

How Did Disasters Change Consumption Behaviour in Thailand and the Philippines?

Kensuke Molnar-Tanaka, Prasiwi Ibrahim and Oudom Hean

This study examines the effects of disasters on consumption in Thailand and the Philippines, using three major natural hazards for each country, including the 2004 tsunami, the 2011 and 2016–17 floods in Thailand, and typhoons Bopha, Haiyan and Meranti in the Philippines. To examine the effects of a disaster on total consumption, this study uses an interrupted time-series analysis. A decline in consumption is observed after a disaster in Thailand, stemming from a reduction in expenditure of the services sector including recreation, restaurants, and hotels, though the decline is partially offset by increased spending on non-durable goods. For the Philippines, declines in overall consumer spending are observed in response to these disasters with no specific sectoral responses in the sample. When a disaster hits, reactions from governments are crucial to providing immediate help to victims, which could have an impact on consumption and overall economic activity. These reactions take the form of emergency relief and assistance including compensation schemes, as well as helping with reconstruction. However, developing longer-term disaster mitigation and resilience policies is also crucial to prevent or prepare for future disasters.

Keywords: disasters, disaster risk reduction, natural hazards, consumption behaviour, developing Asia

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1. Introduction

Developing Asia is one of the most disaster-prone regions in the world. Natural hazards—such as floods, tropical cyclones, and earthquakes—frequently affect countries across the region, causing devastating damage (OECD 2018, 2019). Depending on their intensity and duration, these disasters can affect

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consumer behaviour. This paper examines the effects of natural hazards on consumption behaviour in Thailand and the Philippines, looking at three large disasters in each country. For Thailand, the study adopts as case studies the tsunami in 2004 that resulted from an earthquake in the Indian Ocean, the floods of 2011, and the further flooding of late 2016 and early 2017. For the Philippines, the study examines Typhoon Bopha in 2012, Typhoon Haiyan in 2013, and Typhoon Meranti in 2016.

Overall, the study observed a decline in total consumption in Thailand after these disasters. This decline stemmed from a fall in spending in the services sector, including recreation, restaurants and hotels. At the same time, the study observed a general increase in post-disaster household spending on non-durable goods, such as food, alcoholic and non-alcoholic beverages, tobacco products, and clothing. For the Philippines, however, relatively small changes in consumer spending were observed. In the aftermath of disasters, swift and appropriate government reactions and policy responses are necessary to cope with the damage that they cause.

The paper begins with a literature review, followed by descriptive and empirical analyses. The policy implications of disasters are discussed in the final part of the study.

2. Literature Review: Consumer Behaviour When Disaster Strikes

This study draws on existing academic literature that analyses consumer behaviour in the wake of disasters. Despite the inherent unpredictability of these calamitous situations, several authors have argued that consumption growth following a disaster is significantly influenced by past information, namely consumer confidence, consumption growth, and lagged income (Flavin 1981; Campbell and Mankiw 1989). As a result, estimates typically factor in a lag in consumption growth, testing the permanent income hypothesis posited by Friedman (1957) that individuals base their consumption on a longer-term view of income, consuming a fraction of this permanent income in each period, such that the average propensity to consume is equal to the marginal propensity to consume. In turn, the marginal propensity to consume is shaped by a number of factors, including unemployment, household resources, and broader perceptions of uncertainty.

Several studies have investigated whether large external shocks such as natural hazards or extremely disruptive civil conflicts affect consumption. In particular, Miguel and Roland (2011) explore the long-term impact of the war in Vietnam on local economic conditions. The authors find that the conflict had a moderate negative effect on consumption levels through 1992–93, but that it also contributed to faster consumption growth between 1992–93 and 2002 (Miguel and Roland 2011). In a similar vein, Gignoux and Menendez (2016) study the short- and long-term effects on individual economic outcomes of a set of earthquakes that occurred in rural Indonesia as of 1985. The empirical estimates show that an earthquake reduces household consumption per capita in the short run, but that this negative effect then fades away, with the effect eventually turning out to be positive and statistically significant in the long term (Gignoux and Menendez 2016). These results suggest that any negative short-term impact from the large external shock on consumption dissipated over time, consistent with the permanent income hypothesis.

Moreover, the impact of a natural hazard depends largely upon its intensity and duration. The negative impact on economic outcomes is stronger for more intense disasters (Lee, Zhang, and Nguyen 2018). Similarly, Baez et al. (2015) investigate the causal consequences of Tropical Storm Agatha, in 2010, on household welfare in Guatemala. The authors find that households reduced their food consumption by 10 per cent on average, with a larger impact among urban households, for which average consumption per capita dropped by 12.6 per cent. This greater impact is attributed to the strength of the shock itself, with much stronger excessive precipitation in urban areas (Baez et al. 2015). More generally, Benson and Clay (1998) show that countries that suffer frequently from disasters tend to experience lower growth rates than countries with fewer disasters.

The change in consumption behaviour in times of crisis is asymmetric across different categories of goods. It is well documented that purchases of non-essential goods can easily be postponed. When the reason for postponement wanes, however, some portion of the missing demand tends to recover (Hai, Krueger, and Postlewaite 2013). Forbes (2017) studied the short-term consumption patterns in the aftermath of the 2011 earthquake in Christchurch, New Zealand. The study showed that immediately after the event—namely, within the first week—consumers mostly purchased essential items, such as water, non-perishable food, products providing access to communication services, and cleaning products (Forbes 2017).

Anttila-Hughes and Hsiang (2013) assess the economic effects of typhoons in the Philippines. They conclude that income losses induced by the typhoons translated into a 7.1 per cent drop in household spending, with the sharpest adjustments hitting the kinds of spending most akin to investments in human capital, such as medicine, education, and high-nutrient food. By contrast, spending tends to fall much less when it comes to pure consumption goods, namely recreation, alcohol and tobacco (Anttila-Hughes and Hsiang 2013). Similarly, Aladangady et al. (2016) show that in the immediate aftermath of Hurricane Matthew in the United States in October 2016, consumer discretionary spending decreased, falling by 4.1 per cent at restaurants, and 6.8 per cent at clothing stores.

3. Data and Descriptive Analysis of Thailand and the Philippines

This section briefly introduces the large disasters in Thailand and the Philippines used in this analysis, and examines consumption data before and after these disasters to evaluate the effects of these events, particularly on consumption.

3.1 Thailand

The present study focuses on three disasters in Thailand: the tsunami in 2004, the floods of 2011, and another flooding disaster in late 2016 and early 2017. These are among the biggest disasters to affect Thailand in terms of human casualties or property damage.

The 2004 Indian Ocean Earthquake and Tsunami

The 2004 Indian Ocean tsunami occurred on 26 December. An earthquake measuring 9.1 Richter scale struck west of Sumatra causing massive tsunami waves from Indonesia to the east coast of Africa. The tsunami displaced 1.7 million people in fourteen different countries, killing nearly 230,000 people with the total damage estimated at US\$9.9 billion. More than half of the total deaths and damage occurred in Indonesia (Telford, Cosgrave, and Houghton 2006). According to the Centre for Research on the Epidemiology of Disasters (2020), the total number of people affected in Thailand was about 67,000, and the total damage was estimated at US\$1 billion. It is estimated that more than 8,200 were killed and approximately 8,400 were injured by the tsunami in Thailand alone. The most affected sectors in Thailand were tourism, fishing and agriculture (Schwartz et al. 2006; TDRI 2005).

Thailand's Riverine Floods of 2011–12

A series of riverine floods took place from August 2011 to January 2012, starting in the Mekong and Chao Phraya rivers in northern Thailand and Lao PDR, and extending to parts of Thailand's capital, Bangkok. Thailand is prone to flash floods during the monsoon season due to its tropical climate. The 2011 riverine floods affected around 13 million people, inundating 9.1 per cent of the land mass, causing at least 680 casualties, and causing roughly US\$45.7 billion in damage (Centre for Research on the Epidemiology of

Disasters 2020). Approximately 90 per cent of the damage occurred to the private sector, of which 70 per cent to the manufacturing sector (Poapongsakorn et al. 2012; World Bank 2011).

The Flood Disaster in Southern Thailand in 2016–17

The floods of 2016–17 in southern Thailand affected nearly two million people, causing ninety-five casualties, and property damage of about US\$1.15 billion (Centre for Research on the Epidemiology of Disasters 2020).¹ The rains that caused the flooding were the heaviest in the region over the previous eleven years. The gum and palm oil industries, which are based on farming in the inundated regions, were especially affected by the floods. Furthermore, the heavy rains also destroyed much infrastructure, such as roads, bridges and railways (Tebakari and Hayashi 2018).

Analysing Disasters in Thailand: Household Consumption Data and Descriptive Statistics

In order to study the effects of these disasters, data on quarterly household consumption for 2003–18 from Thailand's Office of the National Economic and Social Development Council were examined. These data are seasonally adjusted and inflation-corrected using chained volume measures (with 2002 as the reference year).

Table 1 provides descriptive statistics for the data used for this study. On average, household spending on food and non-alcoholic drinks is the highest, while expenditure on education is the lowest. Generally, Thai households spend around a third of their budget on non-durable goods including food, beverages, and tobacco products. Spending in restaurants, hotels, and on recreation—all categories particularly susceptible to natural hazards—accounts for about 18 per cent of total consumption.

Figure 1 shows Thailand's total consumption before and after these disasters. The statistics show that consumption generally declined in the immediate aftermath of a disaster, but rebounded quickly. Indeed, it usually took less than a year for consumption to return to the pre-disaster expenditure trend. Distinguishing between the three disasters, the present study observes that total household consumption

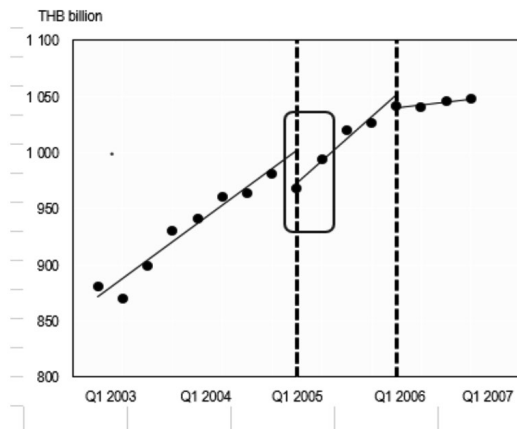
TABLE 1
Thailand's Total Consumption Before and After Disasters (THB billion)

<i>Variable</i>	<i>Observation</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
Total consumption	64	1,211.07	203.84	869.83	1,605.42
Food and non-alcoholic beverages	64	222.08	13.63	187.88	249.59
Alcoholic beverages and tobacco	64	52.11	3.07	46.42	59.52
Clothing	64	71.87	4.4	60.5	76.97
Utility expenses	64	133.77	22.97	99.02	178.85
Furniture	64	63.57	12.31	41.09	82.77
Healthcare	64	65.77	15.65	41.08	93.4
Transport	64	168.37	29.4	123.42	224.6
Communication	64	45.36	11.91	23.98	66.55
Recreation	64	79.52	21.82	46.56	124.46
Restaurants and hotels	64	174	54.99	94.52	281.5
Education	64	20.61	3.19	14.65	26.5
Miscellaneous	64	128.07	34.68	81.83	196.68

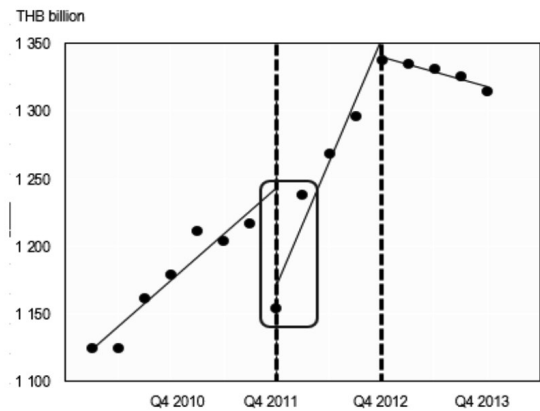
SOURCE: Office of the National Economic and Social Development Council (2020).

FIGURE 1
Total Consumption in Thailand Before and After Disasters (THB billion)

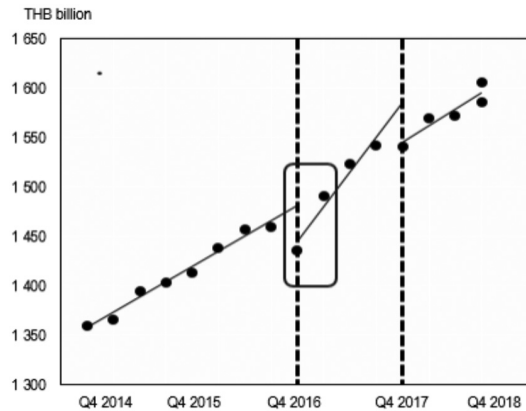
A. Tsunami of 2004



B. Floods of 2011



C. Floods of 2016–17



NOTE: The data represent quarterly household consumption.
SOURCE: Office of the National Economic and Social Development Council (2020).

declined the most during the 2011 floods (represented by the brackets in Figure 1). Total household consumption also fell immediately, albeit to a relatively smaller degree, after the tsunami of 2004 and the flooding in 2016–17.

In all three cases, total household consumption bounced back to its normal long-run consumption trend within a year. Moreover, while the biggest fall in total consumption among the three disasters was after the 2011 floods, consumption then recovered at the fastest pace of all three of the case studies. This is shown in Figure 1 (section B) in which the fast recovery speed is represented by the trend line between the first quarter of 2012 and the last quarter of 2012.

3.2 The Philippines

The Philippines is affected by typhoons regularly and severely (Centre for Research on the Epidemiology of Disasters 2020). Typhoons alone cost on average 2 per cent of GDP, with a further 2 per cent of GDP then being spent every year on rebuilding (UNDRR 2019). This study looks in turn at three super typhoons that have hit the country in recent years: Typhoon Bopha in 2012, Typhoon Haiyan in 2013, and Typhoon Meranti in 2016.

December 2012: Typhoon Bopha

Early in December 2012, Typhoon Bopha (known locally in the Philippines as Typhoon Pablo) blew in to hit the southern part of the country. The Centre for Research on the Epidemiology of Disasters (2020) estimates that Typhoon Bopha affected about 6.2 million people. Moreover, the damage was estimated at over US\$1 billion, and the disaster caused more than 1,900 casualties (Weather Philippines 2015). Most of the damage was to public infrastructure such as roads, power plants and bridges, as well as to agricultural lands used for banana and coconut farming. The damage to agricultural land significantly affected livelihoods, since 80 per cent of the region's population works in the agricultural sector (UNOCHA 2013).

November 2013: Typhoon Haiyan

Less than a year after Typhoon Bopha, came Typhoon Haiyan (known locally as Typhoon Yolanda), hitting the Philippines in November 2013. It affected around 16.1 million people, leaving approximately 4 million of them homeless. There were 6,300 casualties, and the damage cost more than US\$10 billion (Centre for Research on the Epidemiology of Disasters 2020; Weather Philippines 2015). Typhoon Haiyan hit the agricultural sector hard, and felled about 33 million coconut trees, a major source of livelihood. It also destroyed schools, hospitals and roads in an already poor region. The destruction of roads proved to be a particularly grave problem when early emergency help arrived, and continued to prove especially problematic when the recovery and rebuilding started (UNDP 2014).

September 2016: Typhoon Meranti

Typhoon Meranti (known locally as Typhoon Ferdie) hit the northern part of the Philippines in September 2016. It affected about 17,000 people in the country, causing approximately US\$5 million in damage. In addition to destroying more than 2,000 houses, either totally or partially, the damage was mostly to communications network infrastructure. Nonetheless, Typhoon Meranti is tied with Haiyan for being the second most powerful tropical cyclone in history. Most of the typhoon's damage occurred in mainland China (Centre for Research on the Epidemiology of Disasters 2020; NDRRMC 2016).

Analysing Disasters in the Philippines: Household Consumption Data and Descriptive Statistics

This study used quarterly household consumption data from the Philippine Statistics Authority to estimate the effects of these typhoons. The data are inflation-corrected by chained volume measures (with 2002 as the reference year). The data are not seasonally adjusted, however. The data set used in this study spans from the first quarter of 2011 to the second quarter of 2018. Table 2 provides descriptive statistics for the data set. On average, Philippine households spend more than a third of their total consumption on non-durable goods. Spending on restaurants, hotels, and recreation is, on average, less than 10 per cent of total consumption.

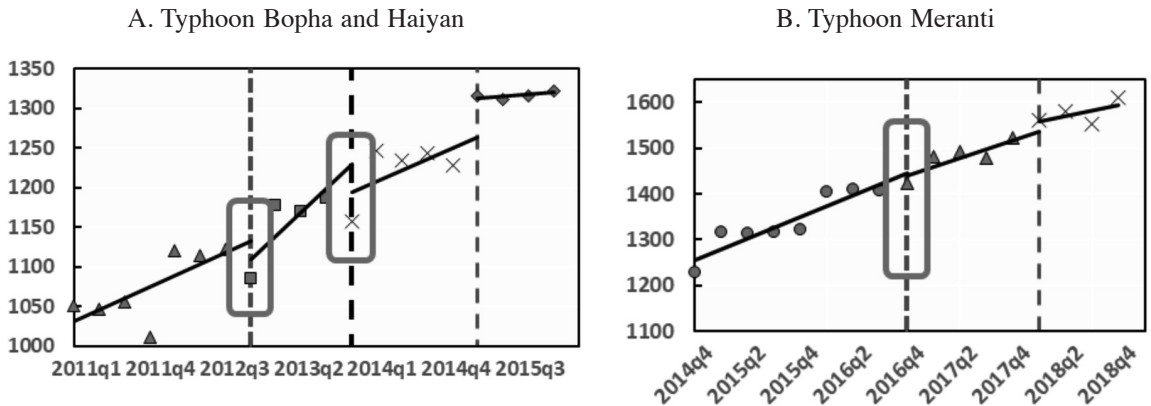
Figure 2 shows Philippine inflation-corrected and seasonal-adjusted total consumption before and after the typhoons.² In each panel, the brackets represent the time these disasters occurred. Compared to the disasters in Thailand, decline in consumption after the Philippine typhoons was usually smaller, and consumption expenditures rebounded quickly. It took less than a year for consumption to return to the long-term consumption trend.

TABLE 2
Total Consumption Before and After Typhoons (PHP billion)

Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Total consumption	32	1,295.136	209.129	967.038	1,789.083
Food and non-alcoholic beverages	32	536.29	92.56	385.365	761.383
Alcoholic beverages and tobacco products	32	17.347	3.138	12.261	24.074
Clothing	32	19.099	1.969	16.29	23.238
Utility expenses	32	142.214	20.849	107.11	187.126
Furniture	32	67.189	7.391	52.126	84.884
Healthcare	32	31.741	6.547	21.642	45.904
Transport	32	112.892	20.95	79.347	149.097
Communication	32	67.368	10.988	45.53	92.076
Recreation	32	29.859	6.243	20.178	43.783
Restaurants and hotels	32	56.331	11.007	38.8	281.5
Education	32	40.722	7.311	30.911	26.5
Miscellaneous	32	174.083	37.973	118.134	275.416

SOURCE: Philippine Statistics Authority (2020).

FIGURE 2
Total Consumption Before and After the Disasters (PHP billion)



NOTES: Each observation point represents the quarterly household consumption. The Philippine Statistics Authority (2020) provides inflation-adjusted quarterly consumption data. To adjust the data for seasonality, we use a seasonal dummy model where we regress total consumption on a series of quarter dummies. See endnote (2) for more details on our seasonal adjustment process.

From the graphs, we observe that total household consumption declined after both Typhoons Bopha and Haiyan (represented by the brackets in Figure 2). However, we do not see a significant decline in total consumption after Typhoon Meranti (represented by the brackets in Figure 2B). In all cases, the total household consumption returned to the normal long-run consumption trend within one year. We also see consumption trend between the last quarter of 2012 (Typhoon Bopha) and the last quarter of 2013 (Typhoon Haiyan) is the steepest; this consumption trend indicates how consumption recovered quickly after Typhoon Bopha before dropping significantly after Typhoon Haiyan.

4. The Effects of Disasters on Consumption in Thailand: Understanding Heterogeneity

4.1 Empirical Model for Studying the Effects of Disasters on Consumption in Thailand

To examine the effects of a disaster on total consumption, this study uses an interrupted time-series analysis by estimating the following specification:

$$Consumption_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 Disaster_{it} + \beta_3 (Disaster_{it} * T_{it}) + \epsilon_{it} \quad (1)$$

$Consumption_{it}$ is seasonally adjusted and inflation-corrected quarterly consumption in country i (i.e., Thailand) at date t . This model analyses both total consumption and its components in order to understand the heterogeneity of consumer spending. In other words, studying these components provides information on how consumers manage their budgets during a period of economic crisis. In this case, $Consumption_{it}$ is a consumption component expressed as a percentage of total consumption expenditure at date t .

T_t is the time since the beginning of the study. $Disaster_t$ is an indicator variable representing the periods of disasters (pre-disaster periods are zeros). In this paper, the pre-disaster period spans around two years, while the post-intervention period covers one year.

The estimated trend before a disaster is β_1 , while β_2 captures the immediate effects of the disaster in question. Furthermore, β_3 captures treatment effects over time relative to the pre-disaster trend. Therefore, the linear combination of $\beta_1 + \beta_3$ captures the quarterly rate of change in consumption in the post-intervention period. The statistical significance of β_3 implies that there is a statistically significant difference between the consumption trends before and after a disaster. The study focuses on β_2 and the linear combination of $\beta_1 + \beta_3$, because they capture the immediate and short- to medium-term effects of disasters.

Specifically, the interrupted time-series analysis is a special form of regression discontinuity design with time as a running variable and a treatment (i.e., a disaster) beginning at a particular threshold in time (Kontopantelis et al. 2015).³ As mentioned in Lee and Lemieux (2010), the regression discontinuity requires milder assumptions compared to those required by other quasi-experimental approaches; therefore, estimates are potentially more credible.

It is important to note that our analysis could not compare the effects on consumption from a disaster that was followed by interventions from governments and other actors, with disasters that did not elicit such interventions. Therefore, our estimates are at the lower bound for the effects of a disaster. That is to say, the effects of a disaster on consumption without policy interventions to mitigate its impact are likely to be greater than our estimates.

4.2 Empirical Results: Evidence of a Decline in Total Consumption in the Wake of Disasters

The empirical study examined the three disasters selected for Thailand: the 2004 tsunami and the floods of 2011 and 2016–17. Overall, the study observed a decline in total consumption in the wake of disasters,

stemming from a reduction in expenditure affecting the services sector, including recreation, restaurants, and hotels. Nevertheless, it was also generally observed that households increased their spending on non-durable goods, including food and non-alcoholic drinks, alcoholic beverages and tobacco products, and clothing.

The Impact of the 2004 Tsunami on Consumption Spending in Thailand

Tables 3A and 3B present the estimated results for the effect of the 2004 tsunami on Thailand's total consumption expenditure, as well as its individual components. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption.

After the disaster, total consumption immediately dropped by THB29.08 billion, a fall of approximately 3 per cent relative to total household consumption spending in the final quarter of 2004.⁴ However, the disaster did not statistically change the consumption trend over the short to medium term.

By examining the individual components of overall consumption, it can be seen that the 2004 tsunami in Thailand had a heavy negative impact on recreation, restaurants, and hotels. The expenditure on recreation, as a percentage of total household spending, fell immediately by 0.28 per cent, while that on hotels and restaurants dropped immediately by 0.66 per cent. This decline in spending on recreation represented about 11 per cent of the pre-disaster average spending in this category, and it reached close to 5 per cent of the pre-disaster average spending for hotels and restaurants.⁵ Furthermore, although consumption in these industries did bounce back, it subsequently grew at a slower or similar pace to the pre-disaster trends.

Still, the study also demonstrated an immediate positive impact on non-durable goods including alcohol, tobacco and clothes because of the disasters. It also showed an increase in immediate spending on household utility expenses. This might not be entirely surprising if consumers ended up spending more time on home-based activities immediately after the disasters.

The Impact of the 2011 Floods on Consumption Spending in Thailand

As demonstrated in Tables 4A and 4B, the 2011 floods had a huge impact on Thailand's levels of consumption. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption.

The immediate drop in total consumption due to the floods came to approximately THB69.6 billion, which is a decline of approximately 6 per cent relative to the third quarter of 2011.⁶ However, total consumption in the Thai economy then proceeded to bounce back at the rate of THB45.53 billion per quarter.

As in the aftermath of the tsunami in 2004, it is apparent that households increased their immediate spending on non-durable goods after the 2011 floods. These goods encompassed food and non-alcoholic drinks, alcoholic beverages and tobacco products, and clothing. Increases in household spending on such goods ranged from 0.3 per cent to around 1 per cent. Households also increased their immediate spending on utility expenses. However, their expenditure on restaurants and hotels fell by 0.7 per cent,

TABLE 3A
Statistical Breakdown of the Impact of the 2004 Tsunami on Consumption in Thailand

	<i>Total</i>	<i>Food and Non-alcoholic Beverages</i>	<i>Alcohol and Tobacco Products</i>	<i>Clothing</i>	<i>Utility Expenses</i>	<i>Furniture</i>	<i>Healthcare</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	16.29*** (1.46)	-0.13** (0.04)	-0.05*** (0.01)	-0.07*** (0.01)	-0.08*** (0.02)	0.02* (0.01)	0.05*** (0.01)
$Disaster_{it}$	-29.08*** (6.38)	0.43 (0.24)	0.49*** (0.07)	0.32*** (0.08)	0.49*** (0.06)	0.04 (0.05)	-0.07 (0.08)
$Disaster_{it} * T_{it}$	3.44 (2.77)	0.10 (0.11)	-0.01 (0.03)	0.08** (0.02)	-0.11*** (0.02)	-0.03 (0.02)	-0.08*** (0.02)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption. See Section 4.1 for more details on the regressions and interpretation of the estimated coefficients.

TABLE 3B
The Effects of the 2004 Tsunami on Consumption Spending in Thailand (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotel</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	-0.01 (0.02)	0.04** (0.01)	0.13*** (0.01)	0.02 (0.08)	-0.00 (0.01)	0.07** (0.03)
$Disaster_{it}$	-0.17 (0.15)	0.11 (0.09)	-0.28*** (0.07)	-0.66** (0.28)	0.04 (0.04)	-0.43* (0.22)
$Disaster_{it} * T_{it}$	-0.04 (0.04)	-0.02 (0.03)	-0.05*** (0.01)	0.17 (0.13)	-0.01 (0.02)	-0.05 (0.06)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption. See Section 4.1 for more details on the regressions and interpretation of the estimated coefficients.

TABLE 4A
Statistical Breakdown of the Impact of the 2011 Floods on Consumption

	<i>Total</i>	<i>Food and Non-alcoholic Beverages</i>	<i>Alcoholic Beverages and Tobacco Products</i>	<i>Clothing</i>	<i>Utility Expenses</i>	<i>Furniture</i>	<i>Healthcare</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	17.25*** (2.02)	-0.23*** (0.02)	-0.06*** (0.01)	-0.04*** (0.01)	-0.10** (0.03)	0.04 (0.02)	0.10*** (0.02)
$Disaster_{it}$	-69.60*** (14.53)	0.89*** (0.26)	0.24*** (0.06)	0.32*** (0.04)	1.00*** (0.15)	0.19 (0.14)	0.05 (0.14)
$Disaster_{it} * T_{it}$	25.27*** (5.56)	-0.34*** (0.08)	-0.07*** (0.02)	-0.20*** (0.01)	-0.11** (0.04)	-0.13* (0.06)	-0.19*** (0.04)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption. See Section 4.1 for more details on the regressions and interpretation of the estimated coefficients.

TABLE 4B
Statistical Breakdown of the Impact of the 2011 Floods on Consumption (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotel</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	0.04 (0.02)	0.01 (0.03)	0.10*** (0.01)	0.20** (0.06)	-0.01** (0.01)	0.06 (0.04)
$Disaster_{it}$	-1.89*** (0.27)	0.15 (0.16)	-0.13 (0.11)	-0.71*** (0.18)	0.05 (0.03)	0.18 (0.30)
$Disaster_{it} * T_{it}$	1.09*** (0.09)	-0.11** (0.04)	-0.01 (0.04)	-0.07 (0.07)	-0.04*** (0.01)	-0.0008 (0.08)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption. See Section 4.1 for more details on the regressions and interpretation of the estimated coefficients.

while spending on transport fell by about 2 per cent. It is also apparent that expenditure on these goods and services more or less returned to pre-disaster levels within a year.

The Flood Disaster of 2016–17 and its Impact on Consumer Spending in Thailand

As shown in Tables 5A and 5B, households reduced their total immediate consumption by THB26.36 billion during the 2016–17 floods—a drop of around 2 per cent from the level of total consumption in the final quarter of 2015. Nevertheless, total consumption bounced back to the pre-disaster trend in less than a year.

As in the previous two disasters in Thailand analysed in this study, the findings show that households rapidly reduced their spending on restaurants and hotels by about 0.45 per cent, or approximately 3 per cent of the level of spending on this category prior to the disaster. Instead of cutting expenditures immediately, households immediately increased their spending by between 0.2 per cent and 1 per cent on non-durable goods such as food and clothing.

To recap, the study observed an overall decline in immediate consumption after the aforementioned disasters in Thailand. The drop in total consumption came from a reduction in spending on the services sector including recreation, hotels, and restaurants. The study also found that households increased their expenditure on non-durable goods, including food and non-alcoholic drinks, alcoholic beverages and tobacco products, and clothing during the same period.

TABLE 5A
Statistical Breakdown of the Impact of the 2016–17 Floods on Consumption

	<i>Total</i>	<i>Food and Non-alcoholic Beverages</i>	<i>Alcoholic Beverages and Tobacco Products</i>	<i>Clothing</i>	<i>Utility Expenses</i>	<i>Furniture</i>	<i>Healthcare</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	15.46*** (0.73)	-0.07*** (0.01)	-0.06*** (0.01)	-0.03*** (0.00)	0.01** (0.00)	-0.04*** (0.01)	-0.01 (0.01)
$Disaster_{it}$	-26.36* (12.60)	0.23* (0.11)	0.003 (0.05)	0.10* (0.04)	0.03 (0.12)	0.12 (0.07)	0.16 (0.12)
$Disaster_{it} * T_{it}$	10.62* (5.76)	-0.12** (0.04)	0.01 (0.02)	-0.03 (0.02)	-0.06 (0.05)	-0.00 (0.03)	-0.05 (0.04)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption. See Section 4.1 for more details on the regressions and interpretation of the estimated coefficients.

TABLE 5B
 Statistical Breakdown of the Impact of the 2016–17 Floods on Consumption (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotels</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	0.03* (0.02)	-0.02* (0.01)	0.12** (0.05)	0.06 (0.04)	-0.00 (0.00)	0.02 (0.03)
$Disaster_{it}$	-0.19 (0.21)	0.18** (0.06)	0.04 (0.20)	-0.45* (0.22)	-0.02 (0.02)	0.15 (0.17)
$Disaster_{it} * T_{it}$	0.12* (0.05)	0.001 (0.02)	-0.12** (0.05)	0.36*** (0.09)	-0.00 (0.01)	-0.08* (0.03)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. The coefficient of T_{it} represents the estimated consumption trend before the disaster, while the coefficient of the variable $Disaster_{it} * T_{it}$ captures the difference in the consumption trend before and after the disaster. The estimated coefficient of the variable $Disaster_{it}$ captures the immediate change in consumption expenditure after the disaster. Column (1) shows the estimates of the effects of the disaster on total consumption measured in billions of Thai baht, while the rest of the columns indicate the consumption components as percentages of total consumption. See Section 4.1 for more details on the regressions and interpretation of the estimated coefficients.

5. The Impact of Disasters on Household Consumption: The Case of the Philippines

As noted previously, this study examined three super typhoons: Typhoon Bopha in 2012, Typhoon Haiyan in 2013, and Typhoon Meranti in 2016. In general, it observed small changes in consumer spending after these typhoons, both overall and by segment. This finding is consistent with Strobl (2019), who finds that typhoons have a small and short-term effect on economic activity. Finally, the study found that households changed their consumption spending more after Typhoon Haiyan than after the other typhoons.

5.1 Empirical Model to Analyse the Impact of Disasters on Consumption in the Philippines

Unlike the case studies for Thailand, the three disasters examined in the Philippines occurred in quick succession. It is, therefore, hard to disentangle their impact on consumption using separate regressions. The three typhoons occurred in 2012, 2013 and 2016. To reiterate, the interrupted time-series analysis is a special form of regression discontinuity design with time as a running variable.⁷ To study their impact, interrupted time series analysis with multiple treatments was used. Specifically, estimate the following regression specification was estimated:

$$Consumption_{it} = \alpha + \beta_0 T_{it} + \gamma_1 Disaster_{it}^{Bopha} + \beta_1 (Disaster_{it}^{Bopha} * T_{it}) + \gamma_2 Disaster_{it}^{Haiyan} + \beta_2 (Disaster_{it}^{Haiyan} * T_{it}) + \gamma_3 Disaster_{it}^{Meranti} + \beta_3 (Disaster_{it}^{Meranti} * T_{it}) + quarter_t + \epsilon_{it}.$$

$Consumption_{it}$ is the inflation-corrected quarterly consumption in country i at date t . Consumption data provided by the Philippine government are not seasonally adjusted. Therefore, quarterly fixed effects (i.e., $quarter_t$) are included in the regression specification (2), in order to control for seasonality. Both total consumption and its components are studied, in order to understand the heterogeneity in consumers' spending.

The symbol α of is a constant, while T_t is the the time since the beginning of the study. $Disaster_t^j$ is an indicator variable representing the periods of disaster j (pre-disaster periods are zeros).

The symbol γ^j captures the immediate effects of disaster j on consumption expenditures. Furthermore, β_0 is the estimated trend before Typhoon Bopha hit the Philippines, while $\beta_0 + \beta_1$ captures the quarterly rate of reduction or increase in consumption in the aftermath of Typhoon Bopha. Similarly, $\beta_0 + \beta_1 + \beta_2$ provides the estimates of expenditure trends after Typhoon Haiyan, while $\beta_0 + \beta_1 + \beta_2 + \beta_3$ amounts to the estimated trends after Typhoon Meranti.

As explained in the section above on the data for Thailand, it was not possible to distinguish between the effects on consumption of a disaster that is not followed by policy interventions, and a disaster for which there is not a subsequent response in the form of policy interventions. As with the data concerning Thailand, therefore, the results can be interpreted as the lower-bound estimates of the effects of a disaster. The effects of disasters on consumption without government economic stimulus are likely to be more significant than the estimates in this study. However, as with the case of Thailand, the Philippines is a developing country, and its government's response capacity to disasters is still relatively limited.

5.2 Empirical Results: Typhoons Tend to Have a Small Effect on Consumption in the Philippines

As can be seen from Tables 6A and 6B, the effects of typhoons on consumption tend to be rather small. Among the three typhoons examined in the study, Typhoon Haiyan had the severest impact on consumer spending. The immediate drop in consumption after Typhoon Haiyan was about PHP40 billion, or 3.6 per cent of total consumption in the third quarter of 2013. However, total consumption then rebounded

TABLE 6A
The Effects of Typhoons on Consumption in the Philippines

	Total	Food and Non-alcoholic Beverages	Alcohol and Tobacco Products	Clothing	Utility Expenses	Furniture	Healthcare
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	17.67*** (1.85)	0.02 (0.06)	-0.002 (0.004)	-0.01 (0.01)	-0.06 (0.05)	-0.04 (0.04)	0.02 (0.02)
$Disaster_{it}^{Bopha}$	-29.25* (15.20)	-0.33 (0.25)	-0.07* (0.04)	-0.09 (0.07)	-0.02 (0.21)	-0.10 (0.18)	-0.003 (0.09)
$Disaster_{it}^{Bopha} * T_{it}$	10.52** (4.08)	0.06 (0.11)	-0.01 (0.01)	0.04 (0.02)	0.25** (0.09)	0.02 (0.04)	-0.03 (0.02)
$Disaster_{it}^{Haiyan}$	-40*** (13.23)	-0.56** (0.24)	0.09** (0.04)	-0.02 (0.06)	-0.45 (0.33)	0.07 (0.10)	0.08 (0.06)
$Disaster_{it}^{Haiyan} * T_{it}$	-7.48* (4.20)	-0.12 (0.10)	0.01 (0.01)	-0.05* (0.03)	-0.21** (0.08)	-0.02 (0.03)	0.02 (0.02)
$Disaster_{it}^{Meranti}$	3.83 (7.06)	0.30** (0.12)	0.00 (0.02)	0.04 (0.07)	-0.14 (0.14)	-0.08 (0.10)	0.04 (0.03)
$Disaster_{it}^{Meranti} * T_{it}$	1.00 (1.74)	-0.05* (0.03)	-0.03*** (0.00)	0.01 (0.01)	0.08** (0.03)	0.06*** (0.02)	-0.01** (0.01)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. See Section 5.1 for more details on the regressions and interpretation of the estimated coefficients.

TABLE 6B
The Effects of Typhoons on Consumption in the Philippines (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotels</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	0.01 (0.04)	0.03* (0.02)	0.04 (0.02)	0.01 (0.02)	-0.03*** (0.01)	0.03 (0.04)
$Disaster_{it}^{Bopha}$	0.12 (0.27)	-0.01 (0.12)	-0.15 (0.10)	0.12 (0.09)	0.15* (0.08)	0.40 (0.24)
$Disaster_{it}^{Bopha} * T_{it}$	-0.11 (0.12)	0.003 (0.05)	-0.003 (0.03)	-0.09*** (0.03)	-0.02 (0.03)	-0.12 (0.08)
$Disaster_{it}^{Haiyan}$	0.52* (0.26)	-0.20 (0.15)	-0.15** (0.07)	0.24*** (0.05)	0.23** (0.09)	0.16 (0.28)
$Disaster_{it}^{Haiyan} * T_{it}$	0.18* (0.10)	-0.03 (0.05)	-0.01 (0.03)	0.10*** (0.02)	0.04 (0.03)	0.09 (0.07)
$Disaster_{it}^{Meranti}$	0.12 (0.17)	-0.18 (0.13)	-0.20*** (0.07)	0.004 (0.06)	-0.03 (0.07)	0.13 (0.16)
$Disaster_{it}^{Meranti} * T_{it}$	-0.16*** (0.02)	-0.01 (0.02)	-0.03*** (0.01)	0.01 (0.01)	0.06*** (0.02)	0.08** (0.03)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. See Section 5.1 for more details on the regressions and interpretation of the estimated coefficients.

at the rate of PHP21 billion per quarter. Changes in consumer spending after Typhoon Bopha were less significant, and there were no significant changes to consumption after Typhoon Meranti.

Looking at the individual components of consumption in granular detail, the study did not detect any regular pattern of consumption spending among Philippine households. For example, it did not reveal any significant change in spending on food and non-alcoholic beverages immediately after Typhoon Bopha. Moreover, the study showed a decline in immediate spending on this component of consumption after Typhoon Haiyan, and yet an increase in it after Typhoon Meranti.

There are two notable findings. First, the study revealed a significant decline in spending on recreation immediately after Typhoon Haiyan and Typhoon Bopha. The estimated immediate fall in expenditure on recreation as a percentage of total consumption came to 0.15 per cent after Typhoon Haiyan, and 0.2 per cent after Typhoon Meranti.

Secondly, immediately after Typhoon Haiyan, the study showed that households immediately increased their spending on alcoholic drinks and tobacco. However, the study also showed that households increased their spending in restaurants and hotels after this typhoon. It could be partly explained that households, especially those living in non-affected regions, increased their spending at restaurants and hotels as they participated in traditional New Year celebrations.

6. Robustness

Our results could be sensitive to the pre-disaster periods. We conduct a sensitivity analysis by extending the pre-disaster period to twelve quarters. Tables 7A to 9B show the sensitivity analysis for Thailand's disasters, while Tables 10A and 10B show those results for the Philippine typhoons. As can be seen, the results are similar to those of the baseline.

In the case of Thailand, we generally find a decline in total consumption. This decline stems from a reduction in expenditures in the services sector including transportation, hotels, and restaurants. In

TABLE 7A
2004 Indian Ocean Earthquake and Tsunami: Sensitivity Analysis

	<i>Total</i>	<i>Food and Non-alcoholic Beverages</i>	<i>Alcohol and Tobacco</i>	<i>Clothing</i>	<i>Utilities</i>	<i>Furniture</i>	<i>Health</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	15.43*** (0.38)	-0.09*** (0.01)	-0.01 (0.01)	-0.06*** (0.01)	-0.05*** (0.01)	0.02** (0.01)	0.03*** (0.01)
$Disaster_{it}$	-25.87*** (5.12)	0.26 (0.19)	0.34*** (0.10)	0.30*** (0.06)	0.38*** (0.05)	0.05 (0.04)	0.00 (0.07)
$Disaster_{it} * T_{it}$	4.30* (2.15)	0.06 (0.10)	-0.05 (0.03)	0.07*** (0.02)	-0.14*** (0.01)	-0.03 (0.02)	-0.06*** (0.02)

NOTES: Newey-West standard errors are in parentheses. We set one lag as the maximum lag order of autocorrelation. *, **, *** denote statistical significance at 10 per cent, 5 per cent, and 1 per cent, respectively. Each consumption component is expressed as a percentage of total consumption expenditure.

TABLE 7B
2004 Indian Ocean Earthquake and Tsunami (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotels</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	0.08** (0.03)	0.04*** (0.01)	0.07*** (0.02)	-0.09*** (0.03)	-0.01 (0.01)	0.06*** (0.02)
$Disaster_{it}$	-0.51* (0.25)	0.10 (0.08)	-0.07 (0.12)	-0.25 (0.31)	0.07* (0.03)	-0.39** (0.17)
$Disaster_{it} * T_{it}$	-0.13** (0.05)	-0.02 (0.02)	0.004 (0.02)	0.28** (0.09)	-0.01 (0.02)	-0.05 (0.06)

NOTES: Newey-West standard errors are in parentheses. We set one lag as the maximum lag order of autocorrelation. *, **, *** denote statistical significance at 10 per cent, 5 per cent, and 1 per cent, respectively. Each consumption component is expressed as a percentage of total consumption expenditure.

contrast, we generally observe increased household spending on food and non-alcoholic drinks, alcoholic beverages and tobacco products, clothing, and utilities.

As seen from Table 7A, the total immediate expenditures declined by approximately THB26 billion after the Indian Ocean tsunami. Similar to our baseline results, we find housing-related expenses, including utilities and furniture, increased during this disaster. However, the estimates of the immediate expenditure declines in recreation, restaurants, and hotels are imprecise (Table 7B); yet we find the expenditure on transportation immediately dropped.

TABLE 8A
2011 Floods: Sensitivity Analysis

	<i>Total</i>	<i>Food and Non-alcoholic Beverages</i>	<i>Alcohol and Tobacco</i>	<i>Clothing</i>	<i>Utilities</i>	<i>Furniture</i>	<i>Health</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	17.39*** (0.92)	-0.22*** (0.01)	-0.07*** (0.01)	-0.06*** (0.01)	-0.05*** (0.01)	0.06*** (0.01)	0.09*** (0.01)
$Disaster_{it}$	-70.08*** (13.37)	0.89*** (0.23)	0.29*** (0.08)	0.39*** (0.05)	0.86*** (0.11)	0.12 (0.13)	0.09 (0.14)
$Disaster_{it} * T_{it}$	25.13*** (4.66)	-0.34*** (0.08)	-0.06*** (0.02)	-0.18*** (0.01)	-0.16*** (0.02)	-0.15** (0.05)	-0.18*** (0.04)

NOTES: Newey-West standard errors are in parentheses. We set one lag as the maximum lag order of autocorrelation. *, **, *** denote statistical significance at 10 per cent, 5 per cent, and 1 per cent, respectively. Each consumption component is expressed as a percentage of total consumption expenditure.

TABLE 8B
2011 Floods: Sensitivity Analysis (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotels</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	0.15*** (0.03)	0.00 (0.02)	0.09*** (0.01)	0.15*** (0.03)	-0.01*** (0.00)	-0.04 (0.03)
$Disaster_{it}$	-2.25*** (0.28)	0.20* (0.11)	-0.12 (0.10)	-0.58*** (0.17)	0.04 (0.02)	0.51** (0.23)
$Disaster_{it} * T_{it}$	0.98*** (0.09)	-0.10*** (0.02)	-0.01 (0.03)	-0.02 (0.04)	-0.04*** (0.01)	0.09 (0.08)

NOTES: Newey-West standard errors are in parentheses. We set one lag as the maximum lag order of autocorrelation. *, **, *** denote statistical significance at 10 per cent, 5 per cent, and 1 per cent, respectively. Each consumption component is expressed as a percentage of total consumption expenditure.

Table 8A shows total consumption expenditure immediately dropped by approximately THB70 billion due to the 2011 Thailand floods. The results presented in Tables 8a and 8b resemble those of the baseline. Specifically, we find households immediately increased spending on both durable and non-durable goods. On the other hand, we find consumers immediately reduced their spending on transportation, restaurants, and hotels.

Tables 9A and 9B show the results pertaining to the 2016–17 Thailand floods. We again find similar results to the baseline estimates. The total immediate consumption dropped by approximately THB31 billion. Similar to the aforementioned disasters in Thailand, households immediately increased spending

TABLE 9A
Late 2016–Early 2017 Floods: Sensitivity Analysis

	<i>Total</i>	<i>Food and Non-alcoholic Beverages</i>	<i>Alcohol and Tobacco</i>	<i>Clothing</i>	<i>Utilities</i>	<i>Furniture</i>	<i>Health</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	16.72*** (0.62)	-0.11*** (0.02)	-0.04*** (0.01)	-0.04*** (0.01)	-0.00 (0.01)	-0.03*** (0.01)	-0.01 (0.01)
$Disaster_{it}$	-30.98** (11.82)	0.36*** (0.11)	-0.05 (0.06)	0.14*** (0.04)	0.08 (0.11)	0.08 (0.09)	0.16 (0.12)
$Disaster_{it} * T_{it}$	9.36 (5.49)	-0.08* (0.04)	-0.00 (0.02)	-0.02 (0.02)	-0.04 (0.05)	-0.01 (0.03)	-0.05 (0.04)

NOTES: Newey-West standard errors are in parentheses. We set one lag as the maximum lag order of autocorrelation. *, **, *** denote statistical significance at 10 per cent, 5 per cent, and 1 per cent, respectively. Each consumption component is expressed as a percentage of total consumption expenditure.

TABLE 9B
Late 2016–Early 2017 Floods: Sensitivity Analysis (Continued)

	<i>Transport</i>	<i>Communication</i>	<i>Recreation</i>	<i>Restaurants and Hotels</i>	<i>Education</i>	<i>Miscellaneous</i>
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	0.03* (0.02)	-0.02* (0.01)	0.12** (0.05)	0.06 (0.04)	-0.00 (0.00)	0.02 (0.03)
$Disaster_{it}$	-0.19 (0.21)	0.18** (0.06)	0.04 (0.20)	-0.45* (0.22)	-0.02 (0.02)	0.15 (0.17)
$Disaster_{it} * T_{it}$	0.12* (0.05)	0.001 (0.02)	-0.12** (0.05)	0.36*** (0.09)	-0.00 (0.01)	-0.08* (0.03)

NOTES: Newey-West standard errors are in parentheses. We set one lag as the maximum lag order of autocorrelation. *, **, *** denote statistical significance at 10 per cent, 5 per cent, and 1 per cent, respectively. Each consumption component is expressed as a percentage of total consumption expenditure.

on non-durable goods including food, beverages, tobacco, and clothing. Households also increased immediate spending on utilities. However, they reduced their spending on transportation, restaurants, and hotels.

For the Philippines, the effects of typhoons on consumption are usually small. Among the three typhoons, we still find that Typhoon Haiyan had the largest immediate effects on consumption expenditures; the total household spending immediately declined by approximately PHP40 billion after Typhoon Haiyan. Although the magnitude of the estimate shown in Table 10A is similar to that of the baseline, the estimate of total immediate households is imprecise. Similar to our baseline estimate, we

TABLE 10A
Effects of Typhoons on the Philippines' Consumption: Sensitivity Analysis

	Total	Food and Non-alcoholic Beverages	Alcohol and Tobacco	Clothing	Utilities	Furniture	Health
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T_{it}	15.26*** (1.82)	0.05 (0.04)	-0.01* (0.00)	-0.01 (0.01)	-0.07*** (0.02)	-0.01 (0.01)	0.02* (0.01)
$Disaster_{it}^{Bopha}$	-19.21 (15.07)	-0.59** (0.26)	-0.02 (0.04)	-0.10* (0.06)	0.05 (0.18)	-0.20 (0.12)	-0.00 (0.07)
$Disaster_{it}^{Bopha} * T_{it}$	12.88** (4.69)	0.09 (0.12)	-0.01 (0.02)	0.03 (0.02)	0.24** (0.09)	0.00 (0.03)	-0.02 (0.02)
$Disaster_{it}^{Haiyan}$	-39.76*** (13.40)	-0.71*** (0.26)	0.12** (0.05)	-0.01 (0.05)	-0.41 (0.30)	0.06 (0.09)	0.07 (0.06)
$Disaster_{it}^{Haiyan} * T_{it}$	-7.47* (4.21)	-0.17 (0.11)	0.02 (0.02)	-0.05** (0.02)	-0.19** (0.09)	-0.03 (0.03)	0.02 (0.02)
$Disaster_{it}^{Meranti}$	2.37 (7.02)	0.32** (0.14)	-0.01 (0.03)	0.02 (0.07)	-0.07 (0.14)	-0.05 (0.10)	0.03 (0.04)
$Disaster_{it}^{Meranti} * T_{it}$	1.37 (1.29)	-0.05* (0.03)	-0.03*** (0.00)	0.02 (0.01)	0.06** (0.03)	0.05*** (0.02)	-0.02** (0.01)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. See Section 5.1 for more details on the regressions and interpretation of the estimated coefficients.

TABLE 10B
Effects of Typhoons on the Philippines' Consumption: Sensitivity Analysis (Continued)

	Transport	Communication	Recreation	Restaurants and hotels	Education	Miscellaneous
	(8)	(9)	(10)	(11)	(12)	(13)
T_{it}	-0.02 (0.03)	0.01 (0.01)	0.01 (0.01)	0.01** (0.01)	-0.02** (0.01)	0.06 (0.04)
$Disaster_{it}^{Bopha}$	0.18 (0.22)	-0.04 (0.07)	-0.04 (0.07)	0.09 (0.07)	0.09 (0.07)	0.42** (0.19)
$Disaster_{it}^{Bopha} * T_{it}$	-0.08 (0.10)	0.02 (0.03)	0.02 (0.03)	-0.08*** (0.01)	-0.04 (0.03)	-0.18* (0.09)
$Disaster_{it}^{Haiyan}$	0.53** (0.24)	-0.13* (0.07)	-0.13* (0.07)	0.20*** (0.05)	0.23*** (0.07)	0.24 (0.29)
$Disaster_{it}^{Haiyan} * T_{it}$	0.18** (0.09)	-0.00 (0.03)	-0.00 (0.03)	0.09*** (0.02)	0.04 (0.03)	0.12* (0.07)
$Disaster_{it}^{Meranti}$	0.05 (0.16)	-0.21*** (0.06)	-0.21*** (0.06)	0.02 (0.06)	0.00 (0.05)	0.09 (0.16)
$Disaster_{it}^{Meranti} * T_{it}$	-0.14*** (0.02)	-0.02*** (0.01)	-0.02*** (0.01)	-0.00 (0.01)	0.05*** (0.01)	0.09** (0.03)

NOTES: Newey-West standard errors are in parentheses. One lag is set as the maximum lag order of auto-correlation. *, **, *** denote statistical significance at the respective levels of 10 per cent, 5 per cent, and 1 per cent. Each component of consumption is expressed as a percentage of total consumption expenditure. See Section 5.1 for more details on the regressions and interpretation of the estimated coefficients.

do not find any significant changes in total consumption after Typhoon Meranti. Finally, we still do not find any regular patterns of change in consumption expenditures when we analyse components of consumption.

7. Policy Responses

When disaster strikes, swift reactions from governments are crucial. These reactions can take the form of emergency relief and assistance, helping with reconstruction, and working where possible to prevent or prepare for future disasters. Emergency relief and assistance can include compensation schemes in the form of cash, as well as food, medicines, shelter, and provision for other primary necessities.

In the case of the 2004 tsunami in Thailand, the interior ministry devised compensation schemes for survivors, distributing funds according to various criteria. For example, families that had lost members received funds, with additional support if the person in question was the main breadwinner, and compensation for those who suffered critical injuries or became disabled. The labour ministry also provided compensation to those who had lost their jobs or businesses. Similarly, the Thai government mobilized various agencies and departments in response to the 2016–17 flood to provide relief to the people it had affected, including especially dedicated relief for people who had become homeless, and for farmers, manufacturers, and small and medium-sized enterprises (SMEs).

In the Philippines, the government's social welfare and development department (DSWD) implemented multiple social welfare and protection programmes in the aftermath of Typhoon Haiyan. These programmes included initiatives focusing on relief, early recovery, general recovery, and reconstruction, ranging from providing shelter, food and other essentials, to providing cash for employment and rebuilding projects (Bowen, 2015). Furthermore, the government enjoyed success with the Pantawid Pamilya Pilipino Programme (known as the 4Ps). The 4Ps programme provided conditional cash grants to poor households (Bowen 2015). Another programme that proved useful in the Philippines was the Cash for Work (CfW) scheme. This scheme was used to gather a workforce for the recovery phase. The government also rolled out an extension to CfW to promote long-term recovery, in the form of its Cash for Building Livelihoods Assets (CBLA) programme. The CBLA aims to promote the long-term restoration of livelihoods and overall recovery.

Policy responses can also include targeting industries that are particularly affected by a disaster. In response to the 2004 tsunami, the Thai government provided targeted local support to the industries that were especially devastated by the tsunami: tourism and fisheries. The government provided compensation to fishermen who had lost boats. The government also provided support to help revive the tourism industry in the affected areas, including incentives to stimulate domestic tourism, as well as marketing and promotion efforts, and tax relief for businesses. Additionally, the Bank of Thailand helped entrepreneurs by providing soft loans through commercial banks, and created the Tsunami SME Fund and the Tsunami Recovery Fund. The Bank of Thailand also launched a THB300 billion soft loan scheme to assist both SMEs and individuals who were affected by the floods. The government also established a national catastrophe insurance fund in 2012 to ensure that disaster insurance options are broadly available for both individuals and businesses.

In addition to immediate support, a longer-term policy perspective is also crucial to make sure that they are better protected in the future. This can include making improvements to early warning systems, revising regulatory frameworks, and, in some cases, establishing new institutions to cope with disasters.

The 2004 Indian Ocean tsunami prompted the Thai government to invest in disaster preparedness and early warning systems. The Thai government's disaster prevention and mitigation department worked to establish community-based early warning systems, and to improve public education. One of this department's main priorities was the establishment of the National Disaster Warning Centre (NDWC)

to monitor for any potential disasters, and to provide warnings and information about any such events. With regard to early warning systems, the Philippine government's science and technology department launched the improved version of the Nationwide Operational Assessment of Hazards (NOAH) project in 2015, to provide early warning messages ahead of a potential disaster. Its activities include providing hazard maps, and it played a key role in establishing a law obligating mobile service providers to issue public service announcements via mobile phones free of charge (UNDRR 2019).

Repeated flooding in Thailand has led the Thai government to update systems and create new institutions, tasking the institutions with various aspects of disaster response and prevention. In response to the flooding of 2011, the Thai government proposed five steps to work towards mitigating flood risks: (i) issuing clear regulations for land use in flood-plain areas; (ii) updating the government's information management systems that monitor real-time water levels in rivers and canals; (iii) further developing the country's canal system and identifying large areas that can temporarily hold water; (iv) enforcing deforestation and pollution laws, in order to keep the drainage systems functional; and (v) centralizing authority in a bid to improve communication and co-operation.

Following the 2016–17 floods, the Thai government's irrigation department made plans to implement new water-management projects, including the construction of dams in flood-prone areas. In addition, the government established a dedicated office of national water resources, which it set up to take the lead in systematically regulating and managing the country's policies of integrated water-resource management, with a particular focus on flooding and drought in 2017. In conjunction with the establishment of the new institution, the government initiated the drafting of a twenty-year master plan on water-resource management (2018–37), which includes goals such as building dams, restoring watershed areas, and solving flooding problems and droughts.

In the aftermath of Typhoon Haiyan, the Philippine government established a dedicated body—the Office of the Presidential Assistant for Rehabilitation and Recovery (OPARR)—to lead a comprehensive rehabilitation and recovery plan. The goal was to help affected areas to recover and rebuild. The recovery plan was made up of five national-level clusters, which were delegated to different government departments. The five programme clusters were infrastructure, resettlement, social services, livelihood, and support. The OPARR was later disbanded, and its projects were transferred to the National Economic and Development Authority, which was already in charge of the support cluster (Jha et al. 2018).

8. Conclusion

This study examined the effects of disasters on consumption in Thailand and the Philippines, using three large natural hazards for each country. The study observed a decline in Thailand's total consumption after these disasters, stemming from a reduction in spending in the services sector, which spans recreation, restaurants, and hotels. Households were generally seen to be increasing their spending on non-durable goods, including food and non-alcoholic drinks, alcoholic beverages and tobacco products, and clothing. In the cases of the Philippines, the study also observed changes in Philippine total consumer spending and its components after the typhoons, although these were relatively smaller than those that followed the disasters in Thailand. The study also found that households made changes to their spending on consumption, and that they did so most of all after Typhoon Haiyan. The havoc that disasters wreak upon developing countries, and the manifest impact they have on consumption and overall economic activity make the case for robust and efficient government action in the aftermath of such disasters, at least in the short term. Longer-term policies focusing on disaster mitigation and resilience are also crucial.

NOTES

1. CRED (2020) does not have an estimate for total damages caused by floods in the month of August 2016.
2. To adjust the data for seasonality, we use a seasonal dummy model where regress total consumption on a series of quarter dummies. We then predict residual terms, that contain no seasonal factors. We add the mean of original data on total consumption to these residual terms; therefore, our seasonal-adjusted consumption expenditure will have the same mean as the original data.
3. See Linden (2005) for how to conduct interrupted time-series analysis.
4. Total household consumption expenditure in the fourth quarter of 2004 was THB980.9 billion.
5. The average spending on recreation from the first quarter of 2013 to the last quarter of 2014 was about 5.7 per cent of total household spending; the average spending on hotels and restaurants in the same period was around 11.9 per cent.
6. Total consumption expenditure in the third quarter of 2020 was THB1.2 trillion.
7. See Linden (2005) for how to conduct interrupted tim-series analysis.

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