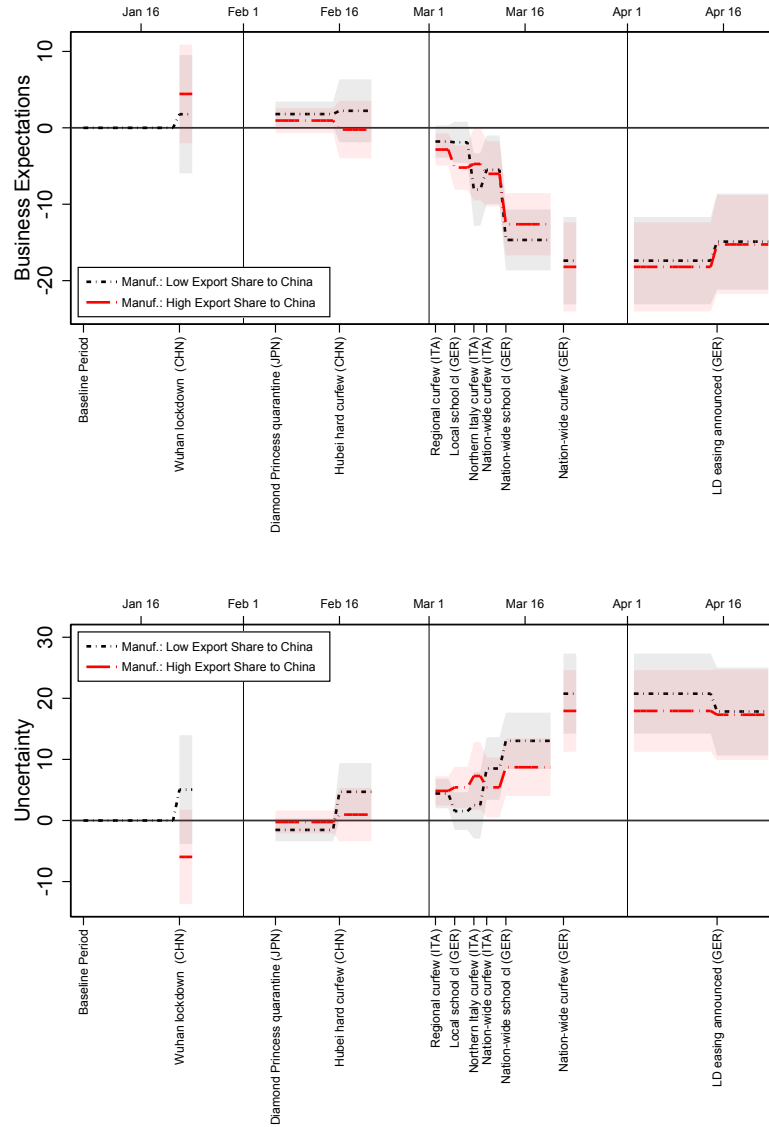Figure B4: Role of Export Share for Business Expectations and Uncertainty
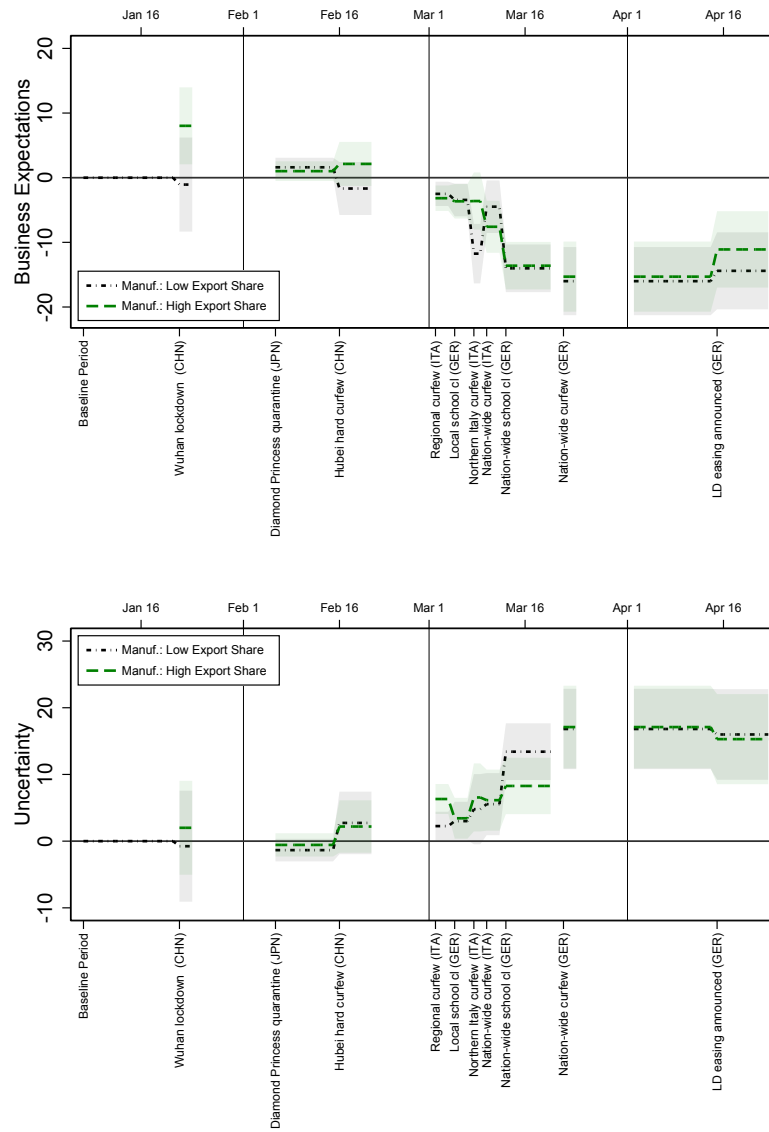
Notes: The solid lines show the effect of COVID-19-related policy measures on manufacturing firms' expected business conditions and uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 22 two-digit industries. The effects are estimated relative to the baseline period before January 22. Firms are grouped according to their export share. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

Figure B5: Role of Industry Export Share to China for Business Expectations and Uncertainty

Notes: The solid lines show the effect of COVID-19-related policy measures on manufacturing firms' business expectations and uncertainty after controlling for the local spread interacted with month dummies, firm size, and fixed effects at the levels of counties and 22 two-digit industries. The effects are estimated relative to the baseline period before January 22. Firms are grouped according to the share of exports to China in their four-digit industry prior to the crisis (median split) obtained from the German Federal Statistical Office. The data gaps correspond to periods that are not covered by the survey. The shaded areas are 90% confidence bounds.

Table B3: Effect of COVID-19 on Business Conditions, Expectations, and Uncertainty: Horse-Races

	Business Conditions				Business Expectations				Business Uncertainty			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Time indicators (baseline period: Jan 1 - Jan 21):												
Wuhan lockdown (CHN)	0.21	0.27	1.18	0.19	1.63	1.53	1.96*	1.28	1.25	1.29	0.42	1.46
	(1.21)	(1.22)	(1.34)	(1.21)	(1.06)	(1.08)	(1.18)	(1.06)	(1.28)	(1.30)	(1.42)	(1.28)
Diamond Princess quarantine (JPN)	1.15**	0.92	1.82***	1.11**	1.54***	1.35***	1.76***	0.95**	-0.42	-0.36	-1.00	-0.07
	(0.47)	(0.57)	(0.62)	(0.48)	(0.41)	(0.51)	(0.54)	(0.42)	(0.50)	(0.61)	(0.66)	(0.51)
Hubei hard curfew (CHN)	0.93	0.69	1.06	0.79	1.54**	1.51**	1.58**	-0.10	0.45	0.68	0.33	1.43
	(0.80)	(0.81)	(0.80)	(0.83)	(0.70)	(0.71)	(0.71)	(0.73)	(0.85)	(0.87)	(0.85)	(0.89)
Regional curfew (ITA)	-2.50***	-3.64	0.46	-2.03*	-3.87***	-4.87**	-2.88*	1.98**	5.44***	5.16*	2.90	1.92
	(0.67)	(2.49)	(1.90)	(1.11)	(0.59)	(2.19)	(1.67)	(0.97)	(0.71)	(2.66)	(2.02)	(1.18)
Local school cl (GER)	-1.49*	-2.68	1.48	-0.91	-4.04***	-4.98**	-3.06*	3.11***	4.90***	4.46	2.35	0.59
	(0.77)	(2.60)	(1.94)	(1.33)	(0.68)	(2.29)	(1.71)	(1.17)	(0.83)	(2.78)	(2.07)	(1.42)
Northern Italy curfew (ITA)	-3.10***	-4.52	3.60	-2.04	-6.87***	-8.11***	-4.64	6.30***	10.30***	10.03***	4.54	2.37
	(0.87)	(2.94)	(4.12)	(2.18)	(0.77)	(2.59)	(3.62)	(1.91)	(0.93)	(3.14)	(4.38)	(2.32)
Nation-wide curfew (ITA)	-5.65***	-7.21**	1.18	-4.44*	-8.63***	-9.86***	-6.35*	6.45***	9.17***	9.17***	3.30	0.12
	(0.97)	(3.29)	(4.22)	(2.49)	(0.86)	(3.70)	(3.70)	(2.18)	(1.04)	(3.52)	(4.49)	(2.64)
Nation-wide school cl (GER)	-10.75***	-12.48***	-2.48	-9.03***	-18.72***	-20.22***	-15.97***	2.76	18.16***	17.98***	11.05**	5.24
	(0.76)	(3.81)	(5.03)	(3.35)	(0.67)	(3.35)	(4.41)	(2.93)	(0.81)	(4.07)	(5.35)	(3.56)
Nation-wide curfew (GER)	-16.38***	-18.25***	-8.04*	-15.24***	-16.06***	-17.77***	-13.29***	-1.80	18.88***	18.38***	11.71**	10.30***
	(0.47)	(4.06)	(4.82)	(2.21)	(0.41)	(3.57)	(4.42)	(1.94)	(0.50)	(4.33)	(5.36)	(2.35)
LD easing announced (GER)	-15.74***	-17.55***	-7.87*	-14.62***	-13.15***	-14.66***	-10.53**	0.82	16.64***	16.19***	9.88*	8.24***
	(0.72)	(3.85)	(4.76)	(2.24)	(0.64)	(3.39)	(4.20)	(1.96)	(0.77)	(4.11)	(5.09)	(2.38)
ln(New COVID-19 cases total)		0.23				0.20				0.05		
		(0.48)				(0.42)				(0.51)		
COVID-19 media coverage			-0.09*				-0.03				0.08	
			(0.05)				(0.05)				(0.06)	
DAX (German Stock Index; in 1000)				0.38				4.71***				-2.83***
				(0.71)				(0.62)				(0.76)
ln(Employees)	0.87***	0.81***	0.87***	0.87***	0.25***	0.26***	0.25***	0.26***	0.52***	0.53***	0.52***	0.52***
	(0.11)	(0.11)	(0.11)	(0.11)	(0.09)	(0.10)	(0.09)	(0.09)	(0.11)	(0.12)	(0.11)	(0.11)
Constant	49.18***	49.39***	49.33***	44.13***	48.87***	48.85***	48.92***	-14.21*	53.49***	53.43***	53.36***	91.44***
	(0.53)	(0.54)	(0.54)	(9.58)	(0.47)	(0.48)	(0.48)	(8.39)	(0.57)	(0.58)	(0.58)	(10.19)
Observations	18306	17938	18306	18306	18328	17959	18328	18328	18329	17960	18329	18329
R^2	0.257	0.258	0.257	0.257	0.216	0.217	0.216	0.218	0.229	0.231	0.229	0.230
County FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Industry FE (2 digit)	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

Notes: This table summarizes the effect of COVID-19 on firms' business conditions, business expectations, and business uncertainty which are elicited on a visual analogue scale between 0 and 100. The period indicators are defined in Table 1. In Columns 2, 6, and 10 we additionally control for the number of daily COVID-19 infections in Germany as provided by the Robert Koch Institute, while we control for the share of COVID-19 related news relative to the total broadcasting time of six German news broadcasts as documented in Weiss et al. (2020) and described in Footnote 18 as well as the development of the DAX—the main German stock market index— in Columns 3, 7, and 11 and Columns 4, 8, and 12, respectively. Further controls include the log number of employees and fixed effects at the levels of counties and 70 two-digit industries. Robust standard errors in parantheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

C. Ifo Business Survey: Survey Instructions

In the paper, we leverage the micro data of the ifo Business Survey (IBS). The IBS is organized in industry-specific sub-surveys covering the sectors manufacturing (IBS-IND, 2020), services (IBS-SERV, 2020), retail/wholesale (IBS-TRA, 2020), and construction (IBS-BAU, 2020). The data can be accessed via the LMU-ifo Economics and Business Data Center onsite the ifo Insitute in Munich.

C.1. Regular Survey Questions from IBS Used in the Paper

We use the following survey questions from the online portion of the regular IBS:

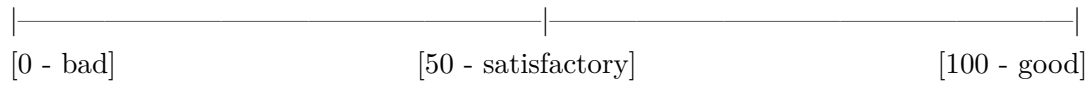**Q1 Business Conditions:** [visual analogue scale][19]

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[19]The respondents choose a number between 0 and 100 by clicking on a visual analogue scale.

Aktuelle Situation: Wir beurteilen unsere Geschäftslage als

|————————————————|————————————————|

[0 - schlecht]   [50 - befriedigend]   [100 - gut]
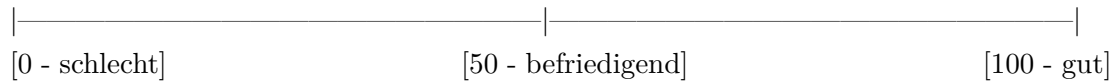
English translation (by authors):

Current situation: We evaluate our current business condition as

|————————————————|————————————————|

[0 - bad]   [50 - satisfactory]   [100 - good]

## Q2 Business Expectations: [visual analogue scale]

Erwartungen für die nächsten 6 Monate: Unsere Geschäftslage wird in konjunktureller Hinsicht

|————————————————|————————————————|

[0 - eher ungünstiger]   [50 - etwa gleich bleiben]   [100 - eher günstiger]
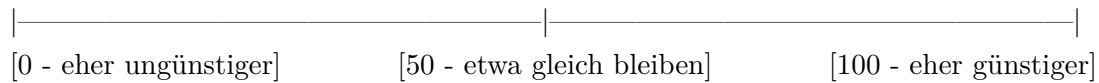
English translation (by authors):

Expectations for the next 6 months: After elimination of purely seasonal fluctuations the development of our business will be

|————————————————|————————————————|

[0 - more unfavorable]   [50 - about the same]   [100 - more favorable]
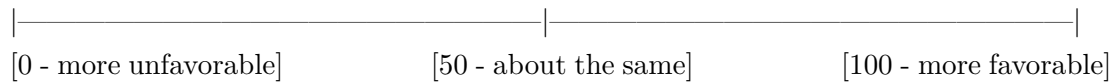
Q3 Business Uncertainty: [visual analogue scale]

Die Unsicherheit hinsichtlich unserer Geschäftsentwicklung in den nächsten 6 Monaten schätzen wir wie folgt ein:

|————————————————|————————————————|

[0 - gering]   [50 - durchschnittlich/saisonüblich]   [100 - groß]

English translation (by authors):

We assess the uncertainty regarding the development of our business during the next 6 months as:

|————————————————|————————————————|

[0 - low]   [50 - average/typical for the season]   [100 - high]
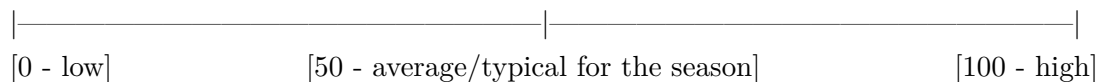
Q4 Number of Employees: [asked annually]

In our company (only domestic establishments), we employ _____ people.

Q4 Export Share: [asked in September 2018]

What percentage of your sales does your company/firm generate abroad?___%

C.2. Special Questions on COVID-19

The wording of the special questions concerning the COVID-19 pandemic of the April IBS survey used in this paper was as follows:

SQ1: COVID-19 Effect on Revenues in 2020

Welchen Effekt der Corona-Pandemie auf Ihren Umsatz erwarten Sie im laufenden Jahr?

☐ keinen Effekt   ☐ Anstieg um _____ %   ☐ Rückgang um _____ %

English translation (by authors):
Which effect of the Corona pandemic do you expect on your revenues in the current year?

☐ No effect   ☐ Increase of _____ %   ☐ Decline of _____ %

SQ2 Dependency on Imports: [Manufacturing Firms Only]

a) Waren Sie vor Ausbruch der Corona-Pandemie auf wichtige Warenlieferungen aus dem Ausland angewiesen?

☐ Ja   ☐ Nein
b) Wenn ja, stammten diese wichtigen Warenlieferungen aus China, Italien oder einem anderem inzwischen vom Corona-Virus besonders stark betroffenem Land?

☐ China   ☐ Italien   ☐ Sonstige, und zwar: _____

English translation (by authors):
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: _____