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Impact of the coronavirus pandemic on the international supply chain of Swedish firms and measures to reduce vulnerability

A survey in collaboration with the Confederation of Swedish Enterprise

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Abstract

This paper reports on the results of a survey of 3441 Swedish companies soliciting information on supply chain disruptions and responses in the first phase of the COVID-19 pandemic. The findings reveal that 69.5% of Swedish companies that use foreign suppliers experienced supply disruptions during the pandemic. In more than two-thirds of these cases problems persisted at the time the survey was implemented (November 2020). Planned measures to reduce vulnerability to future disruptions include increased inventories, spreading purchases over more suppliers and countries, and increasing domestic or regional sourcing. Only a small share of firms planned to re-shore production. Companies have heterogeneous views on desired state action to reduce vulnerability to future trade disruptions, ranging from calls to keep markets open, to doing more at EU level to coordinate crisis measures, strengthening crisis preparedness, and support for domestic producers through public procurement and finance.

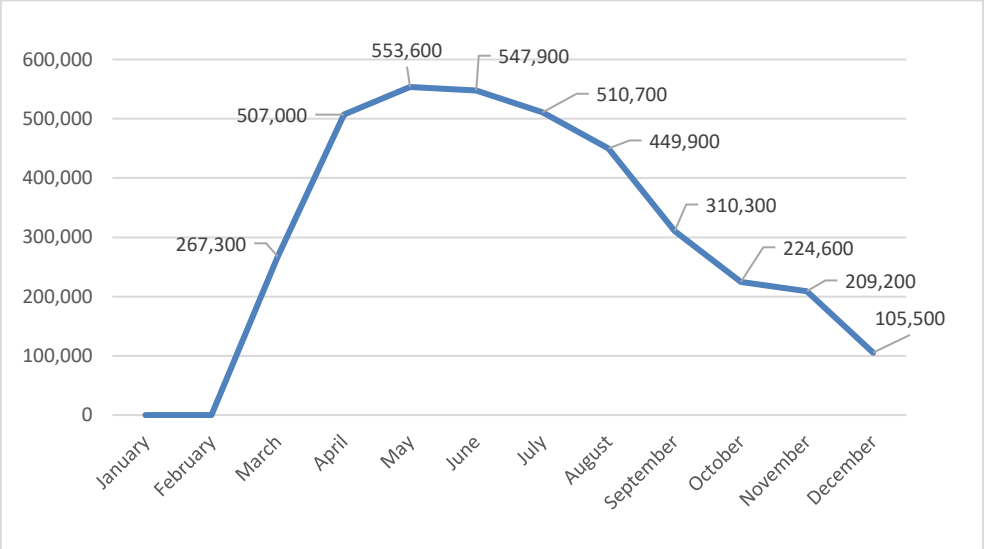
Keywords

Supply chains; global value chains; COVID-19; resilience; reshoring; public policy.

1. Introduction*

During the first phase of the coronavirus pandemic, many companies had to suspend operations for some time due to disturbances in the international supply chain in the wake of measures to contain the pandemic. The shutdown in Sweden began in March 2020 and peaked between April and July, illustrated below by the statistics on short-term layoffs (Figure 1). A case in point is the truck and bus manufacturer Scania, which suspended production on 25 March for a couple of weeks due to a shortage of parts and components.[1] In addition to supply disruptions, many companies also suffered a sharp drop in demand, especially in industries that depend on the free movement of people.[2] In this report, we focus on the first area and the measures taken to reduce the risk of future supply disruptions.

Figure 1. The number of short-term layoffs with state support during the coronavirus pandemic (2020)



Source: The Swedish Agency for Economic and Regional Growth (February 1, 2021)

The report is based on a survey conducted by The Swedish Agency for Growth Policy Analysis (henceforth Tillväxtanalys) in collaboration with the Confederation of Swedish Enterprise. The survey was sent out to 8500 companies in the Confederation of Swedish Enterprise's business panel on 3 November 2020 and was closed on 20 November. A total of 3441 eligible answers were received, of which 1686 were from companies using foreign suppliers. The latter group was asked follow-up questions on whether they had experienced any supply disruptions during the pandemic, whether they had taken or planned any measures to reduce the risks of future shocks, and what role the state can play in this context.

The survey complements an earlier survey that the School of Business, Economics and Law at the University of Gothenburg conducted in collaboration with the public agency Almi Företagspartner AB

* This paper is part of a Swedish Agency for Growth Policy Analysis (Tillväxtanalys) project "Declining globalization – The business community´s adaptation to global risks and the role of public policy". The Agency is grateful to the Confederation of Swedish Enterprise for assistance with implementing the survey questionnaire. The analysis and conclusions are our own are not necessarily shared by the Confederation of Swedish Enterprise.

1 https://www.scania.com/se/sv/home/experience-scania/news-and-events/News/archive/2020/03/scania-stops-production-in-europe.html

2 Hotels and restaurants, sports, leisure, culture, hairdressers and other personal services.

(Fasth and Elliot, 2020). The latter was based on 859 telephone interviews with small and medium-sized companies. Approximately half of interviewed companies had lost sales during the pandemic, while the other half reported unchanged or even slightly increased sales, depending on the industry. In response to the questions on what actions they had taken to deal with the crisis, answers included a wide range of actions from reviewing their finances, securing liquidity, seeking new sources of income, laying off labour and applying for state aid. For the affected companies, reduced demand was the greatest concern, but supply disruptions were also mentioned. No questions were specifically asked about disruptions in international supply chains. The surveys therefore complement each other.

With regard to the general effects of the coronavirus pandemic on the foreign trade of Swedish firms, we would like to highlight the National Board of Trade´s reports that use new data sources to follow developments week by week.[3] The statistics show that a large drop occurred in April and May when trade fell by 15-25% against the same period in 2019. The National Board of Trade (2020) has also analysed the importance of keeping markets open during a crisis, using export restrictions on medical equipment as a negative example. The same pattern repeated itself at the end of the year when vaccines began to be distributed and there was great scarcity on the world market.

Internationally, a great deal has been written about the effects of the coronavirus pandemic, but as far as we can tell, no survey deals with the same issues that ours does. A search in January on Google Scholar on "COVID-19 & global value chains" yielded 3980 hits. A quick review of the latest reports shows that many discuss the advantages and disadvantages of the global production (global value chains) that has emerged in recent decades. The debate is not over productivity gains, which are undisputed, but whether the world economy has become more unstable due to globalization or, conversely, more stable because of opportunities to diversify risks over several markets. Caselli, Koren, Lisicky and Tenreyro (2020) shows that both outcomes are theoretically possible but that the empirical evidence, on balance, speaks in favour of a stabilizing role of diversification through trade. For those who want to delve into this issue, we refer to an overview by the Bank of England (2021) and a policy discussion by Miroudot (2020).

We begin the report by introducing the survey in the next section. Section 3 presents the answers to the first two questions, which identify companies using foreign suppliers and the most important supply regions. Section 4 studies the supply disturbances during the coronavirus pandemic, and section 5 discusses the measures taken to reduce vulnerability. Section 6 presents the views of the business community on what the state can do to reduce uncertainty for companies that trade with other countries. The report concludes with some reflections on the incentives to take precautionary measures and the link to the government´s crisis policy. The second section of the report details the results of the salience analysis. The third section details the results of the position analysis.

2. The survey

The questionnaire was distributed on 3 November 2020 to a random sample of 8500 members of the Confederation of Swedish Enterprise's business panel.[4] The last response date for the survey was 20 November. The response rate was 42.6%, with an industry and size composition reflecting the Confederation of Swedish Enterprise and indirectly the Swedish business community at large, with the exception of the smallest companies without employees. Since we have only 171 responses from the latter group (which make up three-quarters of all companies), we have excluded these and only retained

[3] https://www.kommerskollegium.se/om-handel/corona-import-export/statistik-om-utrikeshandelns-utveckling/. See also Kommerskollegium (2020a).

[4] The Confederation of Swedish Enterprise's business panel is comprised of approximately 12500 companies that volunteer to respond to surveys (approximately every fifth member company). To avoid overloading the participants, not all surveys go to all companies in the panel; rather, each survey goes to a random selection – in our case, 8500 of the 12500 companies in the panel.

companies with at least one employee. We have also deleted 10 companies that submitted incomplete answers as well as the only responding entity from section O of the Swedish industry classification (public administration and defence; compulsory social insurance). After the initial screening, 3441 companies were retained; 1686 of these use foreign suppliers and therefore were asked to complete the section on the effects of the coronavirus crisis.

The answers are reported in total and divided into eleven industries and four size classes of enterprises based on the number of employees. Since the sample was drawn from the Confederation of Swedish Enterprise's business panel, we cannot calculate confidence intervals for the Swedish business community at large. The results should therefore be interpreted with some caution.

The number of respondents in each group is shown in Table 1. The industry and size classification was provided by the Confederation of Swedish Enterprise. The identity of the individual firms was not disclosed. The questionnaire is presented in Table 2. We used a multiple-choice questionnaire complemented with open answers in some cases.

Table 1. Number of survey respondents: Total and companies using foreign suppliers

Industry and size	Total	Using foreign suppliers
Agriculture, forestry, fishing, mining and quarrying (A, B)	151	62
micro (1-9)	109	34
small (10-49)	33	21
medium sized (50-249)	8	6
large (250+)	1	1
Manufacturing (C)	712	581
micro (1-9)	135	89
small (10-49)	364	292
medium sized (50-249)	169	157
large (250+)	44	43
Construction (F)	476	122
micro (1-9)	199	37
small (10-49)	207	56
medium sized (50-249)	60	21
large (250+)	10	8
Wholesale and retail trade; repair of motor vehicles and motorcycles (G)	665	457
micro (1-9)	370	248
small (10-49)	224	162
medium sized (50-249)	61	38
large (250+)	10	9
Transportation and storage (H)	254	70
micro (1-9)	90	18
small (10-49)	111	32
medium sized (50-249)	43	12
large (250+)	10	8
Accommodation and food service activities (I)	272	75
micro (1-9)	119	24
small (10-49)	126	39
medium sized (50-249)	24	11
large (250+)	3	1
Information, communication, financial and insurance activities (J, K)	89	51
micro (1-9)	33	20
small (10-49)	34	20
medium sized (50-249)	15	9
large (250+)	7	2
Professional, scientific and technical activities (M)	264	127
micro (1-9)	133	55
small (10-49)	92	47
medium sized (50-249)	33	19
large (250+)	6	6
Administrative and support service activities (N)	196	58
micro (1-9)	71	16
small (10-49)	78	27
medium sized (50-249)	36	12
large (250+)	11	3
Education, human health and social work activities (P, Q)	218	38
micro (1-9)	92	23
small (10-49)	77	6
medium sized (50-249)	35	6
large (250+)	14	3
Other industries (D, E, L, R, S)	144	45
micro (1-9)	83	22
small (10-49)	42	13
medium sized (50-249)	16	8
large (250+)	3	2

Table 2. The questionnaire

Question 1. Does your company use foreign suppliers of goods/services?

1. Yes
2. No
3. Don't know

Question 2. From which regions do your most important suppliers come? Several answers possible

1. Sweden
2. EU/EFTA area (excl. Sweden)
3. Great Britain
4. Other Europe/Middle East
5. North America
6. South and Central America
7. China
8. Japan
9. India
10. Other Asia
11. Australia
12. Africa

Question 3. What difficulties with deliveries from abroad has your company experienced due to the COVID-19 pandemic? Several answers possible

1. Have not encountered any difficulties
2. Shortage of goods/services
3. More expensive goods/services
4. Longer delivery times
5. Poorer quality of goods/services
6. Obstacles in the mobility of staff
7. Other difficulties, namely: [free text]
8. Don't know/no opinion

Question 4. Are you still experiencing supply disruptions from abroad?

1. No, the problems were only temporary
2. Yes, we still have some problems
3. Yes, we still have large problems
4. Don't know/No opinion

Question 5. Since the outbreak of the Covid-19 pandemic, what measures has your company taken or is your company planning to take to reduce vulnerability to future disruptions in the international trade flow of goods/services? Several answers possible

1. No measures taken or planned
2. Increase the number of suppliers
3. Distribute purchases across several countries
4. Distribute purchases across several suppliers
5. Place a larger share of purchases in the EU/EFTA area
6. Place a larger share of purchases in Sweden
7. Increase ownership of supply chains
8. Bring home foreign production to Sweden
9. Expand inventory
10. Other measure, namely: [free text]
11. Don't know/no opinion

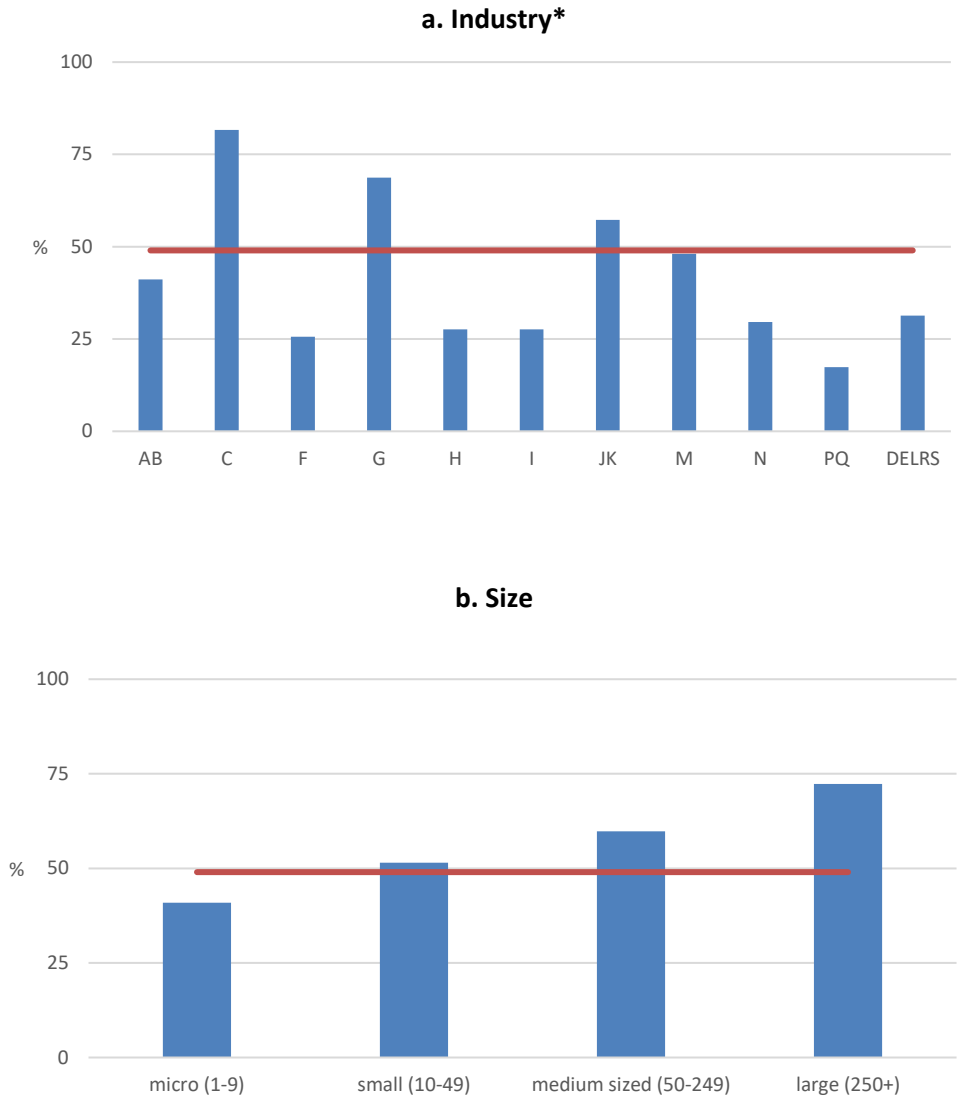
Question 6. Feel free to give examples of what you think the state can do to reduce the company's vulnerability to future disruptions in international trade flows [free text]

3. Foreign suppliers

3.1 Use by industry and company size

We start by looking at which industries and size classes use foreign suppliers of inputs and services. The share by industry is shown in the upper part of Figure 2 and the share by size class in the lower part. The average is shown by the solid line.

Figure 2. Share of companies that use foreign suppliers of goods/services, by industry and company size



* (AB) Agriculture, forestry, fishing, mining and quarrying; (C) manufacturing; (F) construction; (G) wholesale and retail trade; repair of motor vehicles and motorcycles; (H) transportation and storage; (I) accommodation and food service activities; (JK) information, communication, financial and insurance activities; (M) professional, scientific and technical activities; (N) administrative and support service activities; (PQ) education, human health and social work activities; (DELRS) other industries.

Manufacturing (C) is the most internationalized industry, and education, human health and social work activities (PQ) the least internationalized. Larger companies use foreign suppliers to a greater extent than smaller companies.

To see which dimension is more important (industry or company size), we introduce both variables simultaneously in a regression analysis. The regressions are done in Stata with the probit estimator,

which calculates how likely it is that a company in a certain industry and of a certain size uses foreign suppliers in comparison to companies in the benchmark group (small companies/industry M). The first column in Table 3 includes only the industry as an explanatory variable, the second column includes only the size class, and the third column includes both dimensions. If we compare the explanatory power of each specification (given by the pseudo R2 coefficients), we find that industry is more important than size (0.17 compared to 0.02) but that both dimensions contribute to the explanatory power (0.18). The reported coefficients are the *marginal effects* in comparison with the benchmark groups. The latter are chosen because they are closest to the average. Somewhat loosely, the coefficients can therefore be interpreted as the deviation from the mean, even if the correct interpretation is the deviation from the benchmark groups. For example, the probability that large companies use foreign suppliers is 21% higher than that for small companies, taking the correlation between industry and size into account (column 3). Statistically significant coefficients are marked with an asterisk.

Table 3. Statistical analysis of which companies use foreign suppliers

	(1)	(2)	(3)
Industry			
Agriculture, forestry, fishing, mining and quarrying (AB)	-0.06		-0.03
Manufacturing (C)	0.31*		0.28*
Construction (F)	-0.20*		-0.21*
Wholesale and retail trade; repair of motor vehicles and motor cy. (G)	0.18*		0.18*
Transportation and storage (H)	-0.18*		-0.20*
Accommodation and food service activities (I)	-0.18*		-0.18*
Information, communication, financial and insurance activities (JK)	0.08		0.05
Professional, scientific and technical activities (M)	…		…
Administrative and support service activities (N)	-0.16*		-0.18*
Education, human health and social work activities (PQ)	-0.29*		-0.31*
Other industries (DELRS)	-0.14*		-0.14*
Size			
Micro (1-9)		-0.11*	-0.07*
Small (10-49)		…	…
Medium sized (50-249)		0.08*	0.07*
Large (250+)		0.22*	0.21*
Observations	3,441	3,441	3,441
Pseudo R2	0.17	0.02	0.18

Note: The regressions are performed with Stata using the probit estimator. The table reports the *marginal effects* calculated by the command *margins, dydx(*)*. Estimates significant at the 5% level are marked with an asterisk.

3.2 Most important supply regions

In the survey, companies were also asked to list their most important supplier regions. This allows us to assess the correlation of the effects of the coronavirus pandemic with which regions companies trade with, which in turn has a bearing on the measures taken to reduce vulnerability. The results are shown in Table 4. The supplier regions are sorted in descending order according to the proportion of companies listing them as "important".

Table 4. The most important supply regions – Total and by industry and company size (share of companies, %).

	EU/ EFTA	SWE	CHN	GBR	NA	ÖE/ ME	ÖAS	IND	JPN	SCA	AUS	AFR
Total	85.6	64.9	19.9	16.9	11.9	9.7	6.4	4.6	3.9	1.8	1.2	0.8
Industry												
Agriculture, forestry, fishing, mining and quarrying (AB)	88.7	64.5	8.1	4.8	4.8	6.5	1.6	0.0	3.2	0.0	1.6	0.0
Manufacturing (C)	88.5	75.6	25.0	19.6	10.0	10.7	7.2	5.9	5.3	2.1	0.9	0.3
Construction (F)	84.4	67.2	7.4	6.6	1.6	8.2	0.8	1.6	1.6	0.0	0.8	0.8
Wholesale and retail trade; repair of motor vehicles and mc (G)	86.9	56.9	25.4	19.5	11.8	11.2	10.3	5.3	3.7	2.4	1.1	0.9
Transportation and storage (H)	87.1	67.1	11.4	10.0	5.7	7.1	2.9	2.9	2.9	2.9	1.4	2.9
Accommodation and food service activities (I)	81.3	57.3	6.7	8.0	9.3	10.7	2.7	0.0	0.0	4.0	2.7	1.3
Information, communication, financial and insurance activities	72.5	58.8	13.7	33.3	39.2	3.9	7.8	7.8	3.9	0.0	0.0	0.0
Professional, scientific and technical activities (M)	83.5	52.8	15.7	16.5	18.1	7.9	4.7	6.3	3.1	1.6	1.6	2.4
Administrative and support service activities (N)	72.4	46.6	8.6	17.2	17.2	13.8	1.7	0.0	1.7	0.0	1.7	1.7
Education, human health and social work activities (PQ)	76.3	63.2	28.9	10.5	28.9	5.3	2.6	5.3	7.9	2.6	5.3	0.0
Other industries (DELRS)	84.4	77.8	8.9	13.3	20.0	2.2	2.2	4.4	2.2	0.0	0.0	0.0
Size												
Micro (1-9)	83.3	57.8	16.6	18.4	12.1	7.3	5.5	2.7	2.9	0.9	1.0	0.5
Small (10-49)	85.3	67.1	19.3	14.1	10.1	10.5	6.7	4.6	4.3	2.5	1.1	1.1
Medium sized (50-249)	89.6	70.9	23.1	18.4	16.1	8.4	6.7	6.0	4.3	2.0	1.3	1.0
Large (250+)	89.5	73.3	36.0	24.4	11.6	23.3	9.3	12.8	4.7	2.3	2.3	0.0

Note. EU/EFTA = EU/EFTA (excl. Sweden); SWE = Sweden; CHN = China; GBR = Great Britain; NA = North America; OE/ME = Other Europe/Middle East; OAS = Other Asia (excl. China, India and Japan); IND = India; JPN = Japan; SCA = South and Central America; AUS = Australia; AFR = Africa.

A total of twelve supplier regions were defined in the survey, and the average firm classified 2.3 of these as important suppliers (Table 5). The two first spots are held by EU/EFTA (85.6%) and Sweden (64.9%), which reflect the free mobility of goods, services, capital and people upheld by the EU and EES treaties. In the third to fifth spots, we find China (19.9%), the United Kingdom (16.9%) and North America (11.9%), with some exceptions, such as North America coming in third for information, communication, finance and insurance activities. The rest of Europe and the Middle East (OE/ME) is the sixth most important region, especially for large companies. India (IND), Japan (JPN) and the rest of Asia (OAS) are quite important for the manufacturing industry and for large companies. Other regions have a relatively small significance as suppliers of inputs, although they can be large for individual goods, services and niche companies that trade with these regions.

Table 5. Number of important supplying regions

	Average
Total	2.3
Industry	
Agriculture, forestry, fishing, mining and quarrying (AB)	1.9
Manufacturing (C)	2.5
Construction (F)	1.8
Wholesale and retail trade; repair of motor vehicles and motor cycles (G)	2.3
Transportation and storage (H)	2.0
Accommodation and food service activities (I)	1.8
Information, communication, financial and insurance activities (JK)	2.4
Professional, scientific and technical activities (M)	2.1
Administrative and support service activities (N)	1.8
Education, human health and social work activities (PQ)	2.4
Other industries (DELRS)	2.1
Size	
Micro (1-9)	2.1
Small (10-49)	2.3
Medium sized (50-249)	2.5
Large (250+)	2.9

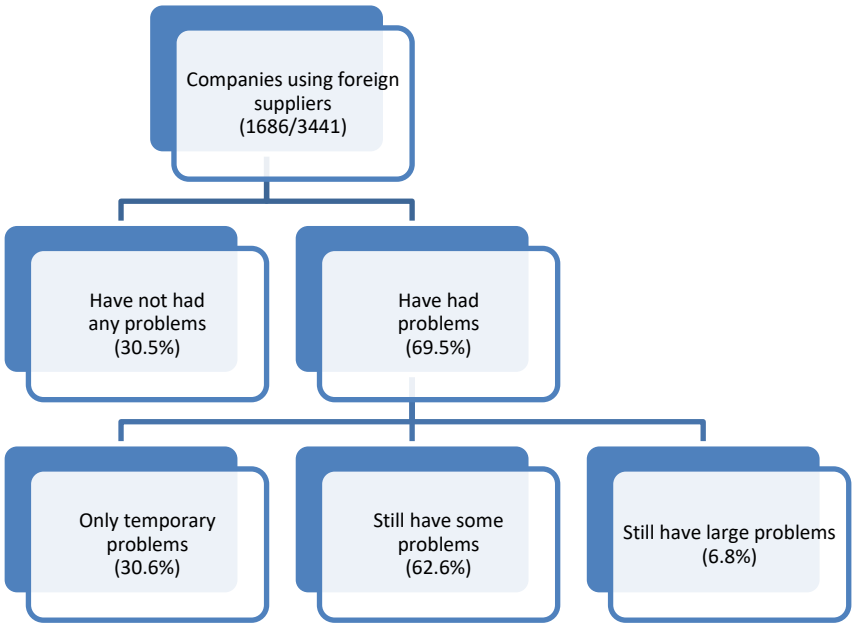
In summary, approximately half of the companies use foreign suppliers of inputs and services, where the most important regions are the EU/EFTA area, Sweden, China, Great Britain and North America.

4. Supply disruptions

4.1 Disruptions by industry and company size

We now turn to the questions on supply disturbances during the coronavirus pandemic. These questions were asked only to companies using foreign suppliers (1686/3441) and assessed how common supply disturbances were during the pandemic and whether they were temporary or still ongoing when the survey was done in November 2020. The overall picture is shown in Figure 3 and details in Table 4.

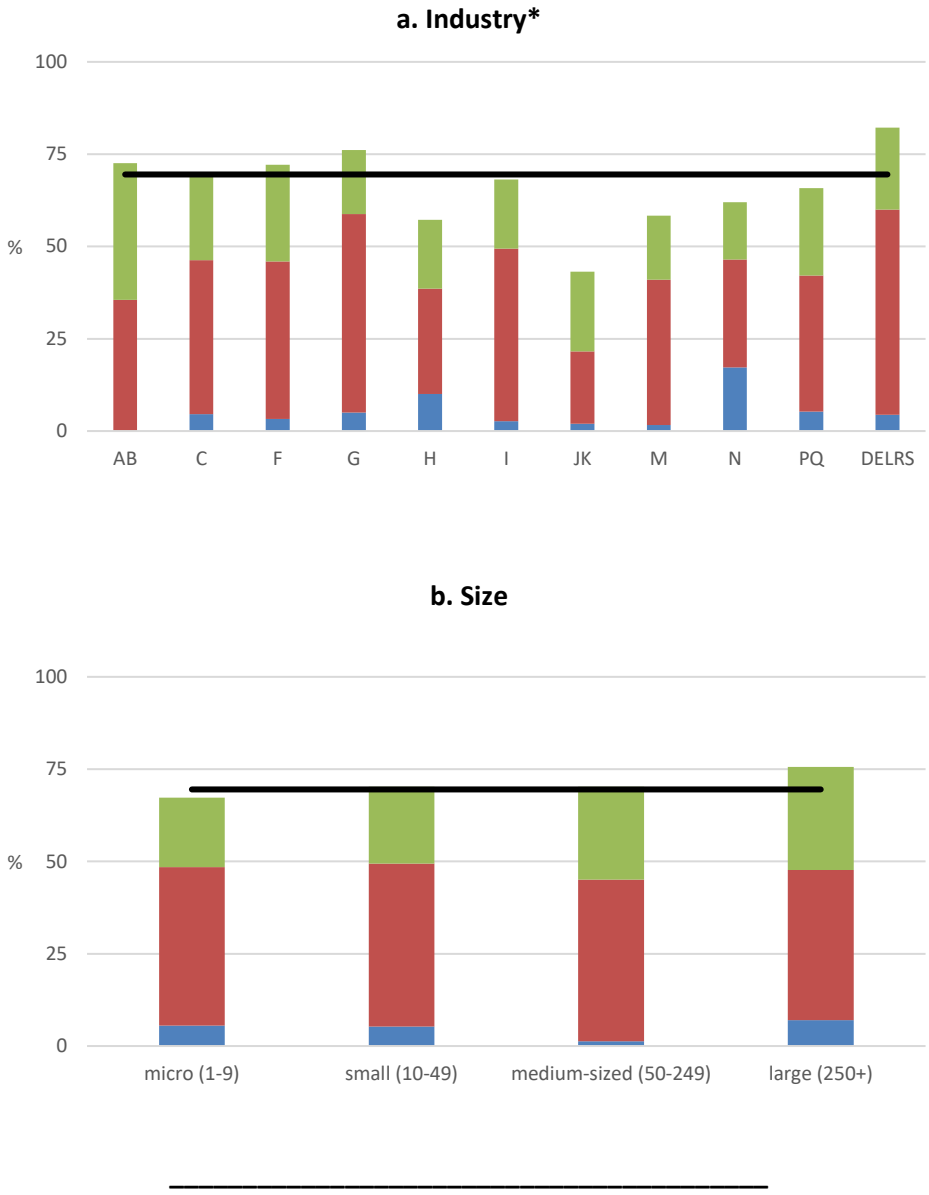
Figure 3. Share of companies reporting supply disturbances during the coronavirus pandemic



A total of 69.5% of the companies that use foreign suppliers reported the occurrence of some disruption during the coronavirus pandemic. For 30.6% of the affected companies, the disturbances were only temporary, while 62.6% said that they still had some problems and 6.8% that they still had major problems in November 2020 when the survey was administered.

If we break down the data by industry and company size, we see that the supply disruptions hit some industries more than others (Figure 4). The biggest problems are recorded in the other industries category, composed of sections D, E, L, R and S of the Swedish industry classification SNI 2007, which is identical to NACE REV 2 up to the fourth digit. If we break down this aggregate group, we find that it is (R) arts, entertainment and recreation and (S) other service activities that pull up the average. This is likely due to the travel restrictions that stopped most cultural and sport exchanges between countries for a considerable time. The least affected sections of SNI 2007 are J and K (information, communication, financial and insurance activities), which likely reflect the high degree of digitalization in these industries. For example, IT services outsourced to India were only marginally affected by travel restrictions.

Figure 4. Share of companies that had supply disruptions during the corona pandemic, by industry, company size and whether the disruptions were temporary (light grey) or ongoing to some extent (grey) or to a large extent (dark grey)



* (AB) Agriculture, forestry, fishing, mining and quarrying; (C) manufacturing; (F) construction; (G) wholesale and retail trade; repair of motor vehicles and motorcycles; (H) transportation and storage; (I) accommodation and food service activities; (JK) information, communication, financial and insurance activities; (M) professional, scientific and technical activities; (N) administrative and support service activities; (PQ) education, human health and social work activities; (DELRS) other industries.

The colour coding of the bars indicates whether the disturbances were temporary (light grey) or ongoing to some (medium grey) or a large (dark grey) degree when the survey was administered in November 2020. Apparently, the situation has improved for many industries since the pandemic was declared in March 2020, but there are still pockets where the problems are significant. A case in point is (N) administrative and support service rental, where 17.2% of the companies report extensive ongoing problems. If we break down this sector to the 2-digit level, we find that it is section 79 (travel agency, tour operator reservation service and related activities) where the situation has not improved much since

March. This also applies to the (H) transportation and storage industry to some degree, suggesting that the culprit is travel restrictions. If we break down the data by size classes instead of by industry, we find that the impact is rather evenly distributed across all sizes of companies.

To obtain a clearer picture, we conduct a regression analysis of the supply disruptions during the coronavirus pandemic (Table 6). In addition to industry and company size, we include the most important supplier regions in the regression (using data from question 2). The latter variable is motivated by the fact that two companies in the same industry and size class may have different experiences depending on where they source their inputs, which in turn suggests that the risks can be reduced by diversification. The benchmarks for the estimations are in this case the manufacturing industry, small companies and domestic suppliers (which are closest to the overall average).

Table 6. Probability of supply disruptions during the coronavirus pandemic

	(1)	(2)	(3)	(4)
Industry				
Agriculture, forestry, fishing, mining and quarrying (AB)	0.03			0.08
Manufacturing (C)	…			…
Construction (F)	0.02			0.07
Wholesale and retail trade; repair of motor vehicles and mc (G)	0.07*			0.08*
Transportation and storage (H)	-0.12*			-0.07
Accommodation and food service activities (I)	-0.02			0.04
Information, communication, financial and insurance activ. (JK)	-0.24*			-0.20*
Professional, scientific and technical activities (M)	-0.11*			-0.07
Administrative and support service activities (N)	-0.07			-0.02
Education, human health and social work activities (PQ)	-0.04			-0.01
Other industries (DELRS)	0.14			0.19*
Size				
Micro (1-9)		-0.03		-0.04
Small (10-49)		…		…
Medium sized (50-249)		0.00		-0.00
Large (250+)		0.06		0.02
Key supply regions				
Sweden			…	…
EU/EFTA (excl. Sweden)			0.12*	0.10*
Great Britain			0.06	0.07*
Other Europe/Middle East			0.06	0.05
North America			-0.02	0.01
South and Central America			-0.18*	-0.19*
China			0.19*	0.18*
Japan			0.04	0.04
India			0.05	0.06
Other Asia			0.06	0.05
Australia			0.08	0.07
Africa			0.01	0.03
Observations	1,686	1,686	1,686	1,686
Pseudo R2	0.02	0.00	0.04	0.06

Note: The regressions are performed with Stata using the probit estimator. The table reports the *marginal effects* calculated by the command *margins, dydx(*)*. Estimates significant at the 5% level are marked with an asterisk.

Table 7. Kind of disruptions – Total and by industry and company size (share of companies that use foreign suppliers and that have or have had supply disturbances at some stage, %)

	Longer delivery times	Shortage of goods/services	More expensive goods/services	Obstacles to staff mobility	Other problems	Poorer quality of inputs
Total	78.7	52.1	23.1	22.3	5.6	4.5
Industry						
Agriculture, forestry, fishing, mining and quarrying (AB)	80.0	40.0	20.0	33.3	2.2	2.2
Manufacturing (C)	82.5	54.6	22.0	21.0	4.4	3.2
Construction (F)	76.1	56.8	9.1	31.8	2.3	3.4
Wholesale and retail trade; repair of motor vehicles and mc (G)	83.0	58.3	26.1	12.9	3.7	5.2
Transportation and storage (H)	67.5	27.5	30.0	32.5	15.0	2.5
Accommodation and food service activities (I)	76.5	43.1	33.3	17.6	9.8	5.9
Information, communication, financial and insurance activities (JK)	86.4	40.9	13.6	31.8	4.5	0.0
Professional, scientific and technical activities (M)	67.6	35.1	14.9	51.4	5.4	5.4
Administrative and support service activities (N)	41.7	41.7	22.2	30.6	19.4	2.8
Education, human health and social work activities (PQ)	76.0	64.0	52.0	8.0	28.0	32.0
Other industries (DELRS)	70.3	51.4	24.3	21.6	5.4	2.7
Size						
Micro (1-9)	78.4	54.3	27.9	14.7	5.3	5.6
Small (10-49)	81.5	49.6	20.7	21.7	5.6	4.6
Medium sized (50-249)	75.7	53.8	20.0	32.9	6.2	3.3
Large (250+)	67.7	52.3	21.5	38.5	6.2	1.5

The analysis suggests that the disturbances during the coronavirus pandemic had more to do with where the companies sourced their inputs from than the industry and size class to which they belong.

4.2 Kinds of disruptions

What kinds of disruptions did the companies suffer? Data are gathered from question 3, which defines five choices and another category that the firms were invited to specify.

As shown in Table 7, the most common disturbances during the coronavirus pandemic were longer delivery times (78.7%), shortages of goods/services (52.1%), more expensive goods/services (23.1%), obstacles to staff mobility (22.3%), other problems (5.6%) and lower quality of the available inputs (4.5%). The other problems cited by the companies included increased uncertainty, logistical and administrative costs and new barriers to trade.

The industry that seems to have suffered the most is (PQ) education, human health and social work activities. Approximately two-thirds of companies have (or have had) difficulty obtaining sufficient quantities (64.0%), half have had to pay more than usual (52.0%) and one-third have had to accept lower-quality inputs (32.0%). If we break down the answers between sections P (education) and Q (health and care; social services), we find that section Q stands out. This reflects the situation at the beginning of the pandemic when there were shortages of ventilators, mouth guards, visors, rubbing alcohol and other medical equipment. The shortage situation raised prices, and the secondary choice was sometimes of inferior quality. The initial problems have now been solved in many cases. In November 2020, only 5.3% of the respondents had major problems, while 36.8% had some remaining problems.

Regarding obstacles to staff mobility, it seems that section M (professional, scientific and technical activities) has suffered the most from travel restrictions. More than half of the companies have had problems in this area. Section AB (Agriculture, forestry, fishing, mining and quarrying), where seasonal workers play an important role, have also had some considerable problems.

5. Precautionary measures

5.1 Measures to reduce vulnerability

What lessons has the business community learned from the coronavirus pandemic? The analysis is based on question 5 in the survey, which reads: ”Since the outbreak of the COVID-19 pandemic, what measures has your company taken or is your company planning to take to reduce vulnerability to future disruptions in the international trade flow of goods/services? Several answers possible”.

1. No measures taken or planned
2. Increase the number of suppliers
3. Distribute purchases across several countries
4. Distribute purchases across several suppliers
5. Place a larger share of purchases in the EU/EFTA area
6. Place a larger share of purchases in Sweden
7. Increase ownership of supply chains
8. Bring home foreign production to Sweden
9. Expand inventory
10. Other measure, namely [free text]
11. Don’t know/no opinion

The first option is to do nothing, which can be rational if the cost of increased security is high in relation to the benefit. Options 2-4 are different variants of the classical strategy of reducing risks by not putting all eggs in the same basket. The difference between 2, 3 and 4 is not all that important, and we merge them into the common category of supply chain diversification. Options 5 and 6 involve doing the opposite and instead concentrating purchases in Sweden and the EU/EFTA area. This can be rational if the regional home market is exposed to fewer shocks than alternative regions or because the risk of trade restrictions is lower because of the EU and EES treaties.[5] Option 7 is to increase the ownership share in the supply chain to reduce the risks of going without if a shortage occurs. Only a few companies marked this choice, and we therefore merged it with the other measures category, where many answers were about increased cooperation with suppliers (not ownership). Option 8 is to bring foreign production home to Sweden, a strategy that multinational companies may consider. Option 9 is to stockpile inputs to bridge temporary disruptions in the supply chain, which was a common strategy before the just-in-time philosophy gained popularity in the 1970s. The last option in the list is "Don't know/no opinion", which we interpret as firms having made no decision regarding whether to take any measures or which measures to take. As we see in Figure 5, 51% of the companies have taken or planned measures to reduce the risks of delivery disruptions in the future. If we break down the measures, we find that 54.4% of the proactive companies are considering larger inventories; 47.3% diversifying purchases over more countries and/or suppliers; 29.7% increasing the domestic share; 14.5% increasing the EU/EFTA share; 3.7% bringing home foreign production to Sweden; and 7.2% other measures, including increasing ownership or collaboration with suppliers.

The most common measure (after none at all) is thus to keep larger stocks to bridge temporary supply disruptions, which is a return to past practices. This will likely lead to some additional costs in comparison to those of just-in-time delivery, but many companies seem to be willing to assume these costs to create a buffer in the production system. The other strategies are also associated with some additional costs. Spreading purchases over more suppliers and countries will reduce the volume from each supplier, which may reduce volume discounts. Likewise, buying more domestic and regional inputs may increase costs over those of working with overseas suppliers such as China, with its lower production costs.

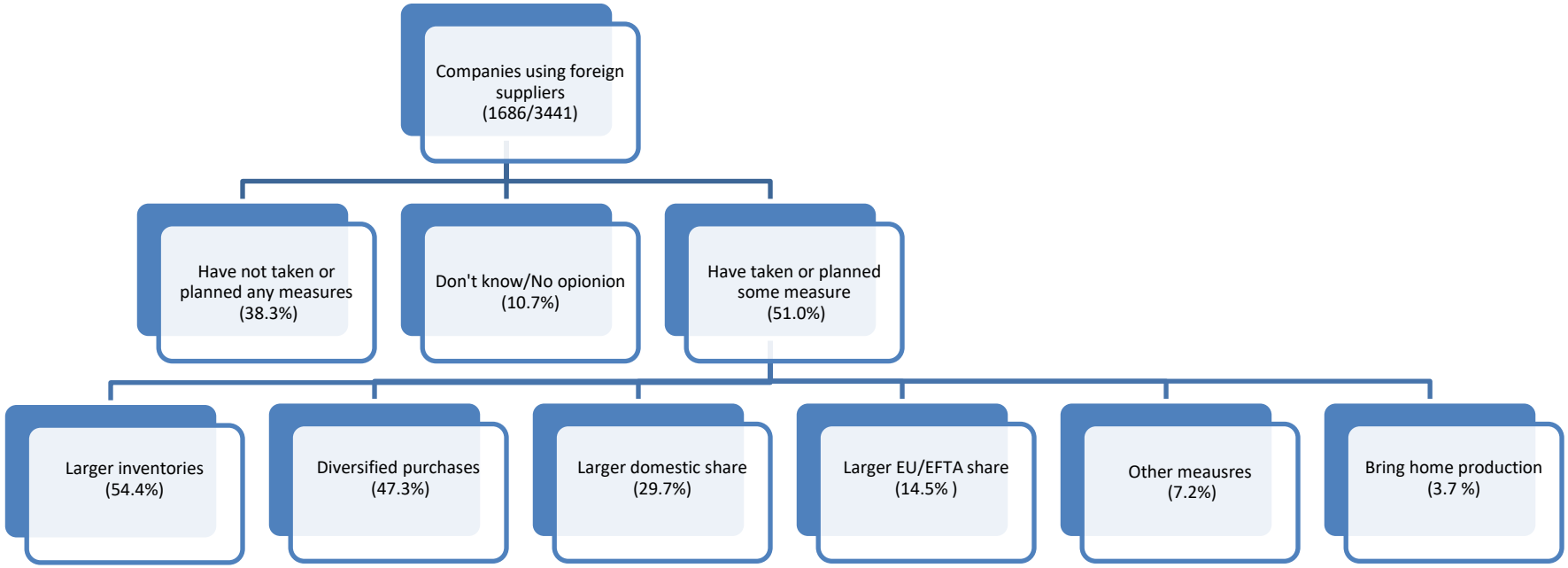
The differences between different sectors and size classes are shown in Table 8. The share of proactive companies is highest in the manufacturing industry, where 63.5% have taken or planned some measure(s), with the most common being increasing inventories and spreading purchases over more suppliers and countries to reduce risks. We find the second highest share of proactive companies in (PQ) education, human health and social work activities, reflecting the shortages of supplies during the first phase of the pandemic. The least proactive industry is (JK) information, communication, finance and insurance activities, which is also the industry that was least affected by the pandemic. This pattern suggests that there is a link between disruptions and measures, a hypothesis that we will investigate below. Larger companies also seem to be more proactive than smaller ones.

In summary, keeping larger inventories, spreading purchases over more suppliers and countries and increasing the proportion of domestic and EU/EFTA area purchases are the most common measures to reduce the risks of future supply disturbances. Only a small minority of firms plan to move production back home to Sweden to reduce supply disturbances

An overview of the answers is presented in Figure 5, and the details are presented in Table 8 .

[5] The free movement of goods, services, capital and persons is a fundamental right in the internal market that can only be restricted in exceptional cases. One of the exceptions is to protect human health and life, which may be applicable during a pandemic if the measures are appropriate and proportionate to the risks.

Figure 5. Share of companies that have taken or plan to take measures to reduce vulnerability to disruptions in the international trade flow of goods/services



* The other measures category includes increased ownership in the supply chain, increased cooperation with suppliers and better planning. The shares in the last row do not sum to one hundred since firms may opt for several alternatives, for example, both holding larger inventories and diversifying purchases

Table 8. Measures – Total and by industry and company size (proportion of companies using foreign suppliers and that have taken or are planning to take some measures, %)

	No measure	Don´t know	Some measures	Larger inventory	Spread purchases	More Sweden	More EU/EFTA	Other measures	Bring home production
Total	38.3	10.7	51.0	54.4	47.3	29.7	14.5	7.2	3.7
Industry									
Agriculture, forestry, fishing, mining and quarrying (AB)	46.8	14.5	38.7	66.7	41.7	12.5	12.5	8.3	8.3
Manufacturing (C)	30.8	5.7	63.5	61.5	52.0	28.2	14.1	4.6	4.9
Construction (F)	44.3	12.3	43.4	47.2	45.3	41.5	13.2	9.4	3.8
Wholesale and retail trade; repair of motor vehicles and mc	39.4	9.2	51.4	54.0	40.4	25.1	16.2	8.1	2.6
Transportation and storage (H)	47.1	22.9	30.0	42.9	42.9	38.1	0.0	19.0	0.0
Accommodation and food service activities (I)	48.0	18.7	33.3	32.0	44.0	52.0	12.0	4.0	0.0
Information, communication, financial and insurance	56.9	13.7	29.4	20.0	46.7	46.7	26.7	13.3	0.0
Professional, scientific and technical activities (M)	44.1	14.2	41.7	39.6	52.8	34.0	22.6	9.4	1.9
Administrative and support service activities (N)	32.8	31.0	36.2	33.3	38.1	33.3	14.3	9.5	9.5
Education, human health and social work activities (PQ)	28.9	10.5	60.5	60.9	52.2	26.1	4.3	13.0	0.0
Other industries (DELRS)	44.4	8.9	46.7	52.4	52.4	38.1	9.5	9.5	4.8
Size									
Micro (1-9)	46.4	12.8	40.8	49.4	42.3	25.9	15.1	11.3	2.1
Small (10-49)	36.9	9.0	54.1	55.3	49.6	34.1	14.5	4.7	4.4
Medium sized (50-249)	29.1	8.7	62.2	59.1	48.4	25.8	12.4	6.5	4.8
Large (250+)	26.7	17.4	55.8	54.2	50.0	27.1	20.8	10.4	2.1

100–50% | 49.9–20% | 29.9–20% | 19.9–10% | 9.9–5% | 4.9–0%

5.2 The link between disruptions and measures

What is the link between supply disruptions and precautionary measures? We study this issue by estimating the probability of taking precautionary measures, given industry, size and supply disturbance during the coronavirus pandemic (Table 9). The data on the supply disturbances are collected from questions 3 and 4 of the survey. The coefficients of the model are estimated in relation to industry G, small companies and companies that have not experienced any supply disruptions during the pandemic.

Table 9. Probability of taking precautionary measures

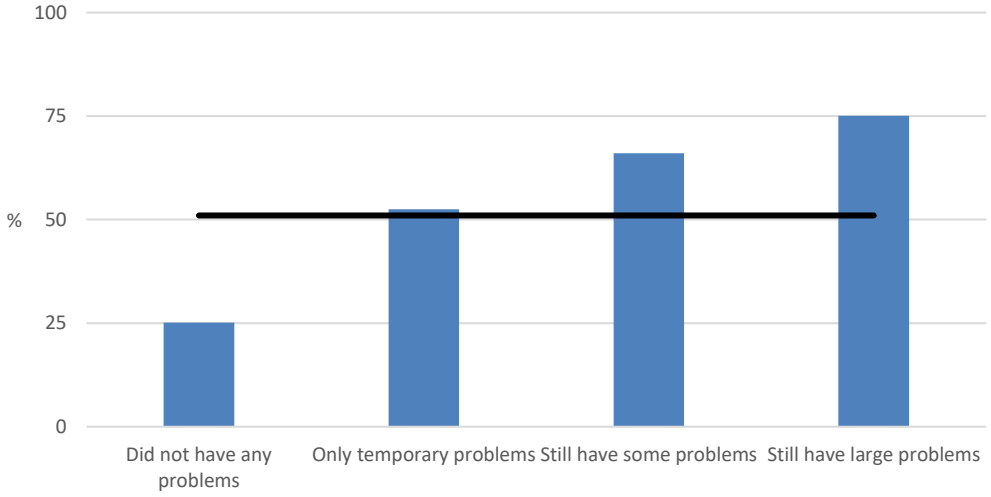
	(1)	(2)	(3)	(4)
Industry				
Agriculture, forestry, fishing, mining and quarrying (AB)	-0.12			-0.07
Manufacturing (C)	0.12*			0.10*
Construction (F)	-0.08			-0.08
Wholesale and retail trade; repair of motor vehicles and mc (G)	…			…
Transportation and storage (H)	-0.21*			-0.18*
Accommodation and food service activities (I)	-0.18*			-0.17*
Information, communication, financial and insurance activ. (JK)	-0.22*			-0.11
Professional, scientific and technical activities (M)	-0.09			-0.04
Administrative and support service activities (N)	-0.15*			-0.16*
Education, human health and social work activities (PQ)	0.09			0.13
Other industries (DELRS)	-0.05			-0.07
Size				
Micro (1-9)		-0.13*		-0.10*
Small (10-49)		…		…
Medium sized (50-249)		0.08*		0.08*
Large (250+)		0.02		-0.01
Supply disturbance during the coronavirus pandemic				
Did not have any problems			…	…
Only temporary problems			0.26*	0.24*
Still have some problems			0.39*	0.37*
Still have large problems			0.48*	0.50*
Observations	1,686	1,686	1,686	1,686
Pseudo R2	0.04	0.02	0.10	0.15

Note: The regressions are performed with Stata using the probit estimator. The table reports the *marginal effects* calculated by the command *margins, dydx(*)*. Estimates significant at the 5% level are marked with an asterisk.

If we study the pseudo R2 coefficients in Table 9, we find that the most important factor in whether a company will take precautionary measures is how seriously the company was affected by supply disruptions during the pandemic. There are also some differences between industries and size classes of companies, but these are of secondary importance.

If we make a prediction based on the coefficients in column 4, we find that the probability of taking action is 25.1% for companies that have not been affected by any supply disturbances, 52.5% for those affected by temporary disturbances, 66.0% for those that had some remaining problems, and 75.1% for those that still had major problems when the survey was taken in November 2020. The estimated correlation is shown in Figure 6. The solid line is the average probability of taking precautionary measures (51.0%).

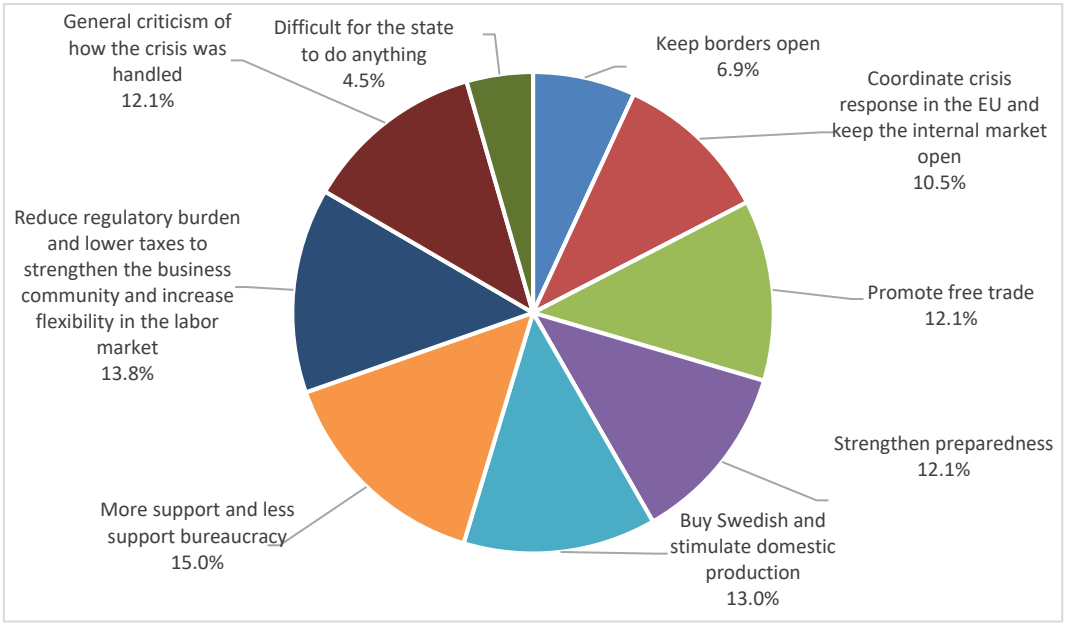
Figure 6. The relationship between how seriously a company was affected by supply disruptions during the coronavirus pandemic and the likelihood of taking precautionary measures to reduce



6. The role of the state

In a final question, companies were invited to give their views on what the state can do to reduce companies' vulnerability to future disruptions in international trade flows. In this case, we did not use multiple-choice answers, and only 247 companies gave short, free-text answers, which were grouped into nine categories (Figure 7).

Figure 7. What the state can do to reduce companies' vulnerability (share of free-text answers, %)



The first three groups said that the foremost role of the state is to keep markets open and to promote free trade. In addition, they asked for greater coordination of crisis measures within the EU and for the internal market to be kept open. The fourth group emphasized the importance of strengthened crisis preparedness. A fifth group said that the state should buy Swedish and encourage domestic production.

A sixth group stressed the need for financial support during a crisis, less bureaucracy and expeditious disbursements. A seventh group argued that the state should focus on long-term measures to strengthen the business community and increase flexibility in the labour market, which in turn would reduce the need for specific crisis measures. An eighth group expressed general frustration over the management of the crisis, while the final group argued that the state could not do much about risks in international trade.

The share of each category is noted in the pie chart. However, since only 15% responded to this question, we cannot say with certainty that the views are representative of the business community at large. Notwithstanding, the opinions can serve as a starting point for discussion of what the state's role should be in this context.

7. Reflections

Perhaps the most striking result in the survey is the connection between crisis and action. Among the companies most affected by the coronavirus pandemic, three-quarters have taken or planned a measure to reduce vulnerability, in comparison with one-quarter of companies with no experience of problems during the pandemic.

If the difference reflects that the latter were better equipped for a crisis (for example, through larger inventories or contracts with alternative suppliers that could fill the holes), all is well and fine. However, if this outcome is just a matter of "luck", it is worse since two crises are never the same. Not being harmed this time is no guarantee of not being harmed next time.

At the same time, the costs must be weighed against the benefits. Reducing vulnerability by, for example, increasing inventory or spreading purchases across more suppliers will incur costs. Whether this "insurance" is worth the price is up to each company to decide.

This leads us to our last point on the role of the state, especially the role as an implicit insurance company if a crisis arises. To date, more than SEK 100 billion has been paid out in various coronavirus support measures (Tillväxtanalys, 2020), and it is difficult to see any alternative under current conditions to prevent viable companies from going bankrupt and unemployment from soaring. At the same time, support measures can create long-term problems if they make companies less likely to look after their own house (the moral hazard problem).

This trade-off needs to be discussed since the coronavirus pandemic is neither the first nor the last crisis that will hit the economy.

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