

A BACKGROUND PAPER >> TOURISM RESILIENCE

360° Resilience

A Guide to Prepare the Caribbean
for a New Generation of Shocks



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Global Facility for Disaster Reduction and Recovery



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Resilience of the Caribbean Tourism Industry

– New evidence from a firm survey

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1. Introduction

Natural hazards, including hurricanes, floods and landslides, are a common phenomenon in the Caribbean, affecting both residents and private companies. Researchers estimate probability of Caribbean country to be hit by a natural hazard as 14% in any given year, making it one of the most vulnerable regions in the world (Laframboise and Acevedo 2014). In recent years, several super storms have devastated the region, including Hurricane Maria, Hurricane Irma, Hurricane Matthew and Tropical Storm Dorian causing immense damages.

The World Travel and Tourism Council ranks the Caribbean as the most tourism-dependent region relative to the contribution of travel and tourism to gross domestic product (GDP) (Mackay and Spencer 2017). The sector has grown continuously since the 1970s. Between 2000 and 1995 average annual growth in tourist arrivals was 5 percent. The growth continued for the following 15 years, but average annual growth slowed to 2.4 percent. Before the COVID-19 crisis, arrivals were expected to continue to grow (UNWTO, 2011) but slower than international average. COVID-19 has completely changed the outlook for tourism, and it is still early to tell what recovery will look like as the crisis is still unfolding.

Private companies are affected by disasters both directly, by having their assets damaged or lost, and indirectly, when supply chains and infrastructure access are disrupted. The tourism sector is particularly vulnerable because firms tend to be in at-risk areas, such as coastal areas or in the mountains. Relatively unique to the tourism sector is also the risk of reputational impacts from being affected by disasters deterring tourists from visiting for years after the event. A significant reduction in tourism arrivals and a multiyear recovery period is common after a major natural disaster (WTTC, 2018). When the private sector is affected, livelihoods is put at risk, which makes the resilience of the private sector a development issue.

While lot of research has been done on what influences tourism arrivals, tourists' perceptions and the relationship between climate and tourism (see literature overview in Scott, et al, 2020), data and information from the firm level has been largely missing in the Caribbean and there is limited understanding on how the businesses in the Caribbean are affected by and recover from natural hazards. Impacts of disasters tend to be quantified at the country level, or sector level, while little is known about the micro level. The lack of data makes it difficult for governments to fully assess the economic losses after a disaster to make the case for investments in more resilient infrastructure and prioritize interventions for strengthening resilience.

To address this, GFDRR and the World Bank collected data from firms in the tourism industry in 13 countries in the Caribbean, listed in Table 1. The data focus on infrastructure resilience, impacts of recent disasters and how firms cope with and manage shocks caused by natural hazards. Due to its regional scope and comprehensiveness, it is a rich source of information about the current state of the tourism industry in the Caribbean and provides insights on the strengths and weaknesses of the sector, beyond climate resilience. The objective of the report is to summarize the main findings from the data collected and illustrate what the data contains and can be used for. The report is organized around the following sections: i) Methodology and data, ii) Infrastructure dependency and reliability, iii) Infrastructure reliability index, iv) Supply chains, v) Direct and indirect impacts of recent disasters, vi) Managing natural disaster, vii) Impacts of COVID-19 crisis on tourism and viii) Discussion and conclusions.

Table 1. Dependency on tourism

States	Direct Contribution to GDP (2018)	Direct and Indirect Contribution to Employment	Indirect to Country group
Antigua and Barbuda	44.1%	44.1%	Very high
	US\$1,404 million	16,300 jobs	
Bahamas	40.4%	48.2%	High
	US\$5,097 million	101,800 jobs	
Barbados	13.0%	40.5%	High
	US\$608.3 million	52,500 jobs	
Dominica	33.4%	30.6%	High
	US\$160.1 million	10,000 jobs	
Dominican Republic	17.2%	16.0%	Low
	US\$13,953.3 million	728,500 jobs	
Grenada	56.6%	52.2%	Very high
	US\$694.5 million	27,400 jobs	
Jamaica	34.0%	30.8%	High
	US\$5,161.2 million	374,900 jobs	
St. Kitts and Nevis	62.4%	59.9%	Very high
	US\$634.5 million	15,100 jobs	
St. Lucia	41.8%	41.8%	High
	US\$1,069.8 million	32,600 jobs	
St. Vincent and the Grenadines	45.5%	42.1%	Very high
	US\$368.1 million	18,600 jobs	
Sint Maarten	45.0%	N/A	Very high
	US\$474.0 million		
Trinidad and Tobago	7.6%	9.5%	Low
	US\$2,013.4 million	59,000 jobs	
Turks and Caicos	40.0%	N/A	High
	US\$445.2 million		

Source: World Travel and Tourism Council (2019) 2019 Annual Research: Key Highlights.

<https://www.wttc.org/economic-impact/country-analysis/country-data/>

2. Methodology and data

This report is a summary of main findings from the Firm Resilience Survey which collected data from 1413 firms in the tourism industry in 13 countries in the Caribbean between March-November 2020. The data collection was financed by the GFDRR with the objective of better understanding how natural hazards – large and small, affect the tourism industry in the Caribbean. It was collected to inform *360° Resilience: A Guide to Prepare the Caribbean for a New Generation of Shocks* (Rozenberg, et al. 2021) to make recommendations on how Caribbean countries can invest resources to strengthen resilience in the region.

The Firm Resilience Survey is designed to collect information from private businesses focusing on i) dependence on and reliability of critical and non-critical infrastructure, ii) suppliers and supply chain disruptions, iii) impacts of recent disasters – coping and long-term effects, iv) firm level preparedness and management of shocks and interruptions caused by natural hazards. The survey is customized depending on the context and research questions. In the Caribbean, because of the focus on the tourism industry, there is a particular emphasis on client profile and origin and air and boat infrastructure, for example.

The section of the questionnaire capturing data on impacts of recent disasters – coping and long-term effects focused on the recent disaster to have affected the region, including Hurricane Irma, Hurricane Maria, Tropical Storm Dorian, etc. Table 2 summarize what hazard event is asked about in what country.

Table 2. Specific disasters covered in the questionnaire

Country	Date	Type	Name
Antigua and Barbuda	6/9/2017	Storm	Hurricane 'Irma'
Bahamas	1/9/2019	Storm	Tropical cyclone 'Dorian'
Dominica	18/09/2017	Storm	Hurricane 'Maria'
Dominican Republic	20/09/2017	Storm	Hurricane 'Maria'
Jamaica	27/09/2016	Storm	Hurricane Matthew
Saint Kitts and Nevis	6/9/2017	Storm	Hurricane 'Irma'
Saint Lucia	28/09/2016	Storm	Hurricane Matthew
Saint Vincent and the Grenadines	29/11/2016	Flood	Flood
Sint Maarten	8/9/2017	Storm	Hurricane 'Irma'
Trinidad and Tobago	19/10/2018	Flood	Flood
Turks and Caicos	08/09/2017	Storm	Hurricane 'Irma'

2.1. Sampling

The sample was drawn to achieve representativeness at the country level as well as the regional level. To be able to say something about different sectors within the tourism industry, the sampling was stratified by three sectors, including hotels and accommodation, restaurants and bars, and a third sector including rental, taxi and tour companies, attractions and souvenir shops (referred to in this report as hotel, restaurant and tour/transport sectors). Since there was no comprehensive list of firms operating in the tourism industry readily available to sample from, the firm hired to collect data created a sampling frame from scratch by contacting relevant organizations and websites.

Once the firm is selected for inclusion in the survey, every effort was made to interview the firm. The firm study's response rate was low due to the COVID pandemic, and replacements were done. The replacement was only conducted where the replaced firm had to be from the stratum.

Figure 1 is a map of sampled and interviewed firms. Table 3 compares the sample, as drawn from the sample frame with the sample which was interviewed and is assessed in this study, by country and sector.

Due to the study's sampling design, which is not self-weighted, to make the survey estimates representative of the population, it is necessary to apply weights to selected firms during analysis. Regional weights are applied to all the statistics representing regional averages while country weights are applied to all country level statistics.

Figure 1. Map of sampled firms (blue dots)



Table 3. Sample

Country	Hotels & Accommodation		Restaurants & Bars		Tours & Transport		Total	
	Sampled	Actual	Sampled	Actual	Sampled	Actual	Samples	Actual
Antigua and Barbuda	36	26	33	37	11	24	143	87
The Bahamas	52	20	15	12	13	17	112	49
Barbados	42	23	20	31	18	31	134	85
Dominica	47	44	21	22	12	15	146	81
Dominican Republic	25	103	28	150	27	202	333	455
Grenada	29	41	29	25	22	34	146	100
Jamaica	45	21	21	74	14	26	175	121
St. Maarten	43	48	21	25	16	22	153	95
St. Kitts & Nevis	23	32	30	16	27	31	128	79
St. Lucia	34	24	20	11	26	36	115	71
St. Vincent	45	44	14	17	21	32	141	93
Trinidad & Tobago	34	41	32	25	14	20	146	86
Turks & Caicos	33	3	30	3	17	5	86	11
Total	488	470	314	448	238	495	1958	1413

2.2. Summary statistics

Firm characteristics were captured during data collection and are summarized in Table 4. The data covers age, size and ownership arrangement of firms. Some general conclusions can be made:

- Demand in low season (May-November) is about half of that in high season (December- April).
- Despite the large drop in demand in the low season, firms stay open.
- The drop in demand in the low season is driven by reduced number of non-Caribbean tourists.
- A vast majority of firms are domestically owned.
- Most firms operate in a highly competitive environment with more than 10 firms offering similar services nearby.

Table 4. Descriptive statistics on firm characteristics

VARIABLE	Obs.	Mean	SD	Min	Max
Age of business	1,413	13.7	12.9	0	106
Open during low season	1,413	1.0	0.1	0	1
Type of firm					
Public or public-private	1,413	1.4%	-	1	0
Private domestically owned	1,413	96.8%	-	1	0

Private foreign owned	1,413	1.8%	-	1	0
Number of employees (full time)	1,410	16.8	40.5	1	600
Number of employees (part time)	1,411	3.4	11.4	0	200
Monthly operational costs (US\$)	856	26,289	68,494	7	681750
Monthly sales high season (US\$)	807	61,834	164,687	6	1850000
Monthly sales low season (US\$)	807	31,317	82,535	3	765400
Daily clients, high season	1,412	107.8	534.8	1	12500
Daily clients, low season	1,386	51.0	323.9	0	11000
Point of sale					
Before client arrives	1,413	23.8%		1	0
Upon client arrival	1,413	32.1%		1	0
After client received service	1,413	44.0%		1	0
Number of competitors					
Many (more than 10)	1,413	82.3%		1	0
Few (10 or less)	1,413	15.8%		1	0
No other firms	1,413	1.9%		1	0
Origin of clients:					
Domestic tourists, high season (share)	1,412	28.0%	26.9%	0	100
Regional tourists, high season (share)	1,412	16.9%	16.3%	0	100
International tourists, high season (share)	1,412	46.5%	30.8%	0	100
Domestic tourists, low season (share)	1,400	36.9%	31.0%	0	100
Regional tourists, low season (share)	1,400	16.2%	16.6%	0	100
International tourists, low season (share)	1,400	37.5%	30.5%	0	100
Suppliers					
Number of food suppliers	1,413	3.1	3.7	0	31
Number of beverage suppliers	1,413	2.1	2.7	0	40
Total number of suppliers (food and beverage)	1,413	5.2	5.7	0	43

3. Infrastructure dependence and reliability

The Caribbean tourism industry is highly dependent infrastructure to keep their business operating. Firms depend on air, boat, and road infrastructure to enable transportations of clients and to access supplies and services. Figure 2 and Figure 3 indicate the share of clients that access the firm using air and boat infrastructure respectively. Almost all firms depend on air transport to access clients and about three quarters of firms access clients via boat and cruise transportation. Once the clients have arrived in the country, 94 percent of firms report that clients use roads to access the firm.

Figure 2. Share of clients accessing business by air

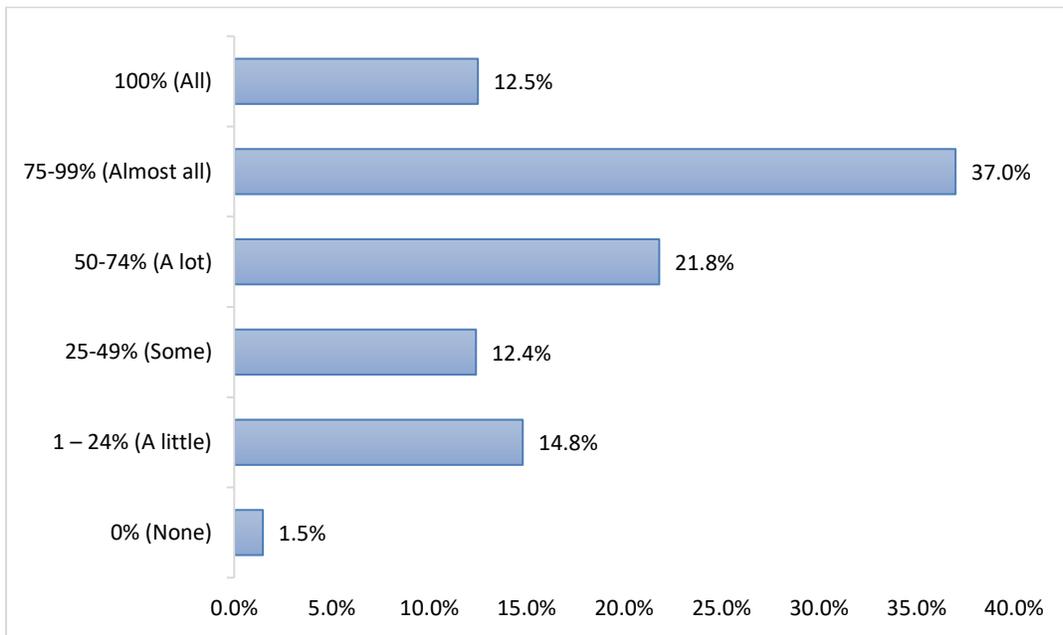


Figure 3. Share of clients accessing business by boat or cruise

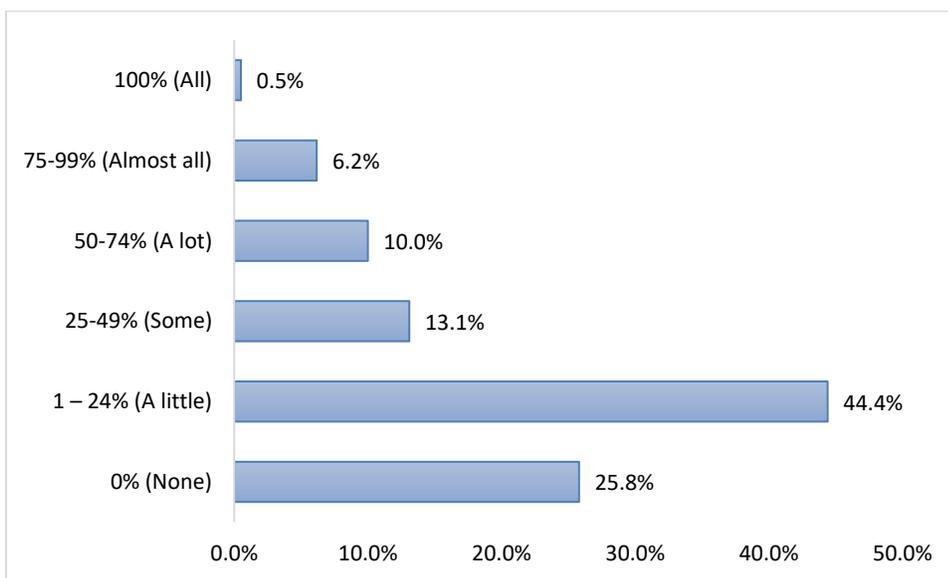
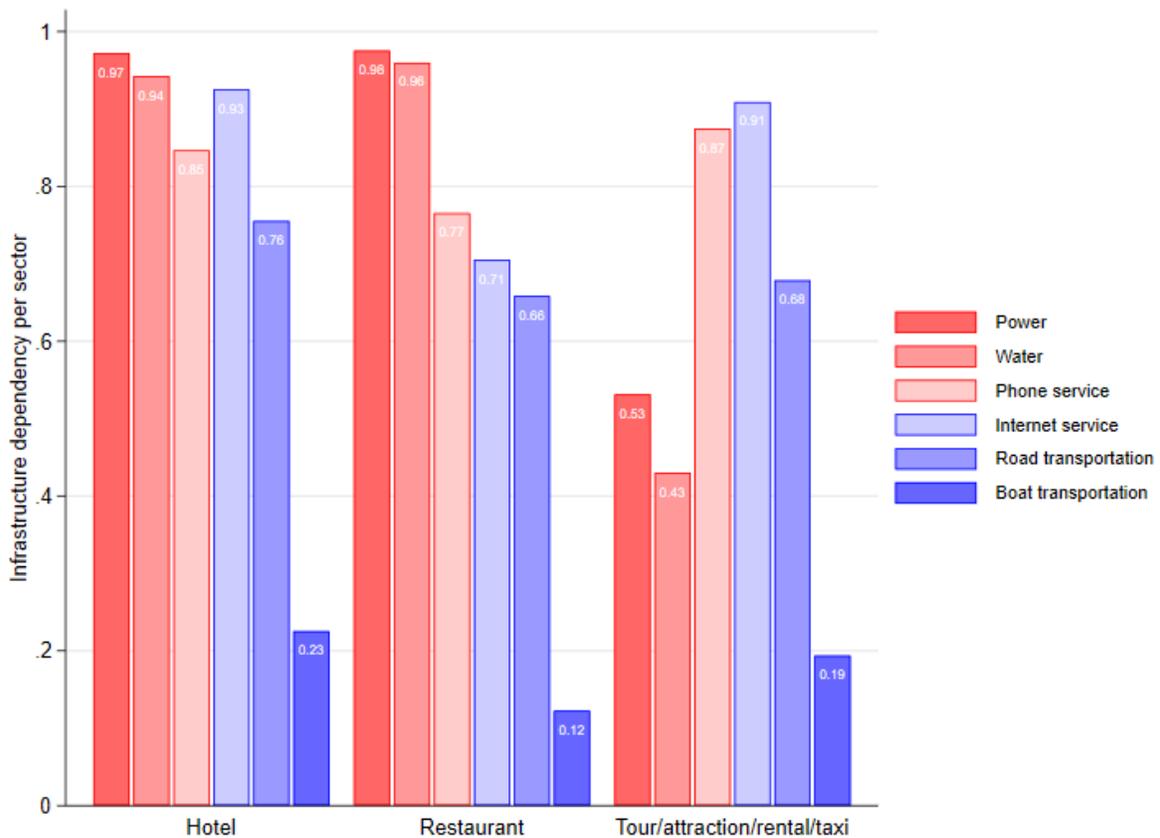


Table 5. Dependence on infrastructure to operate and ownership of backup infrastructure

VARIABLE	Obs.	Mean	SD	Min	Max
Depends on electricity	1,413	88.3%	32.2%	0	1
Depends on water	1,413	84.5%	36.2%	0	1
Depends on phone service	1,413	81.6%	38.8%	0	1
Depends on internet service	1,413	82.2%	38.3%	0	1
Depends on road transportation	1,413	69.5%	46.0%	0	1
Depends on boat transportation	1,413	17.2%	37.8%	0	1
Water tank ownership	1,268	72.3%	44.8%	0	1
Power generator ownership	1,169	56.9%	49.5%	0	1

Businesses are also dependent on other infrastructure services to operate – over 80 percent of firms indicate they rely on electricity, water, phone and internet services to maintain revenue (Table 5). There are some differences across sectors – hotel and restaurants rely heavily on power and water, while tour/transport companies are more dependent on communication services, such as internet and phone services are more important (Figure 4).

Figure 4. Infrastructure dependency per sector

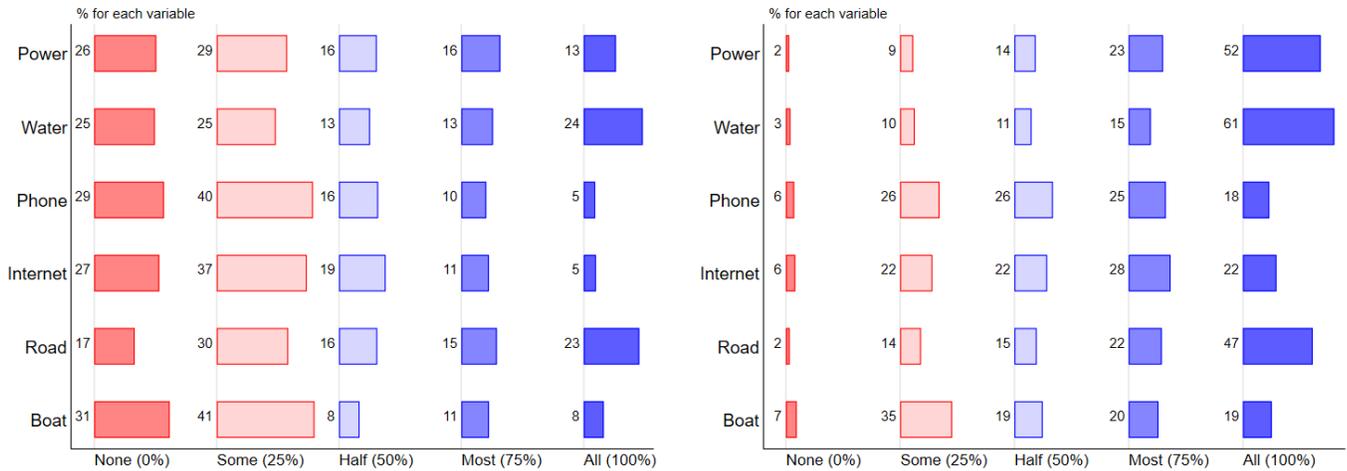


Notes: Numbers in the bars denote the share of firms that says to be dependent on a specific type of infrastructure. A firm can rely on multiple infrastructure types simultaneously.

To understand firms' dependency on different services, they were asked to approximate revenue loss given disruptions of different lengths, in the absence of back-up infrastructure. Firms report that if power infrastructure is disrupted for one day, 45 percent, would experience a drop in daily revenue by 50 percent or more (Figure 5). Meanwhile, 26 percent will be able to maintain sales during a day's power outage. For power disruptions lasting more than a week, the share of firms experiencing a 50 percent drop or more in daily revenue increase to 89 percent. Very few firms can maintain daily revenue for longer outages of any service they depend on. But while many firms can maintain sales (albeit lower) with extended phone, internet and boat transportation disruptions, power, water and road disruption result in complete shutdown of business for between 47 and 61 percent of firms.

Figure 5. Daily revenue that firms expect to lose (in the absence of back-up infrastructure) if...

... infrastructure they depend on shuts down for one day ... infrastructure they depend on shuts down for one week

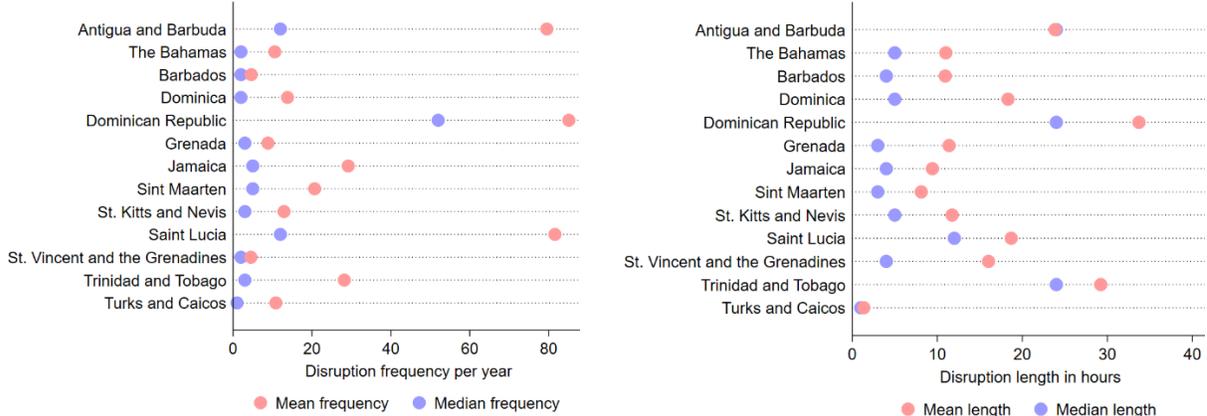


Notes: Numbers shown before each colored bar represents the share of firms corresponding to each answer.

3.1. Disruptions of water and energy infrastructure

Disruption of water services are common occurrence for firms in the tourism industry in the Caribbean. On average firms experience 41 disruptions per year—about one outage every 9 days when equally distributed over a year—and lasting, on average, about 19.3 hours. These large averages are driven by a large variance in reporting, both in terms of frequency and duration. The median of outages is 6 per year and median length of disruption is 6 hours. Among the countries that experience the most disruptions per year are Antigua and Barbuda, Dominican Republic and Saint Lucia with 75, 85 and 81 disruptions per year respectively—for firms in the Dominican Republic this implies experiencing one disruption every 4.3 days. Antigua and Barbuda, Dominican Republic and Trinidad and Tobago experience on average longer disruptions compared to other Caribbean countries with 26, 32.6 and 29.3 hours respectively (Figure 6).

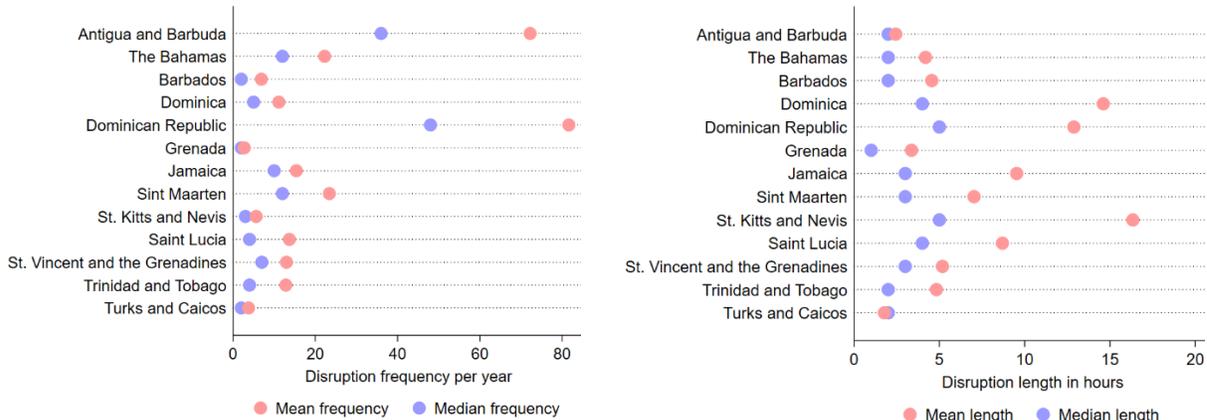
Figure 6. Number of water disruptions per country per year vs. how long they last



Notes: Excluding outliers for frequency and length

Reliability of energy is also a problem for tourism industry in the Caribbean. Firms experience on average 37 power disruptions per year, lasting, on average, about 8.7 hours. There is a large variance in reporting; median outage frequency and duration, respectively, are 12 per year and 3 hours per outage. Antigua and Barbuda and the Dominican Republic have the largest number of power disruptions per year with 68 and 81 disruptions per year respectively, corresponding to one disruption every 5.4 days in Antigua and Barbuda and 4.5 days in the Dominican Republic. Disruptions in the Dominican Republic are also among the lengthiest in the region, lasting about 12.5 hours. Firms in Dominica and St. Kitts and Nevis experience fewer power disruption than other countries, but they are longer lasting than average at 11.6 and 15.7 hours, respectively (Figure 7).

Figure 7. Number of power disruptions per country vs. how long they last



Notes: Excluding outliers for frequency and length

Most firms indicate that power (62 percent) and road disruptions (71 percent) are more frequent during the hurricane season (Figure 8). For water, 57 percent of firms indicates there is no seasonal difference in frequency of outages, while 43 percent report that there are more during the hurricane season. However,

disruptions happen for many other reasons than adverse weather events. For water and energy, very few firms report that more than 60 percent of disruptions are caused by natural hazards (Figure 9). When accounting for the range in the firms' responses, average share of disruptions caused by natural hazards is 15 and 26 percent for water and between 13 and 25 percent for energy.

Figure 8. Infrastructure disruptions and seasonality

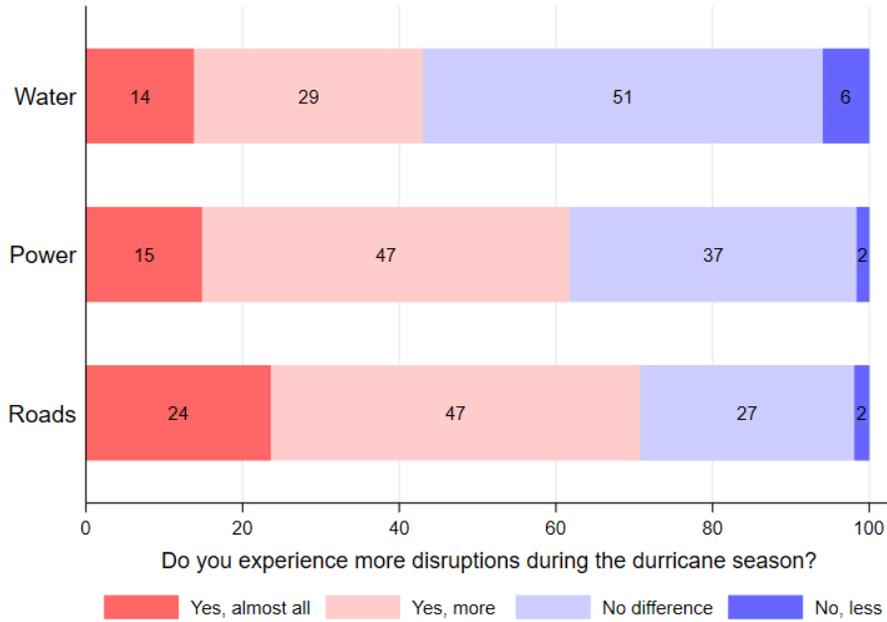
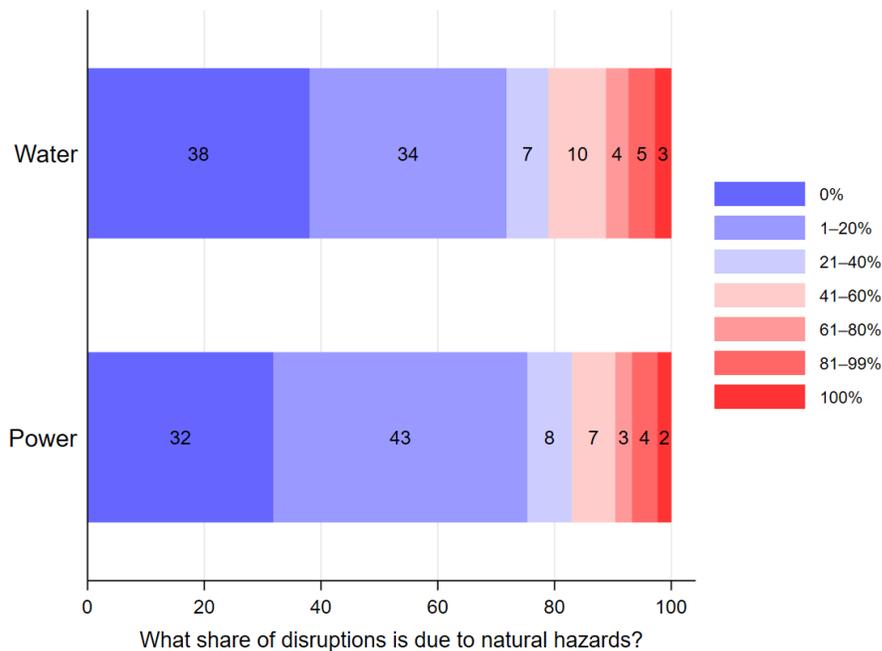


Figure 9. Share of outages caused by natural hazards



3.2. The cost of disruption and the role of backup infrastructure

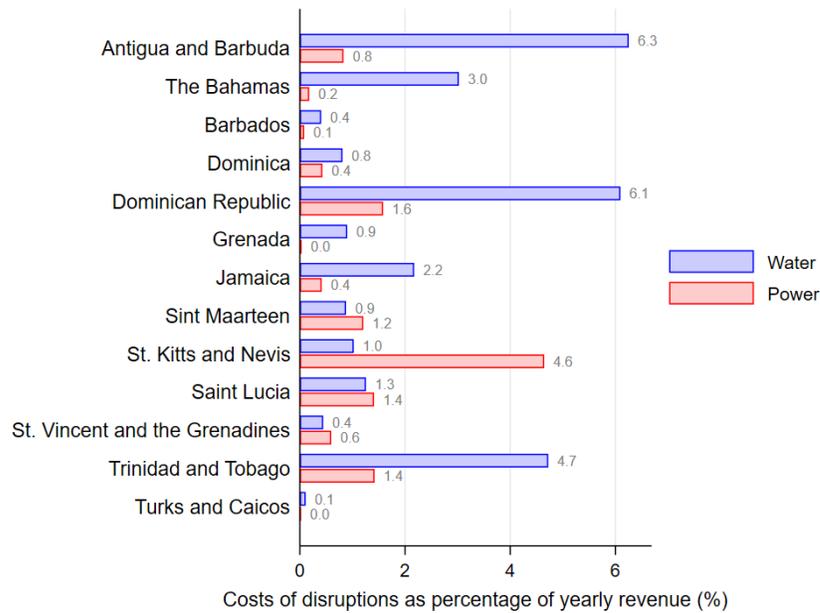
Infrastructure disruptions translate into sales losses for firms. To calculate the sales losses from disruptions we combine the expected revenue loss associated with disruptions (Figure 5), with the length and frequency of disruptions firms experience in an average year (Figure 6 and Figure 7) and information on firms' yearly sales. Here we assume the revenue loss associated with infrastructure disruptions is caused by forgone sales, not increased costs. We also assume that firms are unable to cope with disruptions using backup infrastructure. As we only have information about the expected revenue loss for one or seven days of infrastructure disruptions (based on the information from Figure 5), we employ the following cut-off to assign revenue loss:

- If the disruptions last for four days or shorter, we employ the revenue loss associated with one day of infrastructure disruption.
- If the disruption lasts for more than four days, revenue loss for one day of infrastructure disruption is employed for the first four days of the disruption and revenue loss associated with seven consecutive days of disruption is employed for the remaining days of disruption.

Results indicate that, due to water disruptions, an average firm loses about US\$16,180 per year, corresponding to 3 percent of their yearly sales. Power outages result in losses in revenues equivalent to US\$5,136 or 1.1 percent of yearly sales. Firms in Antigua and Barbuda, the Bahamas, the Dominican Republic and Trinidad and Tobago incur the largest losses due to water disruptions. Power disruptions have the largest impact on firms in Saint Kitts and Nevis, followed by firms in Dominican Republic, Saint Lucia and Trinidad and Tobago (Figure 10).

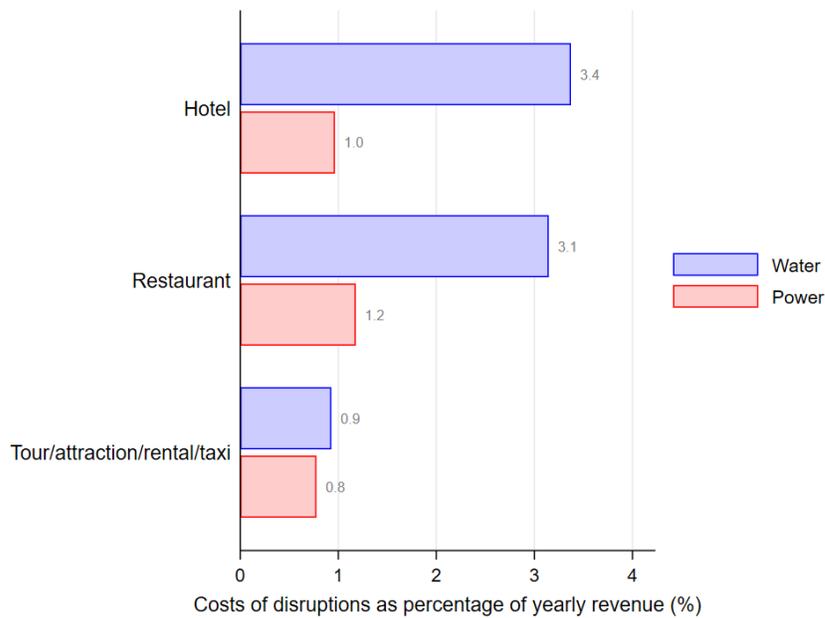
Since hotels and restaurants are more dependent on water, firms in those sectors experience larger losses due to water outages, corresponding to 3.4 percent of annual revenue for hotels (Figure 11). For power outages the difference between the sectors is smaller – hotels, restaurants and tour companies all lose revenue corresponding to around 0.8-1.2 percent of annual revenue due to power outages.

Figure 10. Cost of water and energy disruptions as a share of annual revenue, by country



Notes: Forgone revenue due to disruptions in water and power infrastructure is calculated as percentage of yearly sales.

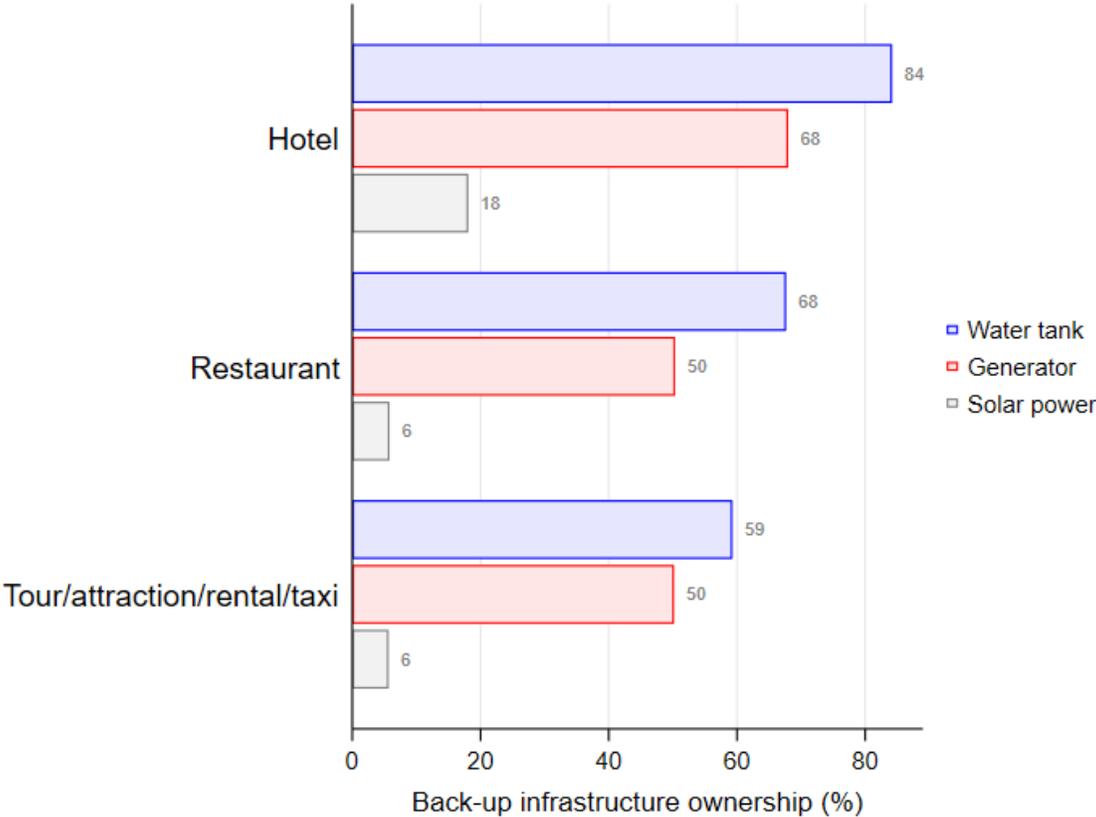
Figure 11. Cost of water and energy disruptions as a share of annual revenue, by sector



Notes: Forgone revenue due to disruptions in water and power infrastructure is calculated as percentage of yearly sales.

Back-up infrastructure can help firms overcome periods of shortage. Water tanks and generators are common in the region – 72 and 57 percent of firms indicate owning a water tank and a power generator, respectively. Solar power is present in the region, but to a lesser extent; 10 percent of firms indicate to rely on solar power as a form of energy. Solar power is most common in the hotel sector. Water tanks and generators are common in all three sectors (Figure 12).

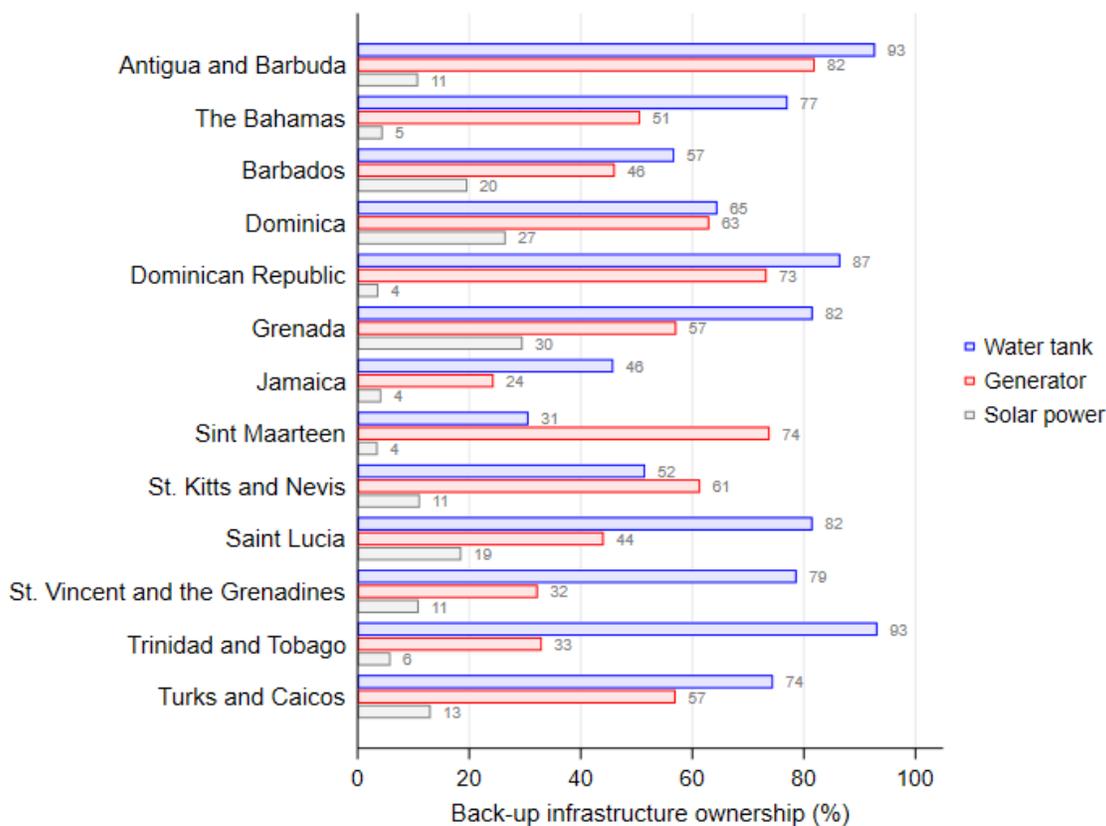
Figure 12. Back-up infrastructure ownership by sector



Notes: Also includes those firms that indicate to use a rain-fed water tank or generator as their main source of water or electricity, respectively.

Countries with the lowest share of water tank ownership are Jamaica (39 percent) and Sint Maarten (37 percent). For all other countries at least 50 up to 94 percent of firms (in Trinidad and Tobago) indicate to own a water tank. Countries with lowest share of generator ownership are Jamaica (21 percent), Saint Vincent and the Grenadines (30 percent), Trinidad and Tobago (33 percent) and Barbados (43 percent). For all other countries at least 50 up to 80 percent of firms (in Antigua and Barbuda) indicate to own a generator (Figure 13).

Figure 13. Back-up infrastructure ownership by country



Notes: Also includes those firms that indicate to use a rain-fed water tank or generator as their main source of water or electricity, respectively.

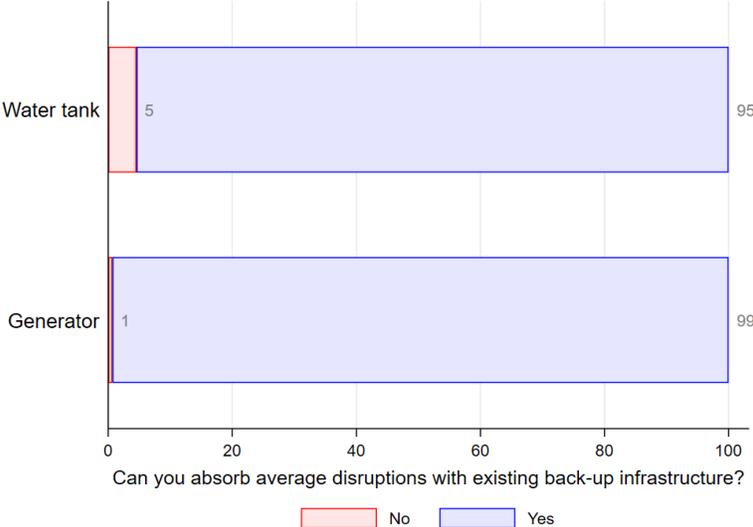
Firms that are more dependent on water and electricity for their revenue are more likely to invest in water tanks and generators, respectively. The data also shows that firms are more likely to have invested in back-up infrastructure in places where disruptions are more frequent and longer. Firms that own water tanks experience on average 47 disruptions per year, each disruption lasting, on average, 23 hours, while firms that do not own water tanks have, on average, 27 disruptions of 11 hours each per year. Firms that own generators experience, on average, 46 disruptions per year, each disruption lasting, on average, 10.5 hours, while firms that do not own a generator experience, on average, 25 disruptions, of 6 hours each, per year. All these differences are statistically significant at the 1 percent level except the difference between power disruption lengths. Owning a power generator or water tank is also associated with larger firm size, in terms of number of employees and, in the case of owning a generator, higher operating costs and sales.

Back-up infrastructure will only help firms maintain business and, with that, their revenues if the disruption is shorter than the length of back-up infrastructure functionality. For example, if a water disruption last 1 day and the water tank lasts half a day, the firm will experience business disruption for half a day, even after having invested in back-up. The data shows that for the case of the tourism industry

in the Caribbean, the back-up infrastructure that firms have invested in seem to be sufficient in buffering at least the length of a “typical” water disruptions that they experience. Firms with water tanks indicate that they would last 5.9 days on average with a full water tank, which is significantly more than the average water disruption, which is 0.8 day. In the case of power disruptions, firms indicate that generators last 3.7 days on average with a full tank, while an average power disruption last 0.4 day.

Figure 14 shows that 96 and 99 percent of firms with back-up infrastructure can buffer average water and electricity disruptions that they experience, respectively. In the figure, the number of days the firms can continue business activities with a full water or generator tank is subtracted from the number of days an average shock last.

Figure 14. Most firms can last through an average shock when they own back-up infrastructure

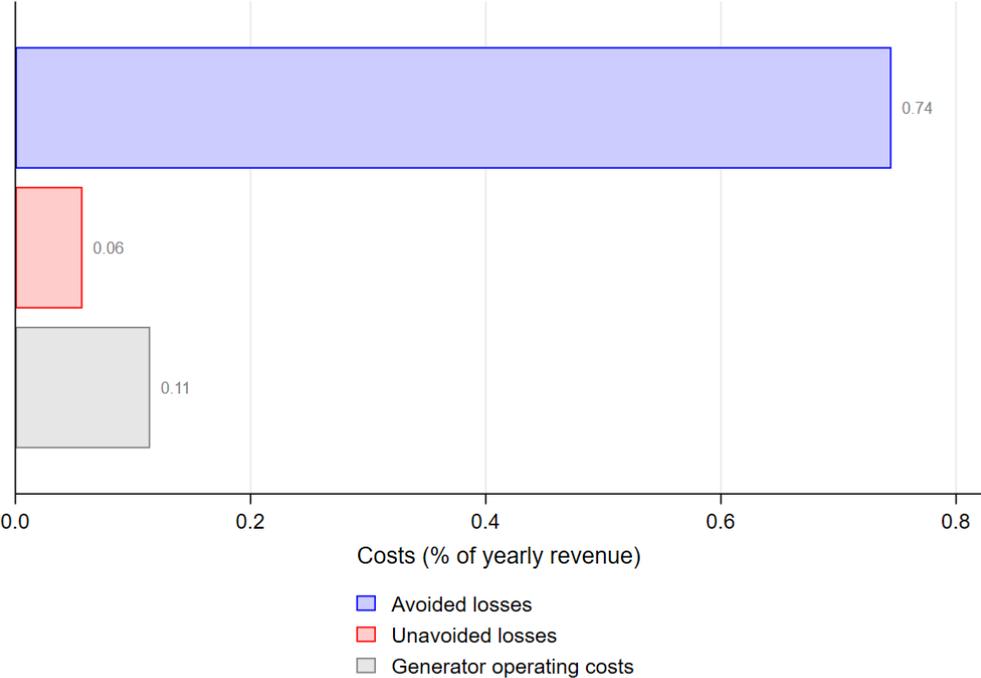


As length of disruptions are shorter than firm’s average buffer capacity, owning back-up infrastructure translates into significant avoided losses. To calculate avoided losses, we employ a similar methodology used to calculate expected losses, combining buffer length—the number of days a firm’s back-up capacity allows it to remain in business—and frequency of disruptions with the expected revenue losses and yearly sales. Whenever the average disruption length a firm experience is shorter than the buffer capacity, the disruption length is used to calculate the avoided loss. It important to note that the buffer length is conditional on having a full water tank or generator. It is also important to note that the disruption length and frequency is based on an “average year”. During a more extreme situation, backup infrastructure would not be able to buffer, and losses would be much greater.

The analysis shows that there are two groups of firms that experience losses due to power and water outage: those that do not own back-up infrastructure and those that own back-up infrastructure, but not enough to buffer disruptions. For water, firms that do not own water tanks lose, on average, about 1.1 percent of yearly revenue—or US\$9,216—to water outages. Firms that own a water tank that is not large enough to help them through the average water outages they experience lose about 0.3 percent of yearly sales—or US\$451—to water outages.

Operating water tanks and power generators is not free. The average cost of operating a power generator is US\$126 per day, which is almost twice the price of the electric grid. Figure 15 quantifies the avoided losses attributable to owning a generator (blue bar), the unavaoided losses (either due to not owning a power generator or not having the capacity to buffer the length of disruption) and the cost of operating the generator to buffer disruptions firms face. Since the avoided losses are larger than the cost of operating the generator, it makes economic sense to own a generator.

Figure 15. Costs of energy disruptions accounting for power generator ownership, as share of annual revenue



4. Infrastructure reliability index

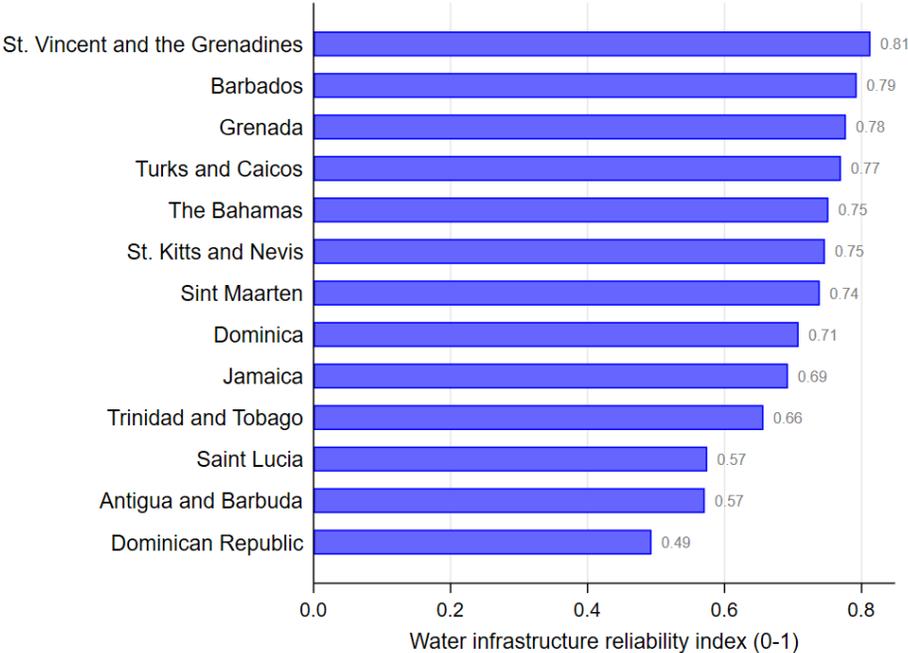
Based on the reported reliability of water and energy services—the reported outage frequency and length firms experienced presented Figure 6 and Figure 7—an infrastructure reliability index was constructed. This index is constructed following equation 1 and the same methodology is used for both water and power. In Equation 1 f_i represents the likelihood for a firm to experience an outage in, respectively, a year, a month, a week and a day in any given country. These probabilities are combined using a weight of 25 percent for each to generate a value associated with the risk of experiencing outages in any given country. For outage length, the likelihood of experiencing an outage that lasts for at least one day long and one week was calculated (represented by l_i in the equation) and combined into one assigning a weight of 50 percent to each probability. The obtained frequency and length probabilities are combined into one index (I_{sector}) for each sector (water or power) assigning differing weights to each, respectively 70 percent to frequency and 30 percent to length. We have chosen to assign a larger weight to outage frequency

since it is more indicative of the level of business disruptions that the firm faces. The aggregated value is then inverted to represent reliability of infrastructure. The index can be interpreted in the following way: the higher the risk of experiencing frequent and long outages, the less reliable the service in the country is. In a country with zero chance of disruptions, the value of the index will be 1.

Equation 1: $I_{sector} = 1 - (w_f * (\sum_i 0.25 * f_i) + w_l * (\sum_i 0.5 * l_i))$

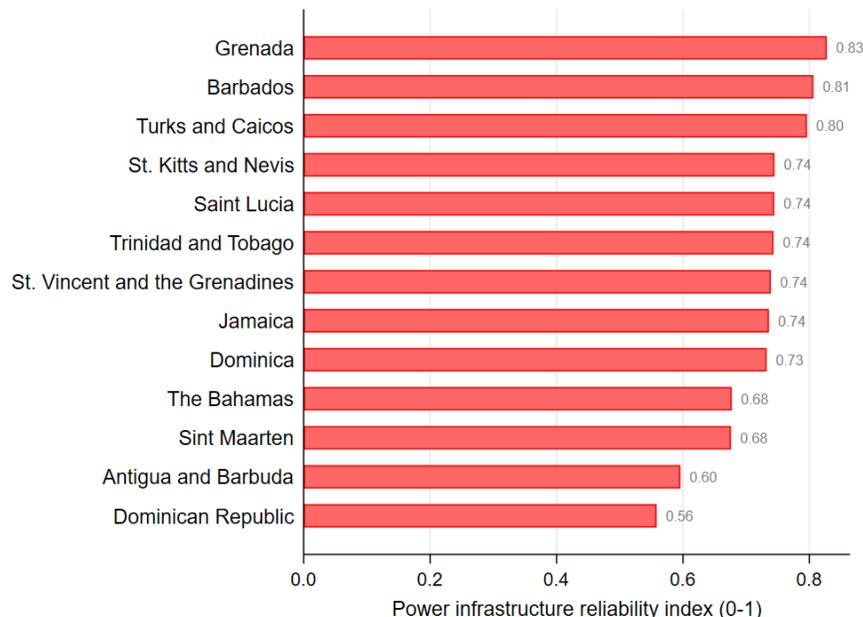
Figure 16 presents the constructed infrastructure reliability index for the examined countries. Dominican Republic has the lowest score for both water and electricity, followed by Antigua and Barbuda—implying that, water and power infrastructure in the tourism sector is, in comparison to these countries’ peers, the least reliable in these two countries. Saint Lucia has lower than average reliability in water provision but not in electricity. Most countries perform better in electricity than water service provision. Few exceptions include The Bahamas, Sint Maarten, Sint Vincent and the Grenadines and Sint Kitts and Nevis (by 0.1 point).

Figure 16. Water infrastructure reliability index



Notes: The water infrastructure reliability index per sector is calculated as follows: $I_{sector} = 1 - (w_f * (\sum_i 0.25 * f_i) + w_l * (\sum_i 0.5 * l_i))$, where w_f and w_l are the weights assigned to, respectively outage frequency and length—in this case 0.7 and 0.3, respectively—and f_i and l_i are the share of firms that, for outage frequency (f_i), experience more than one outage per year, month, week and day, and for outage length (l_i), experience outages that last for more than a day and a week.

Figure 17. Power infrastructure reliability index



Notes: The power infrastructure reliability index per sector is calculated as follows: $I_{sector} = 1 - (w_f * (\sum_i 0.25 * f_i) + w_l * (\sum_i 0.5 * l_i))$, where w_f and w_l are the weights assigned to, respectively outage frequency and length—in this case 0.7 and 0.3, respectively—and f_i and l_i are the share of firms that, for outage frequency (f_i), experience more than one outage per year, month, week and day, and for outage length (l_i), experience outages that last for more than a day and a week.

5. Supply chains

Most firms have suppliers they depend on to access essential goods to operate their business. Hotels and Restaurants are more likely than tour/transport firms to have suppliers. About 23 percent of tour/attraction firms do not have any suppliers. Most firms use primarily domestic suppliers. Between 77 and 88 percent of suppliers are domestic, between 9 and 18 percent are non-Caribbean and between 4 and 10 are Caribbean suppliers. A quarter of the firms report having experienced a supply delay in the past year. The most common reason for the delays is issues on the suppliers' end.

On average, firms have 3.1 food suppliers and 2.1 beverage suppliers. Restaurants have the highest number of suppliers, followed by hotels (Figure 18). There is quite a large variation in the number of total suppliers by country (Figure 18). The average firm can maintain sales for 11 days without receiving supplies. There is no difference across sectors.

A simple analysis indicates that firms protect themselves from supply chain disruptions by using a larger number of suppliers and by receiving smaller more frequent deliveries. Although these results are not statistically significant.

Figure 18. Number of suppliers by sector

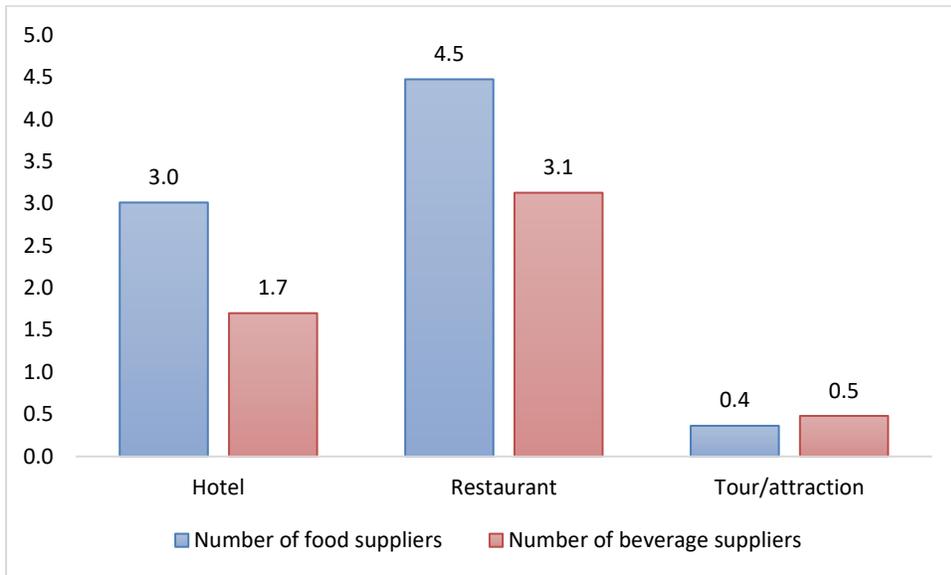
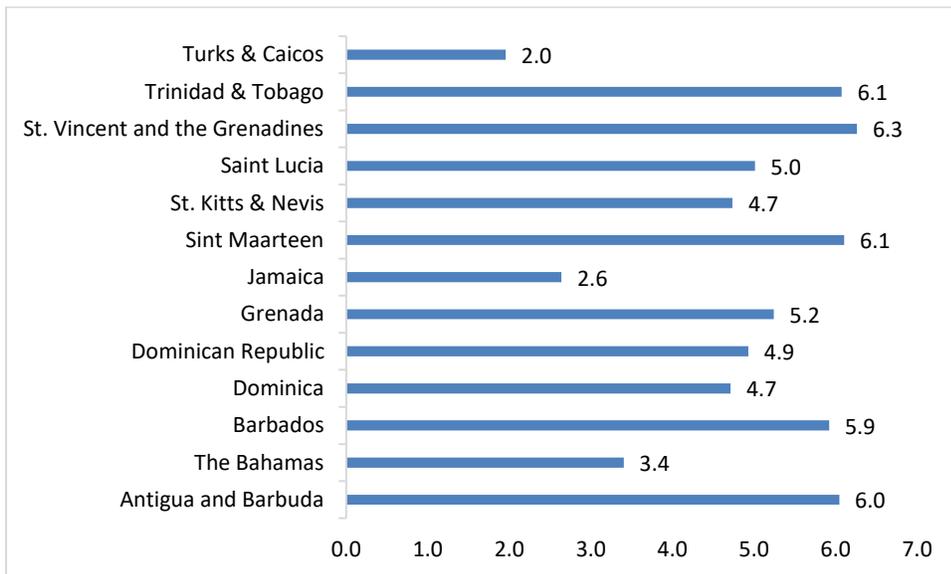


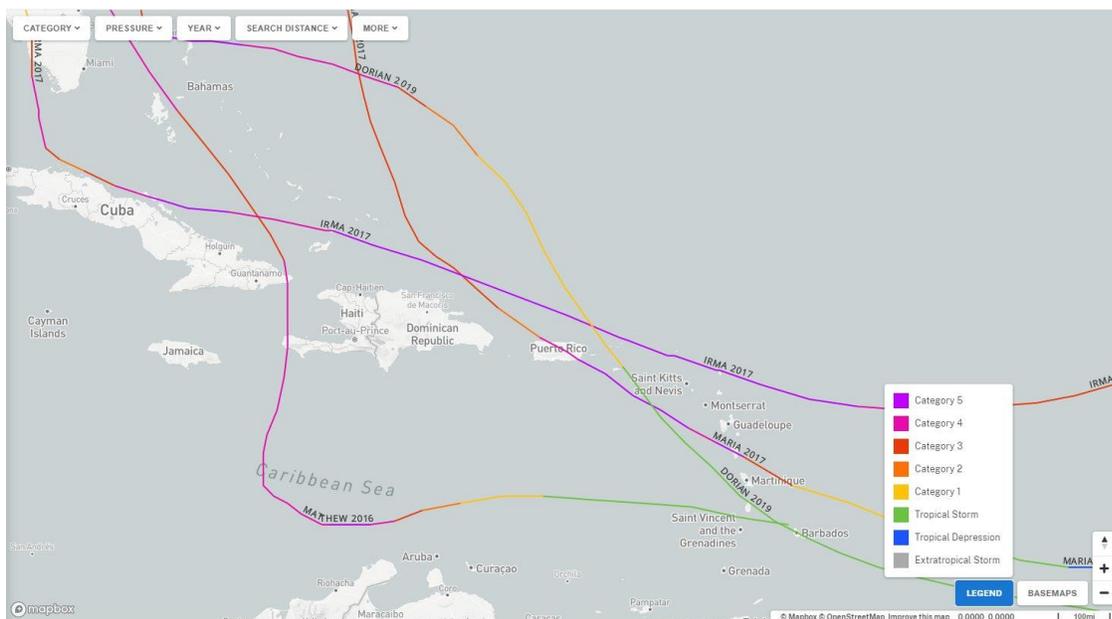
Figure 19. Total number of suppliers by country



6. The direct and indirect impact of recent disasters

When countries are hit by natural disasters, whether they are minor or major, the tourism industry is affected in various ways. Tourism firms are often located close to coastal or mountainous areas and are therefore very much exposed to natural hazards, which often result in large asset losses. Firms also experience significant losses due to the infrastructure disruptions, as discussed in section 3. There are also losses caused by reduced demand as tourists decide to cancel or reroute their travel plans. However, as tourists reroute their travel plans due to disasters, other countries can potentially benefit from unexpected influx of tourists. The section explores these different impacts and how they have affected the tourism industry, focusing on 4 major Hurricanes: Hurricane Matthew (Sept. 28, 2016 to Oct. 10, 2016), Hurricane Irma (Aug. 30, 2017 to Sep. 13, 2017), Hurricane Maria (Sep. 16, 2017 to Oct. 2, 2017) and the cyclone Dorian (Aug. 24, 2019 to Sep. 9, 2019) (NOAA 2021) as well as major floods (St Vincent and the Grenadines in 2016 and Trinidad and Tobago in 2018). The paths of the hurricanes discussed in this section are illustrated in Figure 20.

Figure 20. Paths of recent hurricanes/storms in the Caribbean



Source: NOAA's Historical Hurricanes Tracks. <https://coast.noaa.gov/hurricanes>

Some important data considerations: since the data was collected in 2020, it only covers firms that survived the disasters, not the firms that were forced to close, potentially skewing the data to exclude the worst affected firms. For the major disasters, such as Hurricane Maria in Dominica and Hurricane Irma in St Maarten, this could pose an important selection bias for the results presented here on damages and losses. Only firms located in countries that have experienced a significant disaster in recent years are included in the analysis in this section. Since no major disaster has affected Grenada and Barbados in recent years, they are not covered. The analysis is done primarily at the disaster level, applying regional weights rather than on the country level (due to the regional focus of the report and in some cases lack of observations at the country level). For example, the Hurricane Maria will be made up of Dominica and the Dominican Republic.

6.1. Direct impacts on firms – asset losses

Figure 21 shows the share of firms, that are in countries affected by disasters (as per Table 2) that report having experienced damages due to the disaster. For Hurricane Irma, 49 percent of the firms experienced damages in the countries affected, including Antigua and Barbuda, St. Kitts and Nevis, St. Maarten and Turks and Caicos. For Hurricane Maria, for 22 percent of firms in Dominica and Dominican Republic were affected. A smaller portion of firms was affected by the Hurricane Dorian in the Bahamas. This is most likely since damages of the hurricane were primarily concentrated in a few smaller islands north of the main island.

The share of firms affected by each hurricane does not tell the full story since some countries were much more affected than others (Figure 22). In Turks and Caicos and Sint Maarten, Hurricane Maria caused damages for almost all firms (100 and 98 percent respectively) and in Dominica, Hurricane Irma caused damages for 97 percent of firms.

Figure 21. Share of firms that experienced damages, by disaster

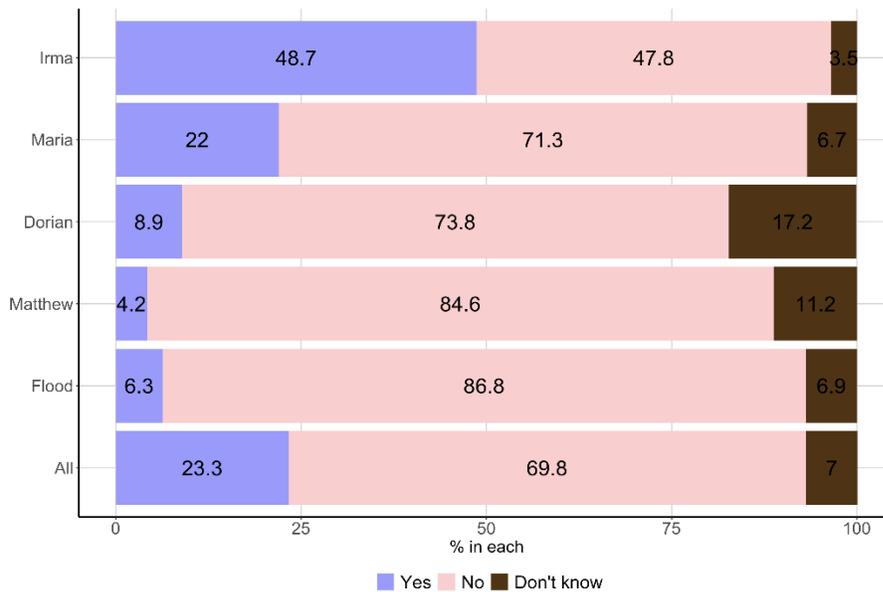
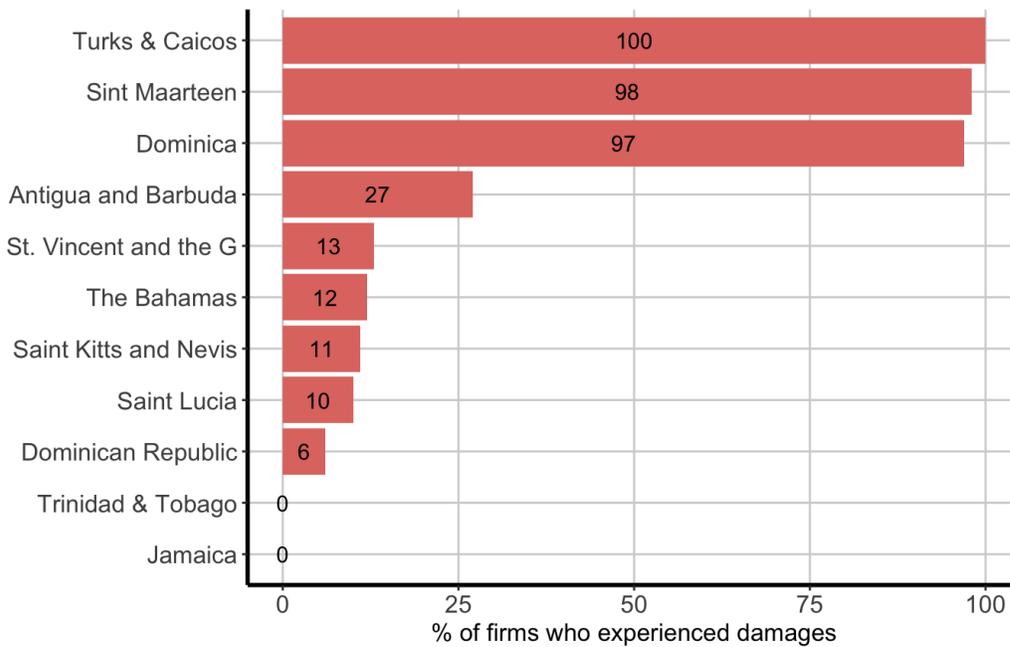
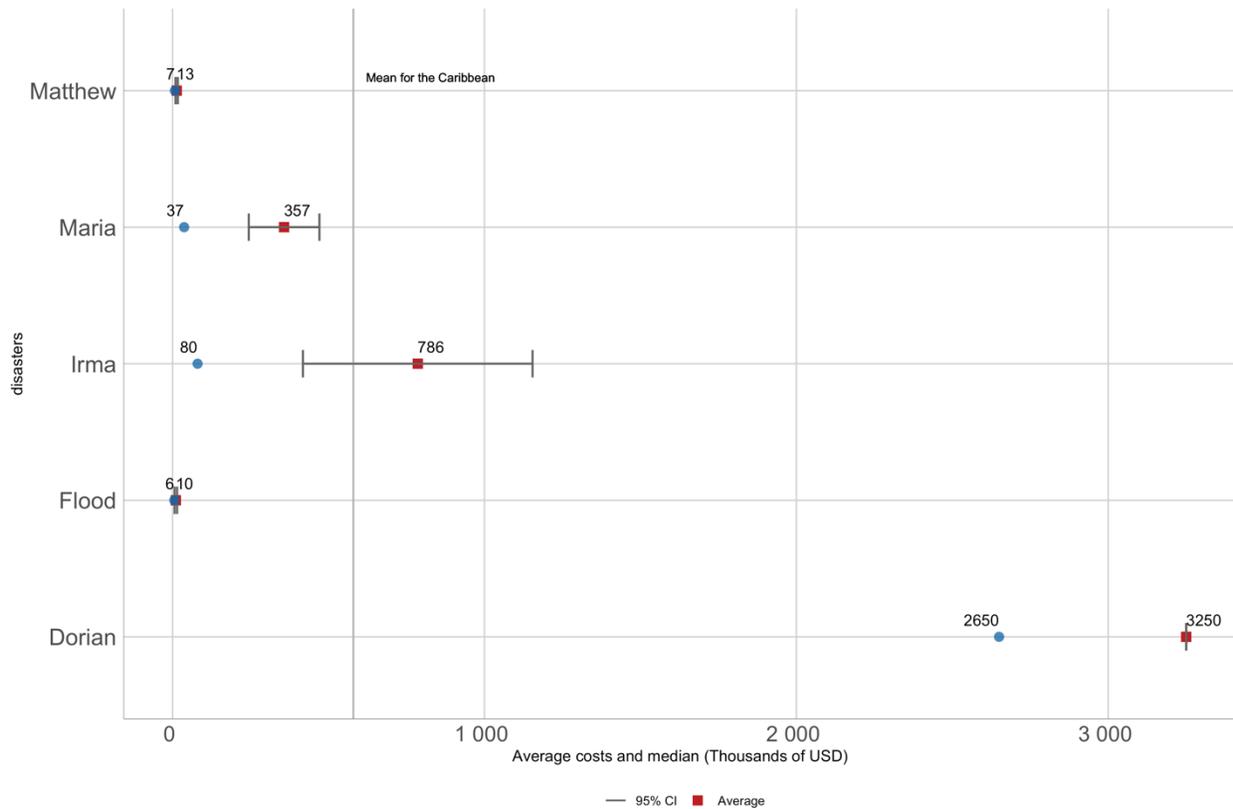


Figure 22. Share of firms that experienced damages, by country



The replacement/repair cost of damages to buildings and equipment caused by the disasters are captured at the firm level. Figure 23 contains average replacement value of damages by disaster. Hurricane Dorian, hurricane Irma, and hurricane Maria cause the largest average damage for firms at US\$ 3.25 million, US\$ 786,000 and US\$ 357,000 respectively. Although the number of firms affected by Dorian is too low to be able to say anything with confidence about the results. In addition, since results are driven by a few firms reporting very high losses, the median cost of damages is much lower for hurricanes Irma (US\$80,000) and Irma (US\$37,000). The countries with the highest replacement cost per firm is Sint Maarten at US\$870,000 per firm on average, Dominica at US\$446,000 and Turks and Caicos at US\$134,000. Sint Maarten and Turks and Caicos were both affected by Hurricane Irma, while Dominica was affected by Hurricane Maria – both storms happened in 2017.

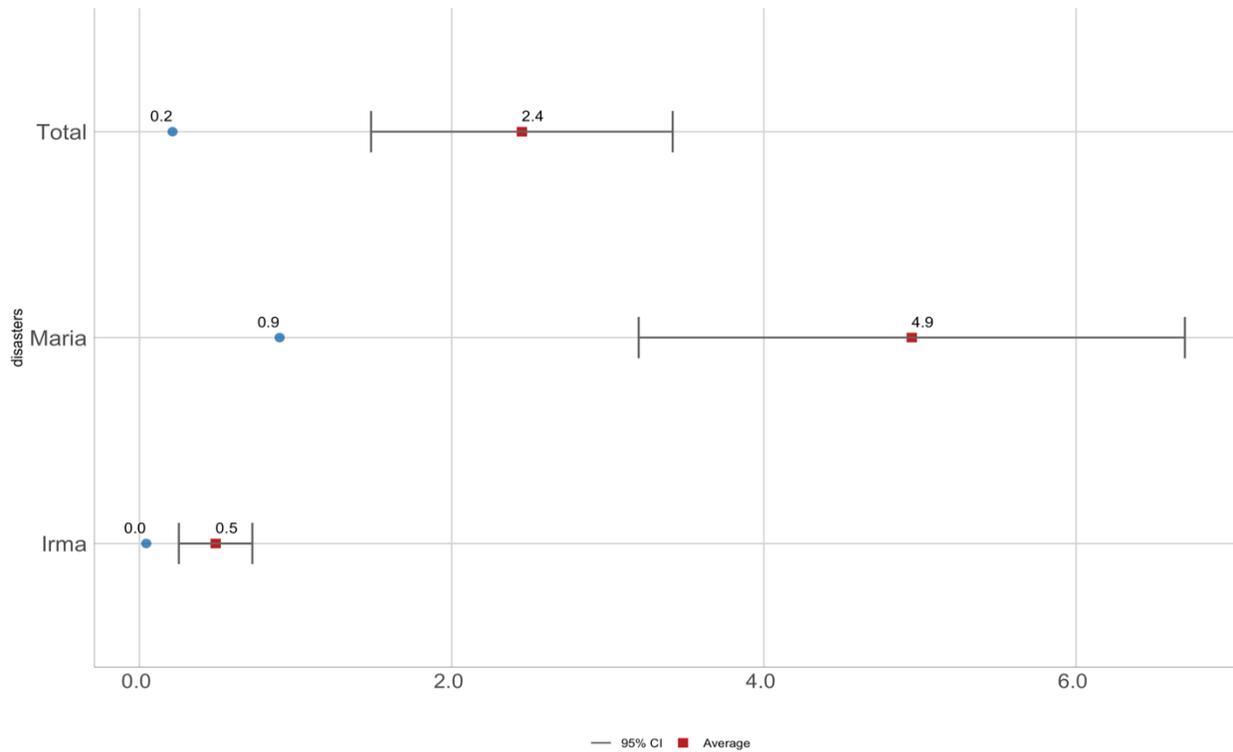
Figure 23. Average value of damages for affected firms, by disaster



Notes: (1) Round dot indicates the median. (2) Observations for some of the disasters are small and due to very nature of the limited number of firms who suffered damages. (3) values were winsorized at the 98th percentile.

Figure 24 compares the total damages to annual revenues for Hurricane Maria and Hurricane Irma. The largest replacement costs are attributed to hurricane Maria, with an average of 4.9 times (or 490 percent) yearly sales of affected firms. Hurricane Irma caused damages equivalent to 0.5 times (or 50 percent) the yearly sales of affected firms. Since losses caused by Hurricane Irma were larger in absolute terms, but smaller in relative terms, it is indicating that the firms affected were on average larger than those affected by Hurricane Maria.

Figure 24. Median - Mean ratio of value of damages with respect to annual revenue



Note: (1) Less than 85% of the sample was available for doing these calculations due to lack of observations for the cyclone Dorian, hurricane Matthew and the Floods, , as well as missing values for monthly sales.(2) The ratios were winsorized at the 98th percentile.

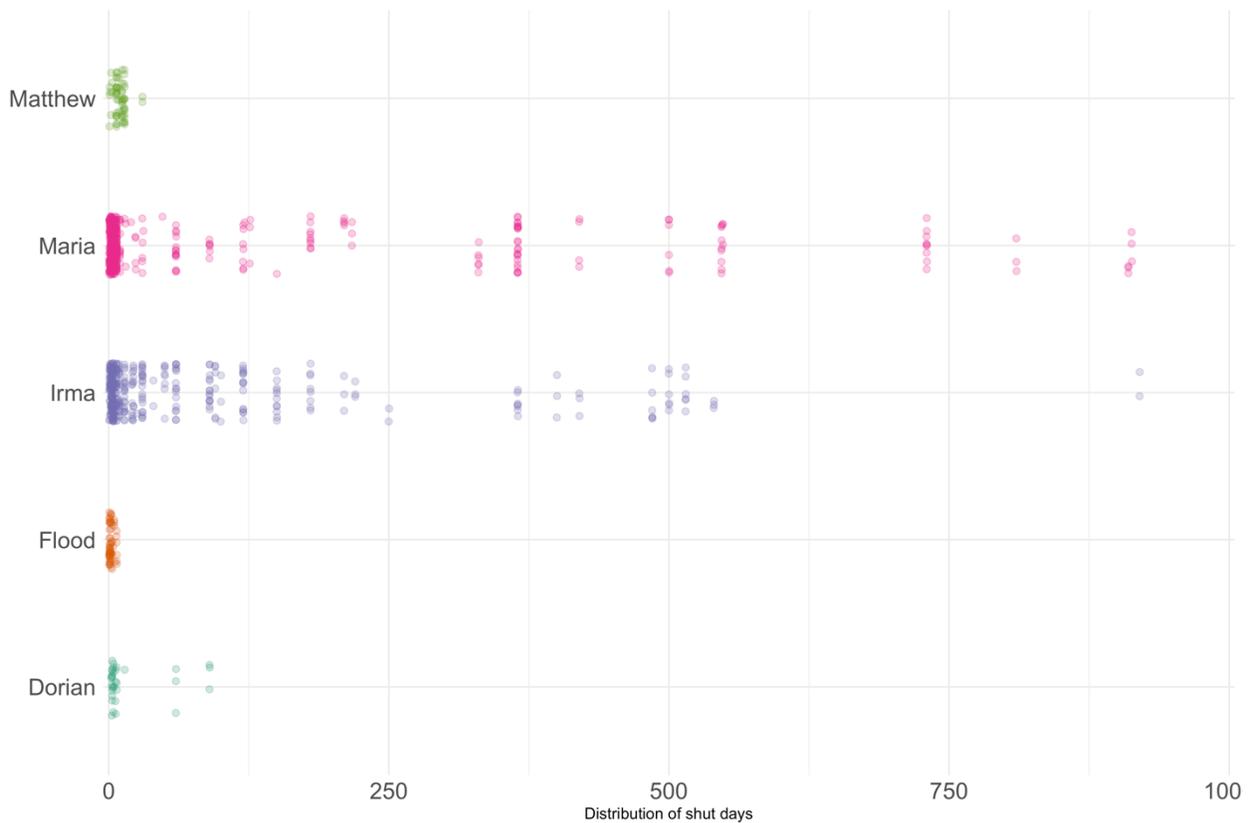
6.2. Indirect impacts on firms – sales losses

A major disaster can cause businesses shut down for extended periods of time. Firms can decide (or be forced) to shut down to make time for replacing and repairing assets that have been lost or damaged in the disaster. Firms may also be unable to keep the business open because of the lack of tourists. Tourists maybe unable to travel to the country because vital infrastructure is damaged, or they may not want to travel to a country that has been affected by a hurricane. In our data, about 42 percent of firms were forced to close due to the disasters. Most of the ones that were forced to shut down could reopen within the first seven days after the disaster. However, some disasters caused prolonged closures for firms. Notably, 53 and 31 percent of firms stayed shut for longer than 7 days after hurricane Maria and Irma respectively. Table 6 shows the average number of days that firms were forced to stay shut due to respective disaster. To further illustrate the delay in reopening businesses for hurricane Maria and Irma compared to other disasters, Figure 25 plots the time closed in days by firm and disaster.

Table 6. Days shut because of the disaster

Stats for shut days	Dorian	Flood	Irma	Maria	Matthew	Caribbean
% of firms shut	31	15	66	44	23	42
Average days shut	16	2	77	86	10	70
% shut for 7 days or less	81	100	47	69	48	62
% shut for 1 month or less	85	100	67	75	100	76

Figure 25. Days shut down by firm and disaster



Prolonged closures are naturally associated with sales losses for firms. Sales losses may continue after the firm opens again because of extended reconstruction of vital infrastructure and attractions needed for the tourists to come back. This may take time. The surveyed firms were asked about the impact of the disaster on revenues over time. Table 7 and Figure 26 illustrates sales recovery by disaster. As expected, recovery was longer for hurricane Maria and Irma than for the other disasters. Average delay in sales recovery after hurricane Irma is 131 days and 65 days for hurricane Maria. The firms were asked about the main contributing factors to the reduction in sales. The five main reasons were halted international air transport (44.8 percent), a negative perception of country due to disaster (37.6 percent), cruise ships

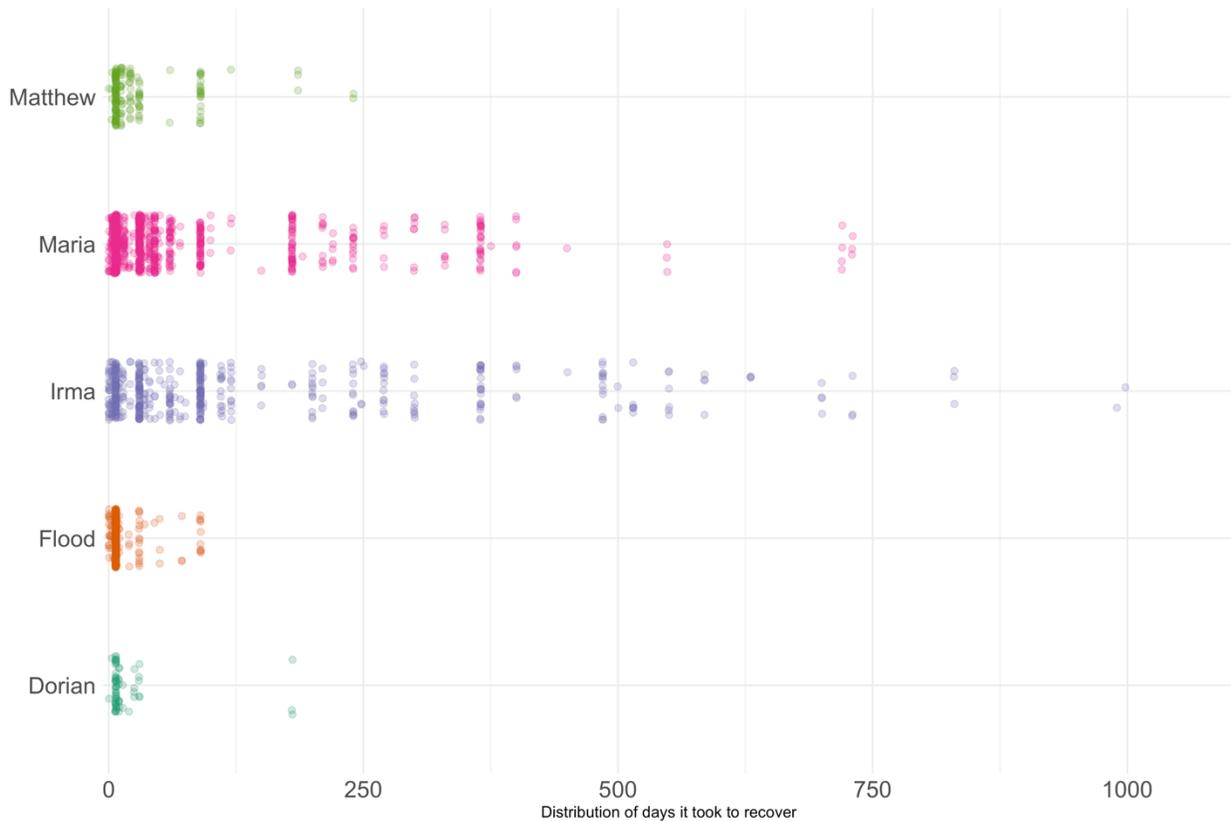
that rerouted or stopped coming (26.1 percent), travel agencies that rerouted or stopped sending tourists (25.5 percent), and damages to touristic attractions (24.4 percent).

Table 7. How many days it took to recover to pre-shock revenue levels

Statistics	Dorian	Flood	Irma	Maria	Matthew	Caribbean
Average days to recover	17	11	131	65	29	68
% recovered in 7 days or less	64	87	25	37	48	44
% recovered in 1 month or less	96	95	43	58	83	64
% recovered in 6 months or less	100	100	76	90	97	89

Note: Firms for which sales had not recovered at the time of the interview are not included here.

Figure 26. Days needed to recover to pre-shock revenue levels

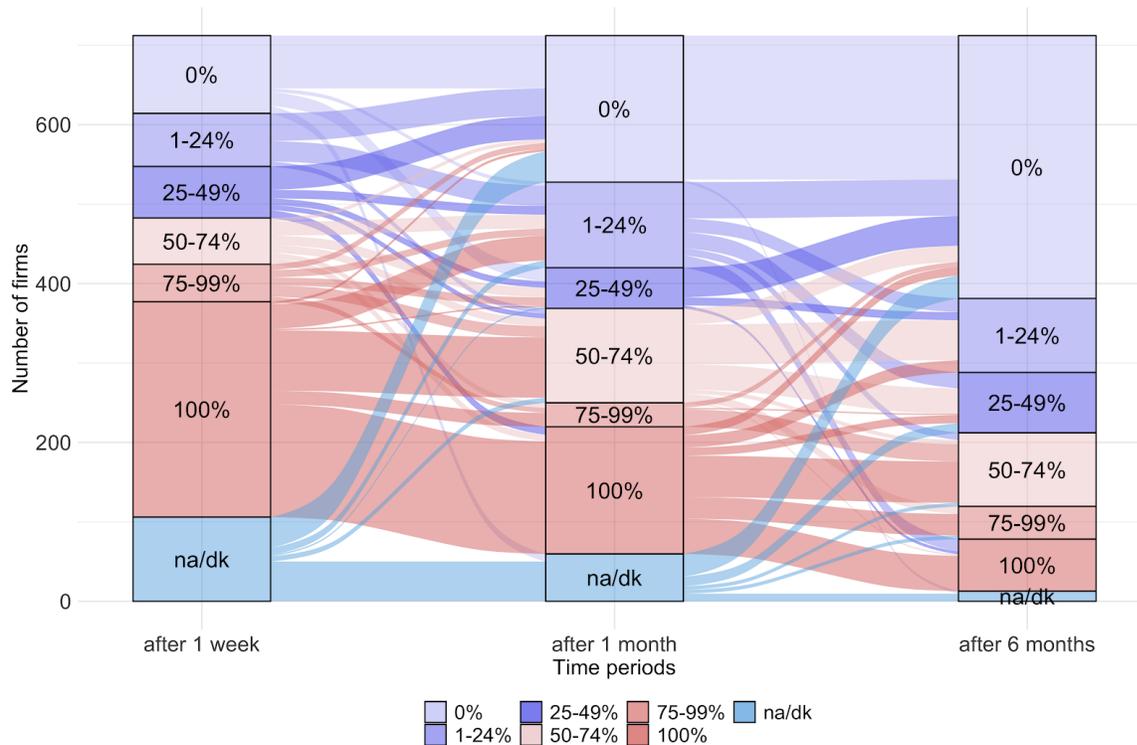


Note: Firms for which sales had not recovered at the time of the interview are not included here.

Firms were also asked about the magnitude of sales reductions 7 days after the disaster, one month after the disaster and 6 months after the disaster. In Figure 27 one can follow the evolution of sales in the aftermath of the disaster for the affected countries. For the first 7 days, more than 50 percent of firms reported a decrease in revenues. More than 30 percent of them saw a 100 percent decrease of revenues.

A month after, the outlook improves a bit. Nevertheless, 6 months after hurricane Irma occurred, less than half of the firms returned to pre-shock earnings.

Figure 27. Percent change in demand after one week, one month and six months after Hurricane Irma



Notes: Firms who reported not knowing their revenue loss across all periods, were not considered. An increase in sales was taken as 0% loss.

6.3. Positive spillover effects of disasters on tourism in neighboring countries

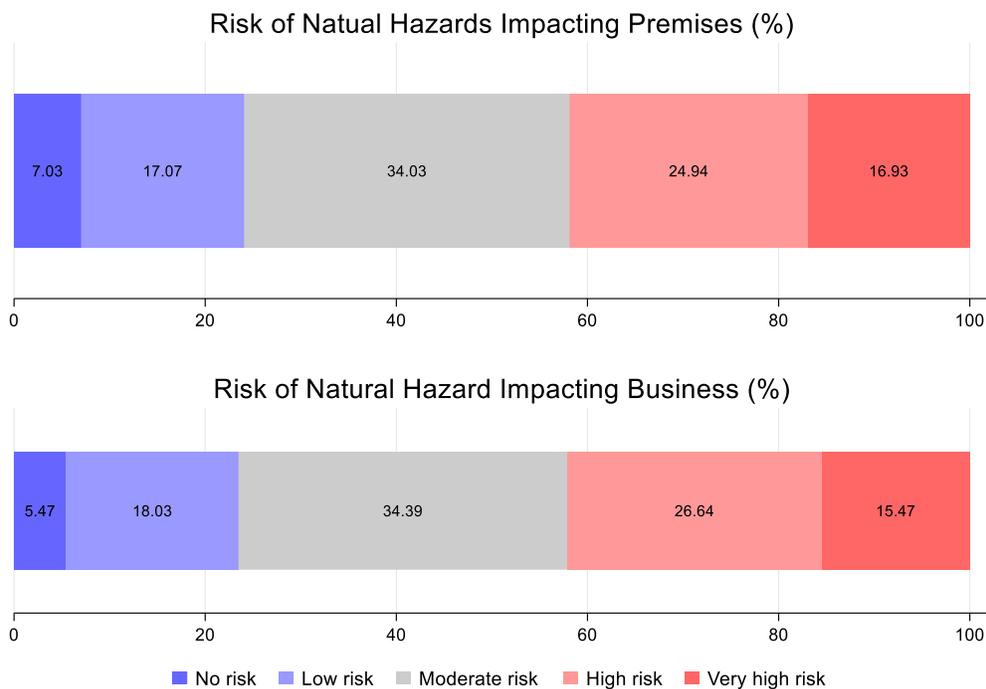
When a country in the Caribbean is affected by a disaster, tourists tend to be rerouted to other countries, often in the same region. This happens as big cruise ships decide to change their route, or travel agencies send their clients to other countries because there is a risk a disaster may happen or because it already did. A devastating natural hazard has a reputational risk for countries. Tourists may be less willing to go to a place that has been affected by a major disaster because they fear it can happen again. This effect can linger on for a long time. In Dominica, 35 percent of firms report that sales had not returned to pre-disaster level at the time of the interview in 2020, and 24 percent of affected firms report the negative perception of tourists as the main bottleneck for recovery. When this happens, other countries that were not affected tend to benefit.

Firms from all the countries included in the survey, except for Jamaica, reported having experienced an increase in demand because of a natural shock that occurred in a neighboring country. However, some countries benefitted more than others. The countries with the most firms that have experienced this are St. Kitts and Nevis (70 percent) and Antigua and Barbuda's (64 percent). Figure 28 shows the share of firm by country that have benefited from natural disaster happening in other countries. Firms also identified the specific shock that caused the influx of demand. The shock that brought more positive effects in countries' demands, was hurricane Irma (40 percent), followed by the Dorian cyclone (28 percent) and

7. Managing natural disasters

The following section examines firms' risk perception, preparedness and coping capacity to natural disasters. Respondents were asked to rate the likelihood of a natural hazard to impact the premises of the firm (directly impact), as well as the likelihood of natural hazards to indirectly impact the firm (e.g., through blocked roads or power outages). Perception of risk is an important indicator since it is closely related to preparedness action. Results are presented in Figure 30. The respondents that rate the risk of direct and indirect impacts as high or very high make up 42 percent of total, while the share of respondents that rate the risk as low or nonexistent is 24 percent.

Figure 30 – Most firms rate the risk of natural hazard impacts as moderate to high



Firms are well-informed and have access to early warning information. Prior to a severe weather event, most firms (92 percent) report that they receive warnings. Firms primarily receive this information from government agencies such as local disaster/emergency organizations or ministries, or the meteorological office (66 percent), while the news and social media is the second most popular source (28 percent).

Firms also seem to be well prepared for natural disasters. Approximately 82 percent of respondents feel at least somewhat prepared to cope with a natural disaster and 97 percent of firms have taken preparedness action, including having an insurance plan (63 percent), a business continuity plan (60 percent) or invested in back-up infrastructure (75 percent). Moreover, 61 percent of firms have a disaster preparedness plan, 56 percent have improved their physical structures (storm shutters, hurricane straps) and 59 percent have implemented flood mitigation measures (sandbags, drainage, etc.).

Preparedness actions are common across sectors. In Figure 31, preparedness action uptake is compared across sectors. Most hotels have invested in back-up infrastructure (91 percent), followed by having an insurance plan (76 percent). For restaurants, 52 percent have improved their physical structures while 73 percent have invested in back-up infrastructure. Lastly, most firms in the tour/attraction/rental/taxi sector have an insurance plan (59 percent) while 55 percent have invested in back-up infrastructure.

Figure 31 - Investing in back-up infrastructure is the most common preparedness action

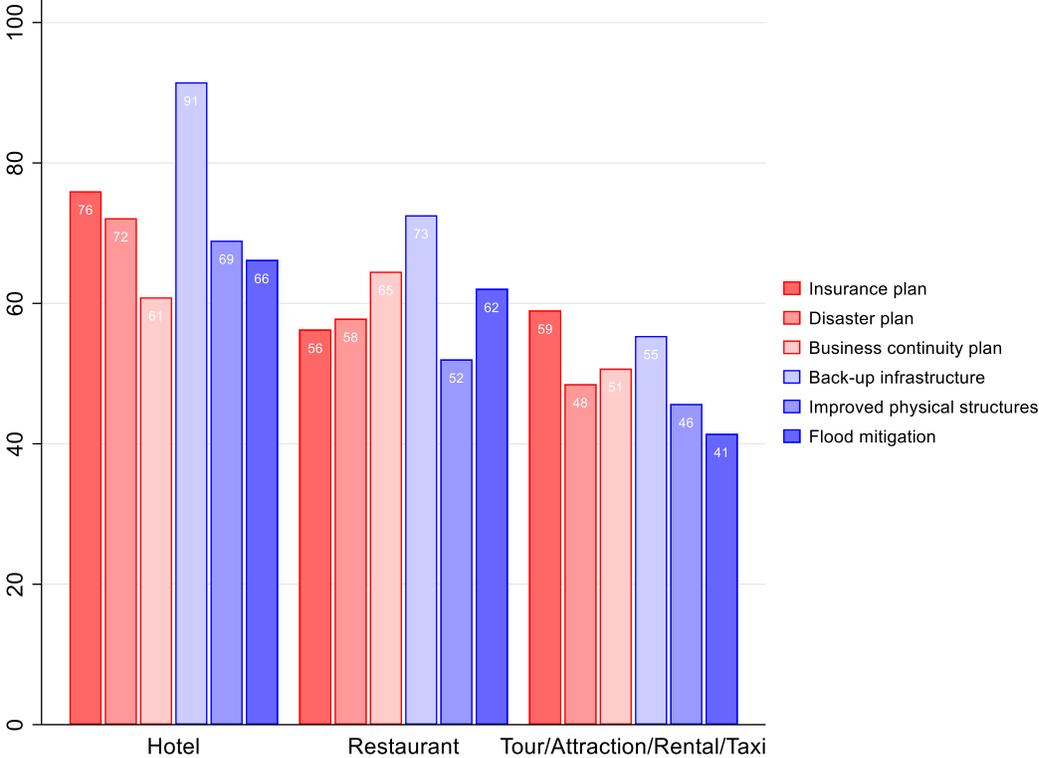
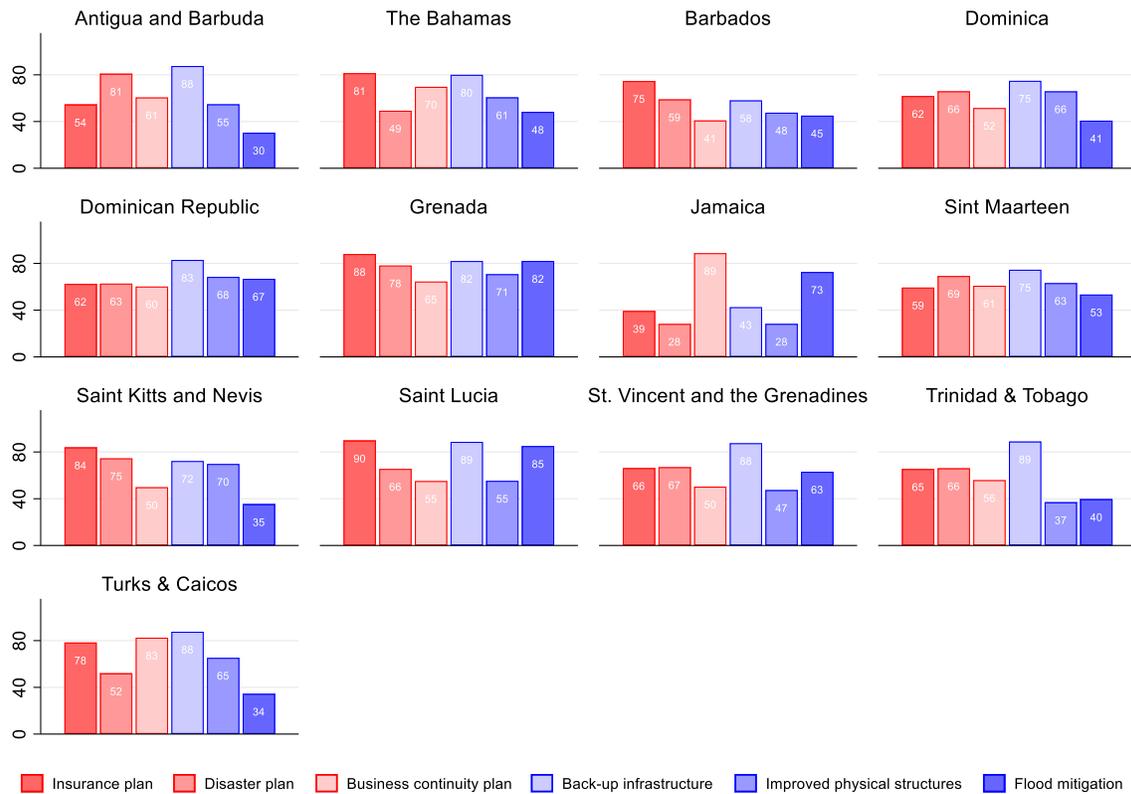


Figure 32 compares preparedness actions across countries. There are some interesting differences between countries. Firms in Jamaica are the least likely to have insurance plans or invest in back-up infrastructure for example. Instead, Jamaican firms seem to invest in putting business continuity plans in place (89 percent) and flood mitigation measures (73 percent). Insurance plans are most common in Saint Lucia (90 percent) followed by Grenada (88 percent) and St. Kitts and Nevis (84 percent). Disaster preparedness plans range from 28 percent among Jamaican firms to 81 percent of firms in Antigua and Barbuda. Apart from Jamaica and Barbados, over 70 percent of firms have back-up infrastructure.

Figure 32 - Preparedness actions by country

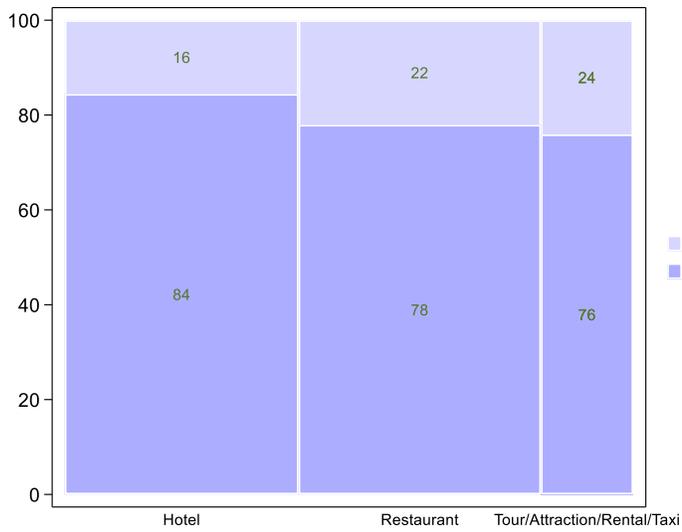


7.1. Specific disaster preparedness actions

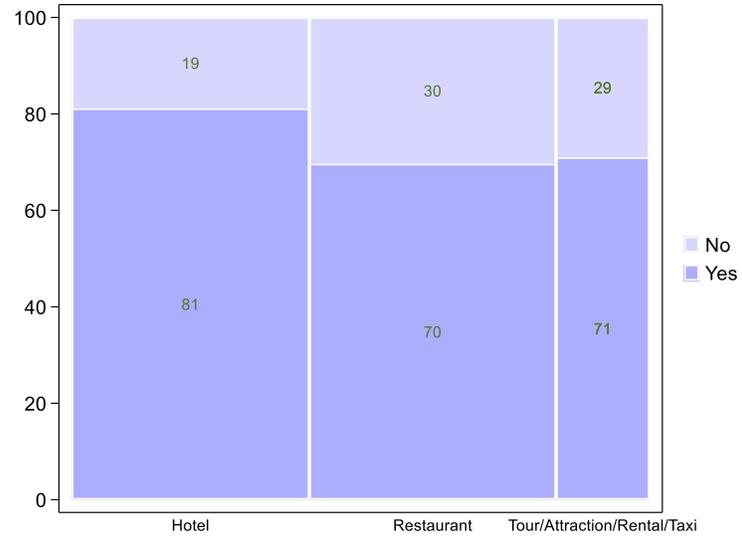
About 61 percent of businesses report having a disaster preparedness plan in place. This usually means that the firm has a plan for what to do in case of emergencies and that they have a dedicated staff member who oversees the emergency response. Out of the firms in the survey, 75 percent report having a dedicated staff member. It is also common for firms to provide their staff members with training in disaster planning/response. About 80 percent report doing so.

Figure 33 - Most firms...

...train their staff for disaster response



...have a dedicated staff member



Having an **insurance plan** that includes coverage from natural disasters is common – 63 percent of firms report having an insurance plan with disaster coverage. Figure 34 shows the breakdown of insurance coverage by country. Most firms in Jamaica (61 percent) report not having an insurance plan. Saint Lucia followed by Grenada are the countries with most firms reporting that they have an insurance plan – 90 percent and 88 percent, respectively. We also asked about the type of hazards covered in the insurance plans held by the firms. Insurance plans tend to cover most hazards that were inquired about (hurricane, floods, storm/wind/thunder, earthquake and fire).

Figure 34 - Insurance coverage by country (%)

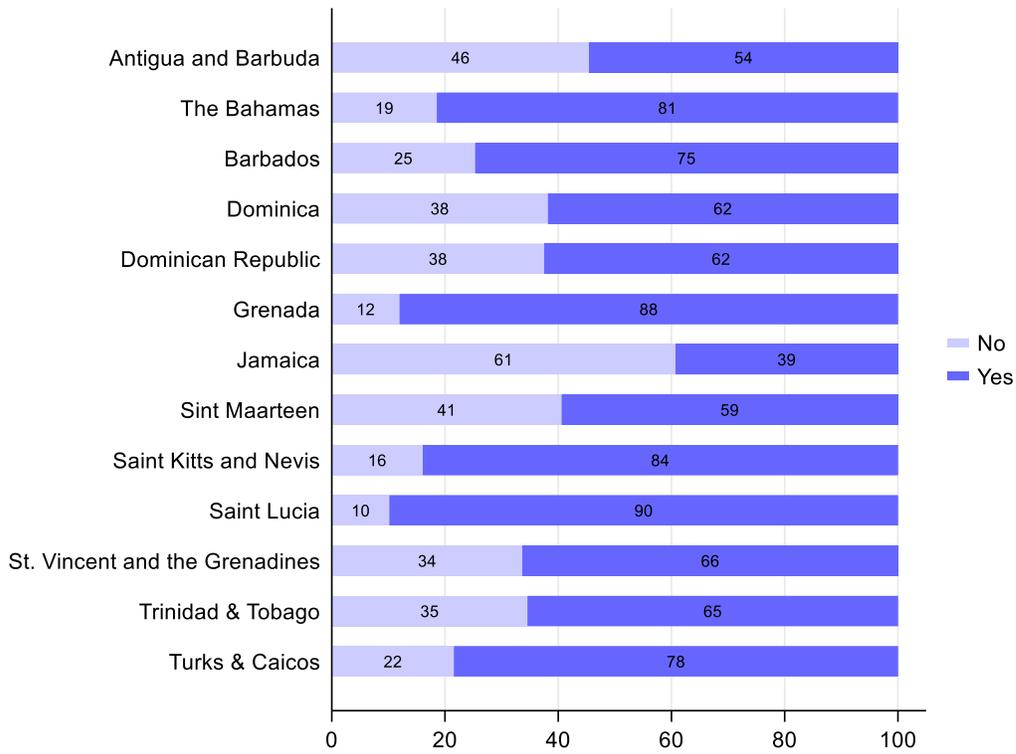
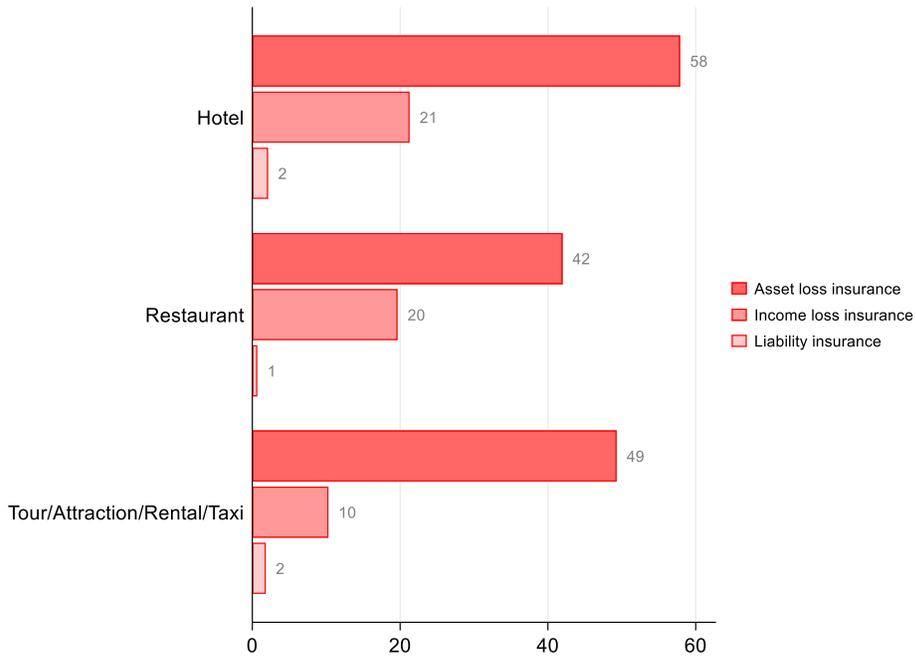
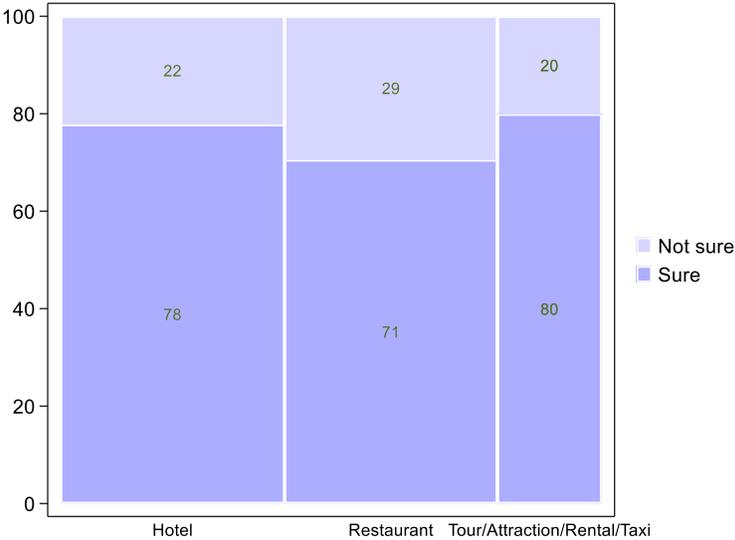


Figure 35 - Type of insurance by sector(%)



Firms are generally confident that their insurance plan would cover natural disaster damages. No significant differences exist across sectors, although restaurants are the least confident, at 71 percent (Figure 36).

Figure 36 - Businesses report being confident that their insurance plan would cover damages in case a disaster



Among the firms that report not having insurance covering disaster damages and losses (37 percent of all firms), the most common reason why firms report not having insurance is that it is too costly. While 36 percent of firms indicate that insurance is too costly, 28 percent report having not considered it. Figure 37 shows the information by country. Most businesses in The Bahamas and Trinidad & Tobago report that they do not have insurance coverage for disaster impacts because it is not needed, or it had not been considered. Across sectors (Figure 38), tour/transport firms are more likely to report that insurance has not been considered (30 percent) or that it is not needed (24 percent).

Figure 37 - Reasons why firms report not having insurance with coverage for disaster impacts by country

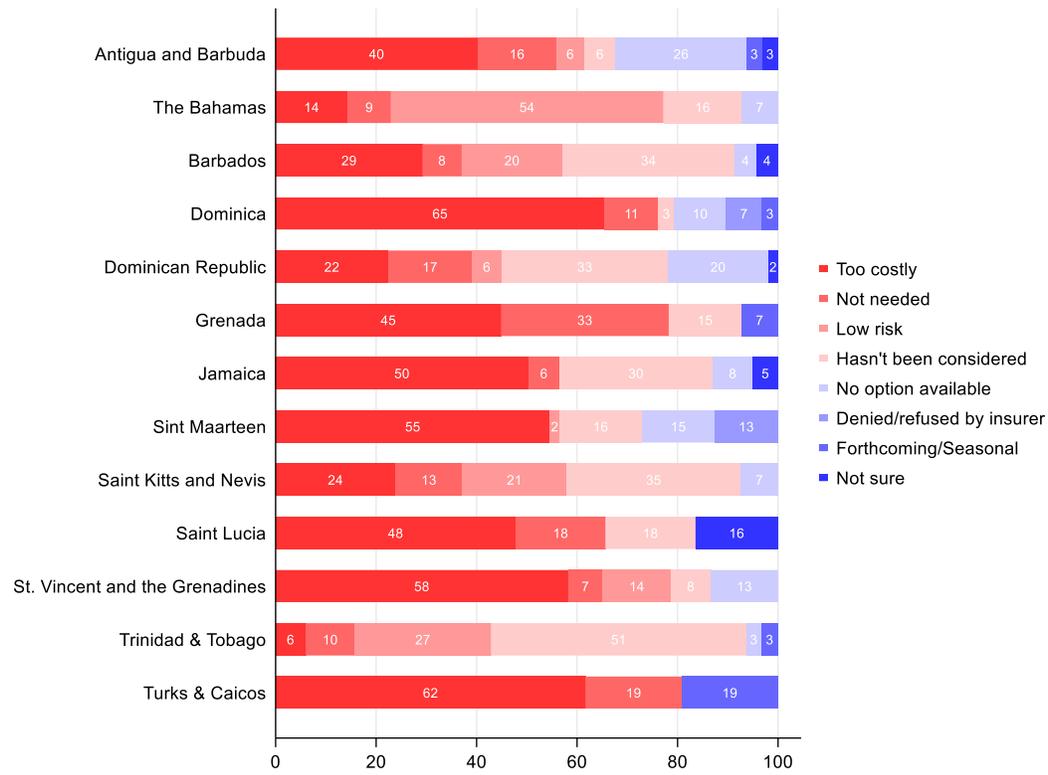
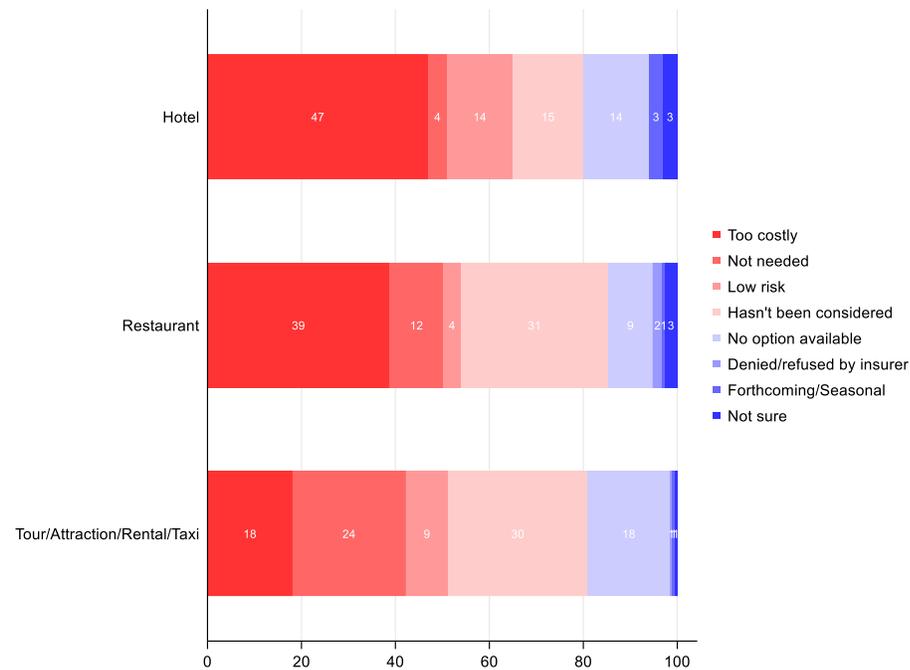


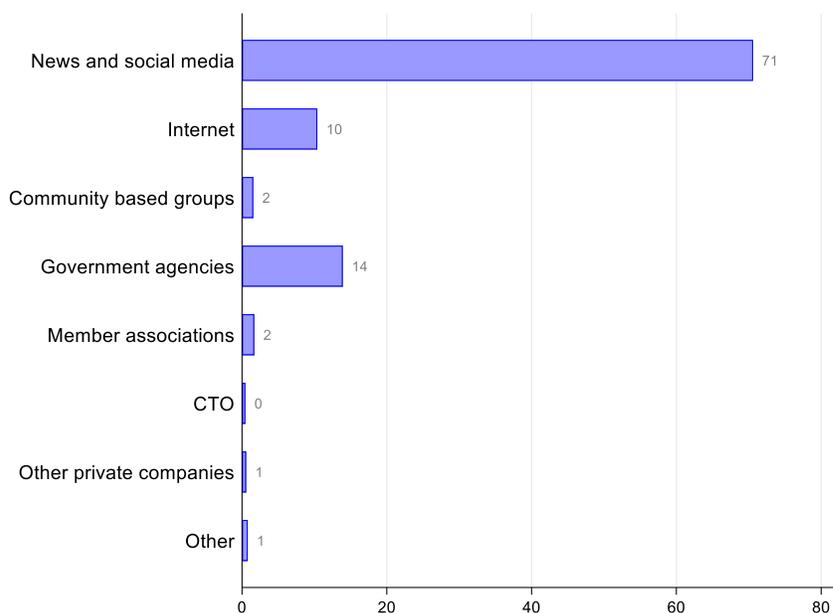
Figure 38 - Reasons why firms report not having insurance with coverage for disaster impacts by sector



7.2. Coping mechanisms and recovery

Generally, most firms report knowing where to find information about recovery efforts and available assistance (86 percent) in post disaster situations. When there is a disaster, firms' primary source of information on what to do comes from news and social media (71 percent) while the secondary source of information is the internet (72 percent). Only 14 percent of firms report turning to government agencies for information about recovery and assistance (Figure 39).

Figure 39. Firms primary source for information on recovery and assistance



To understand better how firms respond to actual disasters and cope with impacts, we looked at responses to how firms responded to specific disasters discussed in the section on specific shocks. For both hurricane Irma and Maria, businesses indicate that they relied on their own financial resources to recover. Many businesses did nothing to respond to the shock (32 and 23 percent of firms for Irma and Maria respectively).

Despite the high coverage in insurance, only 23 percent of firms affected by disasters in recent years indicated that insurance was what they relied on *the most* to recover. If including the second most important support to recover, the number increases to 28 percent of firms. Among the firms that experienced direct damages to property and inventory, 50 percent reported being able to cover some of the damages with insurance.

By combining the information on firms relying on insurance to recover from disaster, and the insurance payout received to cover asset losses from damages, the total share of firms that used insurance to cope is 32 percent of affected firms (either directly or indirectly). Figure 40 breaks down the information by disaster and Figure 41. Share of firms that relied on insurance to cope with disaster, by country breaks it down by country. By design, each country was only asked about the impact of one disaster (even when they could have been affected by several). See which country was asked about which disaster in Table 2.

Using insurance as a response is more common for the more severe disasters, hurricane Maria and Irma. While more firms reported direct damages because of hurricane Irma, using insurance was more common as a response to hurricane Maria. In Dominica and Dominican Republic 52 and 44 percent of firms report having relied on insurance to cope with hurricane Maria. In Sint Maarten, 52 percent of firms reported using insurance after hurricane Irma. For Dominica and Sint Maarten, the use of insurance makes sense since close to 100 percent of firms reported direct damages due to the disasters (see Figure 22). However, only 6 percent of firms reported direct damages to hurricane Maria in Dominican Republic. In Turks & Caicos, 100 percent of firms reported direct damages, but only 26 percent reported having used insurance. This is despite 78 percent of firms reporting having access to insurance and that 65 percent of those firms report having hurricane coverage.

Figure 42 shows the share of replacement value from damages covered by disaster for firms that report damages to assets and having received payout from insurance. Hurricane Matthew has the lowest coverage and Tropical Storm Dorian has the highest. For both disasters, the number of observations is low, and results should be treated with care. As for hurricane Irma and Maria, coverage was around 60 percent.

Figure 40. Share of firms that relied on insurance to cope with disaster, by disaster

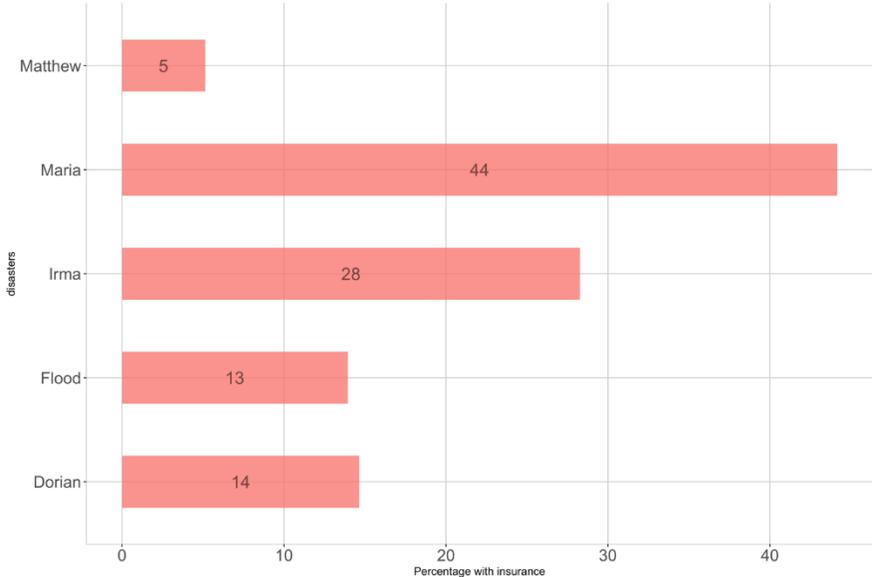


Figure 41. Share of firms that relied on insurance to cope with disaster, by country

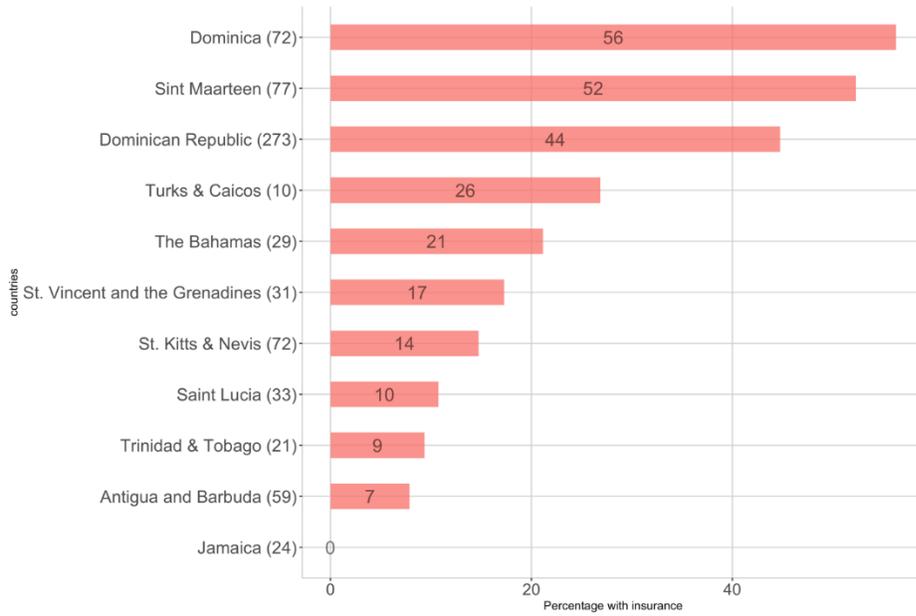
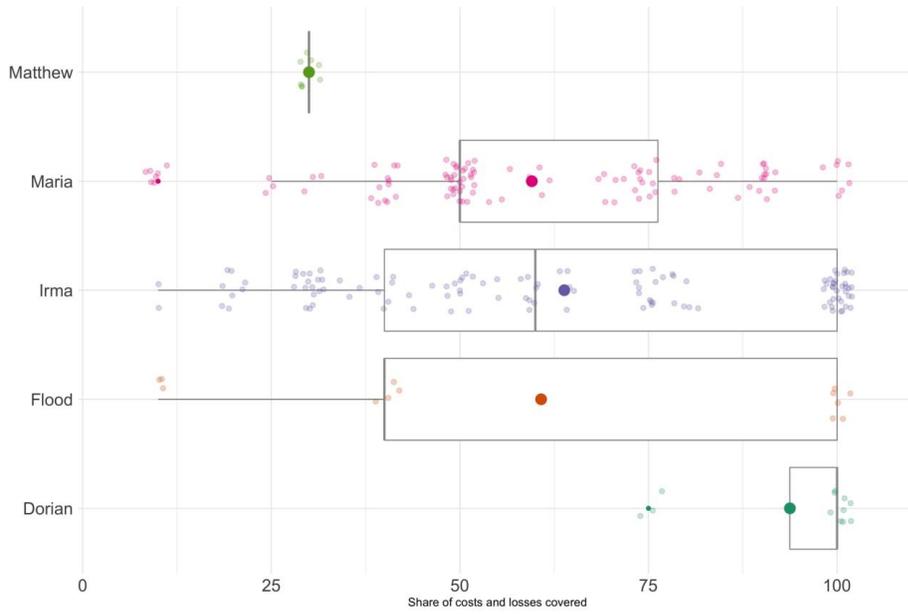


Figure 42. Share of asset losses covered by insurance, by disaster



*Dark point indicates the mean.

8. Impact of COVID-19 crisis on tourism

The firm survey was implemented between March and November 2020. During this period an unprecedented crisis, caused by the spread of covid-19, halted travel around the World. Therefore, businesses dependent on tourism suffered enormous losses during 2020 and beyond. The firms were asked about the impact of covid in sales. Since the interviews took place at different times, the data allows us to follow the development of sales among the firms in the sample during the data collection period. Figure 43 shows the average net sales change by month for countries, depending on their tourism dependance (very high, high, low), as defined in Table 1. The impact has been devastating. Initially, countries with lower dependency on tourism seem to have suffered as much as the other countries, while towards September having made a small recovery. In June and July, countries with high dependence made a bit of a recovery, but sales went down again in August. As for sectors, restaurants have done slightly better than hotels and tour/attraction firms. However, impacts across the board are huge (Figure 44).

Total sales losses by sector are presented in Figure 45, as a share of sales during period March-November. During the period March-November, hotels lost 90 percent of sales, which is 57 percent of annual sales. Restaurants lost about 77 percent of total sales during March-November, which corresponds to 51 percent of annual sales.

Figure 43. Monthly sales changes (March – November 2020) due to COVID-19 by country group (very high, high or low dependence on tourism)

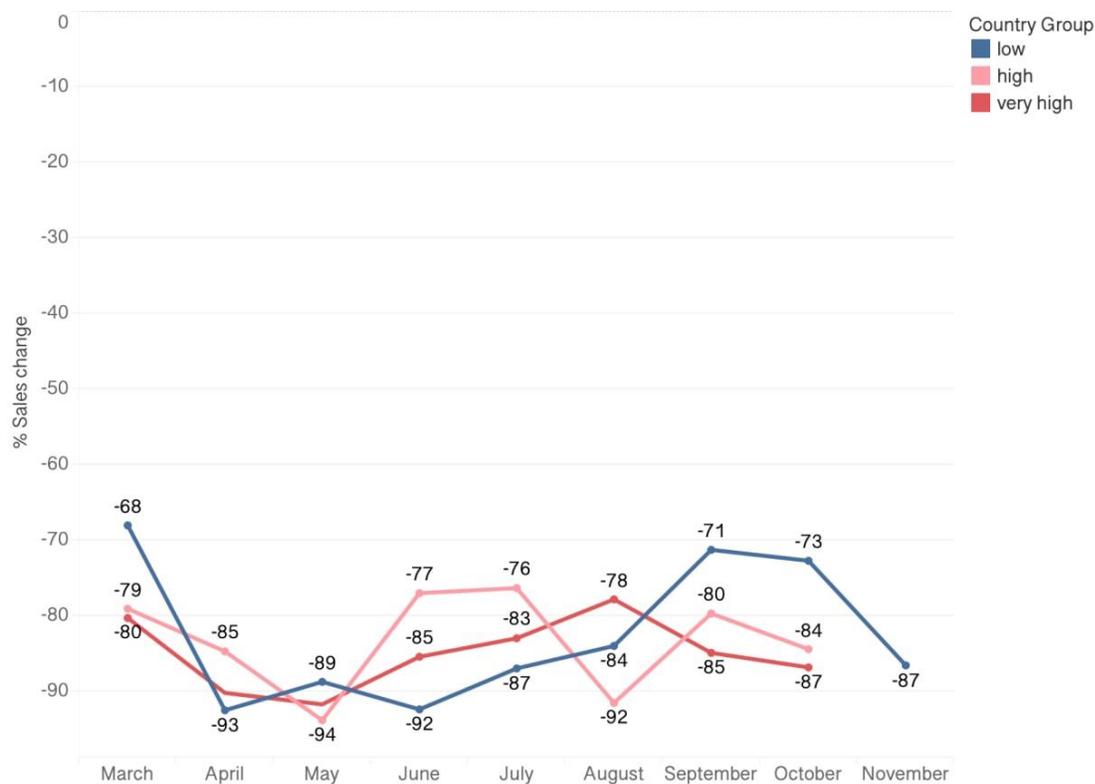


Figure 44. Monthly sales changes (March – November 2020) due to COVID-19 by sector

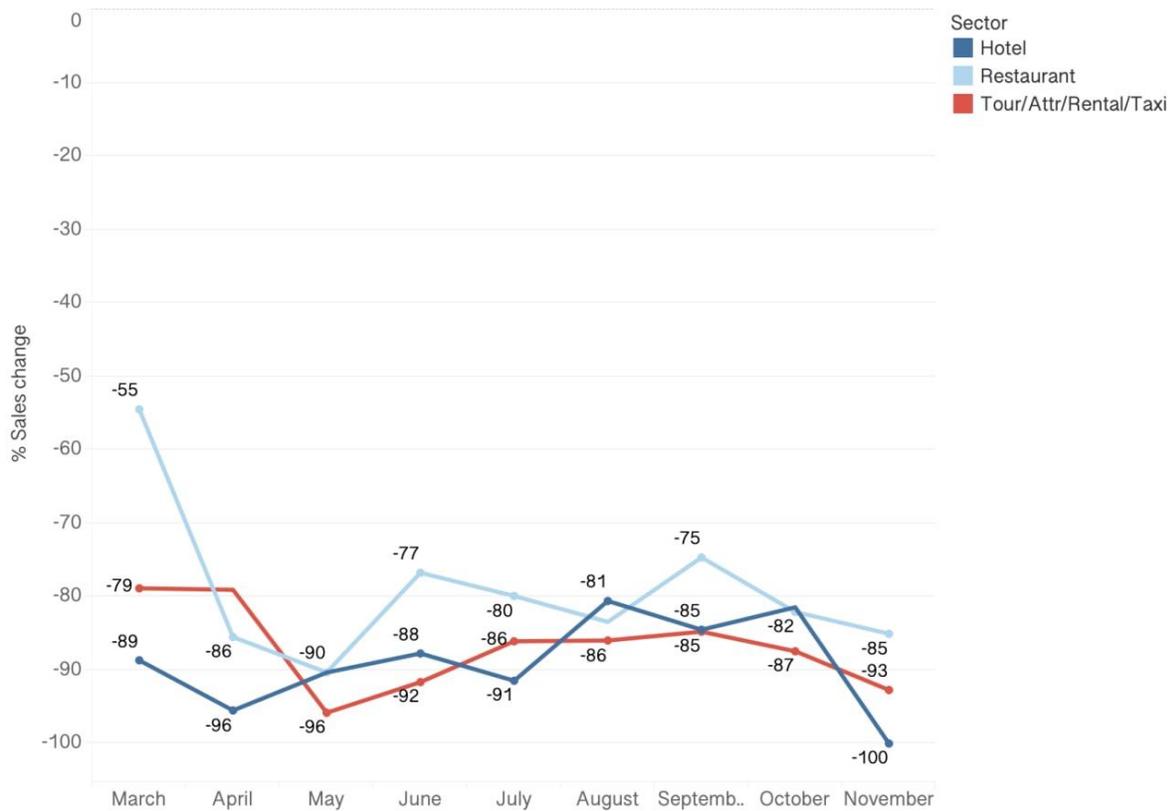
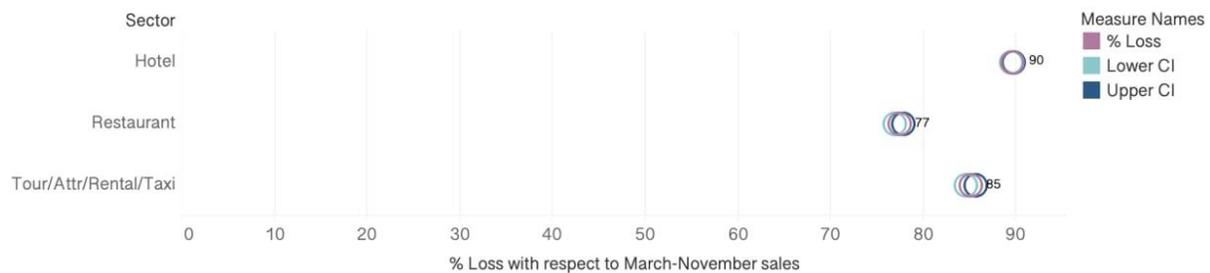


Figure 45. Sales losses due to COVID-19 as a share of sales during period March – November, by sector



9. Discussion and conclusions

The tourism industry in the Caribbean has faced and is facing enormous challenges. In recent years, the region has experienced several category-5 Hurricanes, which has hurt an industry which was already suffering from increased global competition and an aging clientele. The ongoing COVID-19 crisis seemed to have come at a worse possible time. Perhaps unsurprisingly, 41 percent of firms report that they are fighting to stay open.

On the flip side and perhaps more surprisingly, 63 percent of firms report that the number of visitors has increased over the past decade and 16 percent think that there are plenty of opportunities for growth in

the current environment. And perhaps a positive effect of recent number of disasters is that firms are both aware of disaster risks and prepared to manage and cope with natural hazards. Almost all firms feel at least somewhat prepared to cope with a natural disaster and all firms have taken preparedness action. Most firms own insurance and have invested in backup infrastructure to mitigate sales losses from disruptions and have improved physical structure to mitigate asset losses in case a disaster happens.

Not all natural hazards make the headlines, and the Caribbean is frequently dealing with low intensity high frequency events that disrupts local infrastructure. Between 15 and 26 percent of water disruptions and 13 and 25 percent of energy disruptions are caused by natural hazards. And disruptions are long and happen often. Firms face one water outage every 9 days, and they last about 19.3 hours on average. Firms face 37 power disruptions per year, lasting, on average, about 8.7 hours. Firms cope by investing in backup infrastructure. The water tanks and generators that they have invested in do an excellent job in coping with the average length disruptions. However, for disruptions that last longer than 5.9 days for water and 3.7 days for energy, firms are still vulnerable to sales disruptions and losses. Governments and providers have a responsibility to design public infrastructure in a resilient manner which protects users from services disruptions.

According to the infrastructure reliability index for water and energy constructed in the report using reported disruption information, priority countries for improving water services include Dominican Republic, Antigua and Barbuda and St Lucia. For power infrastructure priority countries include Dominican Republic, Antigua and Barbuda and Sint Maarten.

From March to November 2020, hotels missed out on 90 percent of sales, restaurants 77 percent and tour/transport missed out on 85 percent of regular sale due to the COVID-19 crisis. As the crisis is still unfolding, it is difficult to make prediction of how long it will take for firms to recover but most likely years. Building back the country more resilient to climatic shocks should be a priority. Continue to promote and facilitate insurance penetration in the tourism industry is also important since it has helped firms' recovery from previous shocks.

The Firm Resilience Survey was implemented with the objective to improve access to information on the tourism industry in the Caribbean, with particular focus on resilience. The dataset provides a wealth of information at the regional and country level. If you are interested in learning more about how to collect this data in your country or region of interest or want to gain access to the database, contact aerman@worldbank.org.

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