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The impact of disasters on inflation

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Abstract

This paper studies how disasters affect consumer price inflation, one of the main remaining gaps in our understanding of the impact of disasters. There is a marked heterogeneity in the impact between advanced economies, where the impact is negligible, and developing economies, where the impact can last for several years. There are also differences in the impact by type of disasters, particularly when considering inflation sub-indices. Storms increase food price inflation in the near term, although the effect dissipates within a year. Floods also typically have a short-run impact on inflation. Earthquakes reduce CPI inflation excluding food, housing and energy.

JEL codes: E31, Q54.

Keywords: inflation, disasters.

Non-technical summary

Disasters caused by natural hazard such as earthquakes, storms and droughts can cause massive economic disruption and are often accompanied by a significant human toll. Until recently, the economy-wide effects of such disasters had been little studied. While recent research has deepened our understanding of the effects on economic activity, the effect on prices remains little researched. This paper is the first systematic analysis of the impact of such disasters on consumer prices.

The data used here are drawn from two sources: the EM-DAT database on disasters collected by the Centre for Research on the Epidemiology of Disasters at the Université catholique de Louvain and a unique dataset of CPI and its subcomponents for 223 countries and territories.

We find a large heterogeneity in the impact of disasters on inflation. Disasters have little impact on inflation in advanced economies – those high income countries that have been long-term members of the OECD. Only the largest 25 percent of disasters have significant effects in advanced countries. In emerging and developing economies the impact of disasters can be large and persist for a number of years.

The impact of disasters also differs by type of disaster and by sub-index of consumer prices. Droughts increase food price inflation, potentially for many years after the drought has started. Storms affect food price inflation in the six months immediately following the disaster, but this effect dissipates over the subsequent six months, resulting in no significant impact after a year. Earthquakes lower inflation excluding food, housing and energy prices.

1 Introduction

Disasters caused by natural hazards have the potential to cause massive economic disruption, and often are accompanied by a significant human toll. Recent examples of disasters include: earthquakes in Japan, Chile, Haiti and New Zealand in 2010 and 2011; the devastation of Vanuatu by Cyclone Pam in 2015; The 2011 floods in Thailand; ongoing drought in California and the eruption of Eyjafjallajökull in Iceland in 2010. With greater concentrations of population and activity in vulnerable regions, the incidence of economically significant disasters is increasing (Cavallo and Noy, 2011). Barro (2009) estimates the welfare cost of these rare, but extreme, events at 20 percent of output, far beyond the 1.5 percent estimated welfare cost of normal business cycle fluctuations.

Until recently, our understanding of the economic impact of disasters was limited. Progress has been made over the past decade in investigating the impact of disasters on output, but this incipient literature remains silent on the impact on prices. Cavallo and Noy (2011) in their recent survey of the literature on disasters point to the effect on prices as being one of the main remaining gaps in our knowledge. The aim of this paper is to address that lacuna by systematically analysing the effects of disasters on inflation.

Understanding the effect on prices provides monetary policy makers with greater guidance on how to set policy in the immediate aftermath of the disaster. There are a number of other benefits in knowing the likely path for inflation following a disaster: it can help with estimating the insurance costs for rebuild or cash settlement; it provides aid donors with a metric for determining the value of cash donations or gifts in kind; it assists fiscal authorities with calculating the future costs of the rebuild programme. Finally, the path for inflation has implications for the exchange rate and capital account policies.

We combine two sets of data to undertake the analysis here. The first is the EM-DAT database on disaters widely used in the literature. This contains information on a wide range of disasters, including number of people killed, number of people affected and (less frequently) damage caused. This data set is widely used in the literature and is the only one with widespread coverage that is publicly available.

The second data set is the consumer price data from Parker (2016). These data cover consumer prices for 223 countries and territories over the period 1980-2012. We restrict our sample to those countries with at least 40 quarterly observations, resulting in 212 included in the analysis here. The data include information on headline consumer prices, as well as sub-indices for food, housing, energy and the remainder of the index. The panel is not balanced, with coverage for the sub-indices less complete for less developed countries. Nonetheless, coverage of sub-indices far exceeds any other database for consumer prices.

Previous studies have highlighted a large heterogeneity in the impact of disasters on output, particularly between advanced and developing countries. The impact on inflation is similarly diverse. Disasters on average have negligible impact on inflation in advanced countries, but typically increase inflation in developing countries. That said, the impact for severe disasters (those in the upper quartile) is larger, and significant even in high income countries.

The impact of diasters on inflation differs by sub-index. The impact on food price inflation is in general positive, if short lived. The impact on housing and other sub-indices is in general negative. Differences in expenditure weights on these sub-indices will in part explain the differences witnessed in headline inflation numbers by level of development.

Earthquakes do not significantly affect headline inflation, but do significantly reduce CPI inflation excluding food, housing and energy. Storms cause an immediate increase in food price inflation for the first six months, although this impact is reversed in the subsequent two quarters, resulting in no significant impact over the entire first year, or beyond. Floods increase headline inflation in the quarter that the flooding occurs in middle and low income countries, but have no significant impacts in subsequent quarters. In high income countries, the impact on headline inflation is negative, although insignificant. Droughts increase headline inflation for a number of years.

2 How disasters may affect prices

As noted above, there has yet to be a systematic review of the impact of disasters on prices. Nonetheless, evidence from the literature on the impact on economic activity and a small number of case studies provide some guide to the potential channels of impact.

2.1 Short-run impacts

Disasters affect economic activity via a number of channels in the short run. The immediate direct impact of diasters can cause death and injury to people, and cause damage to buildings, transport infrastructure and livestock. The destruction of harvests or housing can create shortages, pushing up the price of remaining food or houses. The size of the increase in prices may depend on market power of firms and perceptions of customers – it may not be in the long-run interest of a firm to be seen to be profiteering from customers' misery. Rotemberg (2005, p.835) notes examples of customer protests at prices increases following the 1994 earthquake in the Los Angeles area.[1]

Beyond the direct impact, other businesses and households may be indirectly affected, such as being unable to bring goods to market due to lack of transport infrastructure. For example, farmers may react to the shortage of feed caused by a drought by slaughtering livestock. This could potentially reduce meat prices in the near term, but increase them in the medium term as farmers act to rebuild livestock numbers once the drought has ended. If the disruption to economic activity is sufficiently large it may reduce demand for goods and services from sectors not directly affected. This lower demand could reduce the prices in these other sectors.

There are a number of papers that aim to quantify the impact of disasters on economic activity. Noy (2009) examines the impact of 507 disasters over the period 1970-2003, finding a significant impact on GDP. The effect is greater for smaller and for less developed countries. Higher per capita income, literacy rates and institutional capacity help to mitigate the impact. The impact of disasters appears to differ by type of disaster. Raddatz (2009) finds that climatic disasters (storms, floods, droughts and extreme temperatures) have a significant negative impact on GDP, mostly in the year of the disaster. Other disasters are not found to have a significant impact. Felbermayr and Gröschl (2014) similarly find differential impacts by type of disaster and level of development, using a database of geological and meteorological events.

A number of authors also consider the impact of disasters on differing sectors of the economy. Loayza et al. (2012) find no significant effect on overall GDP using five-year growth averages over the period 1961-2005, although droughts are negative and storms and floods are positive. Droughts and storms negatively affect agricultural output, whereas floods are positive. The authors suggest that this positive effect may derive from plentiful rainfall providing benefit to crops that outweighs the localised damage from flooding, and the additional nutrients that aid the following season. Furthermore, cheaper electricity from more abundant hydropower aids industry. Nonetheless, this positive effect disappears in the presence of more severe flooding. Fomby et al. (2013) find that earthquakes affect agricultural production in developing countries, potentially a result of damaged infrastructure. Fomby et al. (2013) also find differing impacts of disasters depending on their severity.

[1] In some jurisdictions it is illegal to increase prices of certain goods, termed 'price gouging', in the immediate aftermath of a disaster (Gerena, 2004).

Small-scale studies of individual disasters, or small groups, point to differing inflation impacts by type of disaster. The most comprehensive study to date, Heinen et al. (2015), considers the impact of hurricanes and floods on the inflation rates of 15 Caribbean islands. Damaging hurricanes increased monthly headline CPI inflation by 0.05 percentage points, with a greater effect on impact on food prices. More damaging hurricanes have a proportionately higher impact on inflation, with the implied inflationary impact of the largest hurricane in their sample being 1.4 percentage points on monthly headline CPI inflation. Flooding had an average 0.083 percentage point impact on inflation, with the implied largest effect 0.604 percentage points. The impact of both hurricanes and floods takes place in the month of the event, with no significant effects in subsequent months.

In terms of case studies of individual events or countries, Laframboise and Loko (2012) estimated that headline inflation increased by an additional 2 percent in Pakistan following the severe floods of 2010. Abe et al. (2014) find little increase in prices following the Great East Japan earthquake of 2011. Reinsdorf et al. (2014) compare this earthquake with the Chilean earthquake of 2010 using online data for supermarkets. Their data point to a sharp fall in product availability in the immediate aftermath of both earthquakes, without concurrent increases in price.

Doyle and Noy (2015) find no significant aggregate impact on New Zealand consumer prices from the Canterbury earthquakes of 2010 and 2011. At a disaggregated level, Parker and Steenkamp (2012) and Wood et al. (2016) find large increases in rents and construction costs within Canterbury, consistent with restricted housing supply following the widespread destruction of the housing stock. Munoz and Pistelli (2010) investigate the impact on inflation of a small number of large earthquakes, by comparing inflation outturns with a forecast based on information prior to the event. While they find that some earthquakes resulted in higher inflation, it was by no means universal. Given their small sample of events they were unable to explain the causes of this different response.

Kamber et al. (2013) study the impact of droughts on New Zealand, using measures of rainfall and soil moisture deficit in a VAR framework. Their findings suggest a drought of the magnitude of that of early 2013 raises CPI food prices by around 1.0 - 1.5 percent. In particular, milk cheese and eggs prices increase by 3 percent, reflecting the importance of dairy in domestic agriculture. Wholesale electricity prices increase by as much as 8 percent following such a drought, as lower lake levels increase the cost of hydroelectricity, although this cost increase does not appear to pass through to retail. Conversely, depressed economic activity results in falling prices for other non-tradable sectors, resulting in no significant impact on overall CPI. Buckle et al. (2007) similarly found no significant overall impact on consumer prices from droughts in New Zealand.

2.2 Medium-run impacts

There may be some longer-lasting impacts on prices beyond the immediate destruction and disruption. The destruction of ports and infrastructure may disrupt imports, driving up the price for those goods which are imported. Conversely, the lack of ports for export may lead to a domestic oversupply and price falls in goods normally exported. International investors may also choose to withdraw capital from a country recently hit by a disaster, pushing down on the exchange rate and increasing the cost of imports. Ramcharan (2007) finds that in flexible exchange rate regimes, the real exchange rate depreciates by 10.25 percent in the year following a windstorm. The exchange rate effect is uncertain, however, since domestic investors repatriating foreign investments could lead to an exchange rate appreciation; the yen appreciated sharply in the immediate aftermath of the 2011 Tōhoku earthquake (Neely, 2011).

Over the medium term, as resources are allocated to damage and reconstruct destroyed buildings and infrastructure there may be a 'demand surge', placing upward pressure on prices. Keen and Pakko (2011) calibrated a DSGE model to simulate the impact of Hurricane Katrina. In their simulation, the destruction of capital stock and temporary fall in productivity causes firms to raise prices, resulting in higher inflation

However, this demand surge is not certain. The incidence of a disaster may cause revisions of people's perception of disaster risk and cause outward migration. Boustan et al. (2012) find outward migration from areas affected by tornadoes, Hornbeck (2012) from heavily eroded counties in the Dust Bowl era, and Hornbeck and Naidu (2014) document substantial outward migration following the 1927 Mississippi floods. Coffman and Noy (2012) use synthetic control methods to estimate a 12 percent drop in population on the island of Kauai in Hawaii, following Hurricane Iniki. The population of New Orleans fell sharply following Hurricane Katrina (Vigdor, 2008), although the destruction of housing stock was far greater, resulting in higher house prices and rents. The destruction of disasters may also create poverty traps where households are unable to regain previous wealth and income (Carter et al., 2007). Such scenarios would put downward pressure on prices over the medium term in areas affected by disasters, although it is less certain the extent to which this affects the overall national price level.

Taking the above factors into consideration, the overall impact of disasters on inflation is ambiguous. The prior research on activity suggests there may be at the very least differences in the impact of disasters on inflation: by type of disaster; between the short and medium term; by different sub-component of the inflation basket; by level of development, and; by severity of the disaster. The analysis that follows accounts for these differing potential effects in turn.

3 Data and method

3.1 Disasters

The most widely used source for disasters is the EM-DAT database collected by the Centre for Research on the Epidemiology of Disasters at the Université catholique de Louvain. The database covers disaster events which meet one of the following criteria: ten or more people killed; 100 or more people affected; declaration of a state of emergency; or call for international assistance. Alongside the date of the disaster, the EM-DAT database also includes information on the number of people killed and the number of people affected. For a smaller set of disasters the database includes an estimate of the damage caused.

It is worth noting that the EM-DAT database measures the *ex post* effects of disasters, which as shown in Noy (2009) and elsewhere depend on a number of country specific factors such as institutions. The relevant institutional factors, for example good economic governance, may also affect inflation dynamics. To understand the impact of the underlying natural hazards, it is necessary to have data on the event in question, such as wind speed, rainfall, or intensity of ground shaking. Heinen et al. (2015) use such a dataset for their study of windstorms and floods for a select group of Caribbean islands.

Only disasters with likely macroeconomic effects are considered here, namely: earthquakes, storms, floods, droughts and other disasters (mass movements, insect infestations, extreme temperatures, volcanoes and wildfires). In order to estimate the effect of disasters on inflation, we require the quarter in which the disaster took place. The EM-DAT database does not always have precise start dates for droughts (even to the three-month period required) so as a consequence many droughts have been dropped from the analysis.

Even with these selection criteria, there are a large number of disasters in the EM-DAT database which are small relative to the overall size of the country and are unlikely to have any discernable macroeconomic effects. To aid estimation, only disasters with at least major impact are considered in the analysis below. To estimate the severity of the impact of the disasters we construct an impact variable for each disaster, calculated in a similar fashion to Fomby et al. (2013).

The impact variable used in this paper is:

$$IMP'_{i,t} = (EQIMP_{i,t}, STIMP_{i,t}, FLIMP_{i,t}, DRIMP_{i,t}, OTIMP_{i,t})' \quad (1)$$

where $EQIMP$, $STIMP$, $FLIMP$, $DRIMP$ and $OTIMP$ represent the respective total impact of earthquakes, wind storms, floods, droughts and other disasters. $IMP_{i,t}$ is calculated as:

$$IMP_{i,t}(k) = \sum_{j=1}^{J} intensity^{k}_{i,t,j} \quad (2)$$

where

$$\begin{aligned} intensity^{k}_{i,t,j} &= 100 * \frac{fatalities^{k}_{i,t,j} + 0.3 * total\ affected^{k}_{i,t,j}}{population_{i,t,j}}, \text{ if } intensity > 0.1 \\ &= 0 \quad \text{otherwise} \end{aligned} \quad (3)$$

and J is the total number of each type-k events (k=1,2,3,4,5 and responds to earthquakes, wind storms, floods, droughts and other disasters respectively) that took place in each country i in quarter t. The creation of $IMP_{i,t}$ can be described by the following steps. First, for each disaster the intensity was calculated by dividing the number of fatalities and 30 percent of the total people affected by the population. Where this intensity is smaller than 0.1 percent, the impact is set to zero (equation 3). Then for each country, the total impact for each type of disaster is calculated as the sum of the intensities of each such disaster that occurred in each country for each quarter (equation 2).

The criteria on disasters discussed above, together with the availability of consumer price data (see section 3.2), result in a total of 1349 disasters in 163 countries. Table 1 shows the incidence of disasters by type and by country development. Floods and storms are the most frequently occurring disasters that meet the criteria for inclusion. Measured droughts are rare in advanced countries (following Noy (2009) we take these to be high income members of the OECD in 1990) and other high income countries, with only three in the sample, compared with 124 in middle income countries.

The impact on inflation is likely to depend on the size of the disaster. We follow Cavallo et al. (2013) and focus here on large disasters in the 75th and 90th percentiles. The 75th percentile disaster is approximately the impact of Hurricane

Table 1: Incidence of disasters

	Earthquakes	Storms	Floods	Droughts	Other	Total
Number						
Advanced	17	14	9	2	5	47
Other high income	3	39	21	1	3	67
Middle income	47	288	433	124	29	921
Low income	6	57	155	90	6	314
Total	73	398	618	217	43	1349
75th percentile						
Advanced	1.19	0.66	0.40		1.68	1.09
Other high income		1.26	0.28			0.94
Middle income	0.93	1.56	0.89	5.47	1.20	1.46
Low income	0.53	1.26	0.92	6.68	8.25	2.75
Total	0.95	1.33	0.87	5.79	1.95	1.64
90th percentile						
Advanced	2.07	1.69	1.09		5.10	4.63
Other high income		3.89	0.53			3.67
Middle income	2.34	6.12	2.43	10.75	2.38	4.53
Low income	13.47	3.83	3.28	14.34	12.24	7.00
Total	2.63	4.37	2.48	12.00	5.10	4.99

Notes: countries within advanced and other high income groups set out in table 7 in the appendix. 75th and 90th percentile impact as calculated per equations (2) and (3). Measured in percent of population. Impact omitted where there are fewer than 5 events.

Earl on Antigua and Barbuda in 2010. The hurricane affected around 6 percent of the population and did damage estimated to be around 1 percent of GDP. The 90th percentile is approximately the impact of the 2010 earthquake in Chile, which killed 562 people, affected 2.7 million (16 percent of the population) and had estimated damages of 17 percent of GDP.

3.2 Consumer prices

As noted in section 2 above, different types of disasters may affect different prices, with the prices for food, housing (including rent) and energy being the most commonly cited in the literature. Commonly used international databases, such as the *International Financial Statistics* of the International Monetary Fund and the *World Development Indicators* of the World Bank, typically contain information on just the overall, headline CPI index. Information on the sub-indices is normally only available from national sources.

The consumer price data used here are taken from the dataset in Parker (2016). This dataset contains CPI for 223 countries and territories on a quarterly basis for the period 1980-2012. The series contained are the overall index (CPI) the sub-indices for food (CPIF), housing (CPIH), energy (CPIE), and all remaining items in the index (CPIxFHE). Coverage for CPIH and CPIE is relatively sparse relative to the other indices, so a combined housing and energy index is also included (CPIHE) which has observations for a greater number of countries.

We drop countries for which there are fewer than 40 quarters of CPI data. This results in 212 countries with observations for headline CPI. The average number of quarters of headline CPI data per country is 105. Fewer countries have data for the sub-indices, and the length of coverage is also typically shorter, particularly for less developed countries.

3.3 Method

To estimate the impact of disasters on inflation, we run a panel regression of the form:

$$\pi_{i,t} = \sum_{j=0}^{p} \beta_j D_{i,t-j} + \mu_i + \lambda_t + \nu_{it} \qquad (4)$$

where $\pi_{i,t}$ is quarterly log difference in CPI in country i in quarter t. We multiply the inflation rate by 100 to give coefficients that are in units of percentage points for ease of reading. $D_{i,t}$ is a vector of variables capturing the impact of disasters. The analysis that follows also considers the impact on the inflation rate for food, housing, energy and cpi excluding food housing and energy, respectively $\pi^f_{i,t}$, $\pi^h_{i,t}$, $\pi^e_{i,t}$, $\pi^{xfhe}_{i,t}$. We consider both the impact of all disasters combined, and the five types of disasters (earthquakes, wind storms, floods, droughts and other) individually as described in section 3.1 above. The parameters μ_i and λ_t are fixed effects for country and time respectively. The country fixed effects capture the time invariant characteristics of each country that explain differences in average inflation rates between countries. The time fixed effects capture global factors that affect all countries, such as global developments in output growth and commodity prices or the Great Moderation. The occurrence of disasters is assumed to be exogenous, and unaffected by current or previous values of CPI.

One potential problem with this estimation is that CPI data is typically seasonal, which increases the variance of the underlying series. There are a number of approaches to eliminate this seasonality. The first is to use a seasonal adjustment process, the most widely used of which is the Census Bureau's X12. However, X12 uses both forward and backward looking filters, which violates the exogeneity assumption over CPI and disasters.

The use of country seasonal dummies for each quarter is also unsatisfactory for our purposes if disasters do have an impact on CPI, but are concentrated in particular quarters. Consider windstorms, whose incidence is for the most part concentrated to certain times of the year. In such cases, the seasonal dummy will absorb some of the true impact of disasters. Such quarterly dummies are also unsatisfactory if the seasonal pattern changes over time. Given these problems, we use the non-seasonally adjusted data. The time fixed effects dummies already included do account for the average seasonal pattern across countries, and are robust to changing seasonal patterns, but are unable to account for differences in seasonal patterns across countries.[2]

Standard panel estimation assumes that the errors, ν_{it}, are not correlated cross-sectionally, i.e.:

$$\rho_{ij} = \rho_{ji} = corr(\nu_{it}, \nu_{jt}) = 0 \qquad \text{for} \qquad i \neq j \tag{5}$$

However, such an assumption may not be valid when macroeconomic time series are used. Close trade ties and other economic interactions between spatially

[2] For robustness, we also estimate using country seasonal dummies and using data seasonally adjusted using X12 (not reported). The results using the seasonally adjusted data are qualitatively similar to those presented here.

grouped countries are likely to result in positive cross-correlations. To test the null hypothesis of cross-sectional independence we use the Pesaran (2004) test, which is the most appropriate given the unbalanced nature of the CPI dataset, and the large N relative to T. We obtain a test statistic of 205, which is significant evidence against the null of cross-sectional independence. The average absolute pairwise cross-sectional correlation is 0.302. A positive cross-sectional correlation results in substantial downward bias to the standard errors calculated using standard panel estimation techniques. To account for this large cross-sectional correlation, and any potential serial correlation, we use Driscoll and Kraay (1998) adjusted standard errors in the estimations that follow.[3]

4 Results

This section describes the results from the regression described above in equation (4). We initially consider the aggregate impact of all disasters combined on inflation. Given the potential for heterogeneity of impact, as discussed in section 2, we then analyse in turn the effects on inflation by type of disaster, by level of development and by severity of disaster. To verify the robustness of our findings, we also consider two alternative specifications of impact – damage relative to GDP and considering just the number of disasters rather than differentiating by impact.

4.1 Aggregate impact of disasters on inflation

We first estimate equation (4) on the aggregate impact of all disasters, which is to say $D_{i,t}$ is the sum by country and by quarter of the impact across all types of disaster. We include up to 11 lags, since we find joint significance up to three years following the incidence of the disaster. Further lags are not individually or jointly significant. The individual coefficients from the estimation are included in table 8 in the appendix. To aid assessment of the impact of a typical disaster, we multiply the coefficients by the impact value of the 75th and 90th percentile disasters (see table 1) to give the estimated effect on inflation of these disasters. These estimated impact results are shown in table 2.

Our results estimate that a disaster in the 75th percentile would have a contemporaneous (i.e. quarter 0) impact on headline inflation of 0.26 percentage points (pp).

[3]The Pesaran (2004) test is carried out in Stata using the xtcsd command of Hoyos and Sarafidis (2006). The estimation using Driscoll and Kraay (1998) adjusted standard errors is implemented using the xtscc command developed by Hoechle (2007).

Table 2: Estimated inflation impact of disasters

	Headline	Food	Housing	Energy	CPIxFHE
75th percentile					
Quarter 0	0.264**	0.164**	−0.069	−0.149	0.016
Quarter 1	0.184*	0.158*	−0.058	−0.149	−0.101*
Quarters 2-3	0.159	−0.219*	−0.231***	−0.117	−0.121
Year 1	0.607*	0.102	−0.359**	−0.414	−0.206*
Year 2	0.910	−0.030	−0.351*	0.150	−0.142
Year 3	0.769*	0.274	−0.131	0.203	0.034
90th percentile					
Quarter 0	0.799**	0.497**	−0.210	−0.451	0.048
Quarter 1	0.557*	0.479*	−0.175	−0.451	−0.306*
Quarters 2-3	0.483	−0.666*	−0.702***	−0.355	−0.366
Year 1	1.840*	0.310	−1.088**	−1.257	−0.624*
Year 2	2.760	−0.089	−1.063*	0.456	−0.431
Year 3	2.331*	0.832	−0.398	0.617	0.104
Observations	22471	18933	8191	9167	12639
R^2	0.050	0.042	0.046	0.171	0.054

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Shows estimated impact for 75th and 90th percentile disaster. Underlying regression coefficients in table 8 in appendix. Quarter 0 is the quarter the disaster takes place. Year 1 is quarters 0 through 3 combined, year 2 is quarters 4 through 7, year 3 is quarters 8 through 11.

There is a further significant impact of 0.18pp on headline inflation in the quarter immediately following the disaster (quarter 1). Since exact timing of effects may differ between individual disasters, we combine the coefficients for quarters 2 and 3. The impact at this horizon is positive, but insignificant. The combined impact on inflation of the 75th percentile disaster for the first year (quarters 0 through 3) is estimated to be 0.61pp. The impact over the second year (quarters 4 through 7) is estimated to be 0.91pp, although this is not significant. Finally, the impact over the third year (quarters 8 through 11) is significant, and estimated to be 0.77pp.

Turning to the sub-indices, there is a positive and significant contemporaneous impact on food prices of 0.16pp, and a similar impact in the first quarter following the disaster. However, in the subsequent two quarters there is a negative and significant impact on inflation, such that the overall impact on food prices over the first year is insignificant and close to zero. There is no significant impact on food prices beyond the first year.

Housing inflation is significantly reduced in the aftermath of disasters, by 0.36pp and 0.35pp in the first two years following the disaster. There is no significant impact on energy prices. CPI inflation excluding food, housing and energy is significantly lower in the aftermath of disasters, by an estimated 0.21pp in the first year for the 75th percentile disaster. There is no significant impact beyond the first year. Table 2 also includes the estimated figures for the 90th percentile disaster. Since this involves multiplying the underlying coefficients by a larger impact coefficient, the overall pattern of effects and significance are unchanged from the 75th percentile case.

Strictly speaking, it is not possible to draw conclusions from the individual sub-indices for the overall impact on headline inflation. The samples differ for each sub-index because of the lack of availability of some sub-indices. In particular, the sub-indices for housing and energy are frequently unavailable outside of high income countries. There is also a noticeable difference in relative weights in the sub-indices between countries. For example, the weight of food in the index is around 10-15 percent in advanced countries, but frequently exceeds 50 percent in low income countries (Parker, 2016). For the purposes of robustness, we include the estimation results on a balanced panel of 78 countries over the period 1996-2012 for the sub-indices for food, the combined housing and energy sub-index and CPIxFHE (see table 9 in the appendix). The sample in this balanced panel is heavily biased towards high income countries, and the estimates are similar in nature to those for this group of countries (see section 4.3).

4.2 Impact by type of disasters

As noted above in section 2, disasters have heterogeneous impacts on activity, dependent on type. To test whether this finding also holds for inflation, we re-estimate equation (4) with separate impact variables of each type of disaster. The coefficients from this estimation are shown in tables 10 through 14 in the appendix. The results are summarised in table 3. We again multiply the coefficients by the impact of the 75th percentile disaster of the relevant type. The 'other' category of disasters has almost no significant coefficients, perhaps unsurprising given the diversity of disasters within the category, so these disasters are unreported in table 3.

Earthquakes do not have a significant impact on headline or food inflation at any horizon. An earthquake in the 75th percentile is estimated to increase housing inflation in the first quarter after it takes place by 0.18pp and energy inflation in that quarter by 0.79pp. These increases appear to be unwound in subsequent quarters, with the estimated impact over the first year combined not significantly different from zero. CPI inflation excluding food, housing and energy is significantly reduced by earthquakes in each of the three years following the disaster, by 0.63pp, 0.45pp and 0.36pp respectively.

Storms are estimated to have a contemporaneous positive impact on headline inflation, and a positive impact the following quarter, although insignificant in both cases. The second quarter following the storm is negative and significant. Overall, the estimated impact for the 75th percentile storm over the first year is 0.00pp. There is no significant impact on headline inflation in subsequent years. There is a significant impact on food price inflation during the first year. A 75th percentile storm significantly increases food price inflation by 0.16pp contemporaneously and by a further 0.22pp in the first quarter following the storm. These increases are unwound in the subsequent two quarters, leaving the total estimated impact over the first year to be insignificantly different from zero. Storms reduce housing price inflation in the three years that follow, by 0.38pp, 0.64pp and 0.39pp respectively, although only the second year is significant. The impact on other sub-indices is insignificant.

The 75th percentile flood is estimated to have a positive and significant contemporaneous impact on headline inflation of 0.38pp. There is estimated to be a positive impact on headline inflation throughout the first three years following the flood, although this is not significant. Energy price inflation is estimated to be lower for the first year, before rebounding in the following year. This would be consistent with plentiful rainfall lowering hydroelectric generation costs in the near term. The 75th percentile flood is estimated to have no significant impact on food or

Table 3: Impact on inflation by type of disaster

	Headline	Food	Housing	Energy	CPI ex FHE
Earthquakes					
Quarter 0	0.228	0.238	−0.031	−0.287	−0.092
Quarter 1	0.047	−0.084	0.183*	0.785**	−0.234***
Quarters 2-3	−0.025	−0.165	−0.194	−0.473	−0.302***
Year 1	0.250	−0.012	−0.043	0.024	−0.628***
Year 2	0.364	0.273	0.026	1.931	−0.450***
Year 3	0.220	0.397	−0.261	−0.736	−0.357*
Storms					
Quarter 0	0.101	0.155*	−0.085	−0.523	0.021
Quarter 1	0.056	0.216*	−0.039	−0.318	−0.099
Quarters 2-3	−0.156	−0.332***	−0.260**	0.003	−0.063
Year 1	0.001	0.038	−0.384	−0.838	−0.140
Year 2	−0.124	−0.008	−0.641***	0.075	−0.113
Year 3	−0.067	0.059	−0.387*	0.161	0.201
Floods					
Quarter 0	0.378*	0.144	−0.079	−0.242	−0.145
Quarter 1	0.170	0.071	−0.069	−0.327	−0.159*
Quarters 2-3	0.368	−0.163	−0.005	−0.246	−0.028
Year 1	0.916	0.051	−0.153	−0.815	−0.332*
Year 2	1.652	−0.029	−0.329	1.207**	−0.061
Year 3	1.465	0.255	−0.118	−0.051	0.045
Droughts					
Quarter 0	1.359*	0.540	−0.114	0.225	0.138
Quarter 1	1.300*	0.398	−0.295	−0.243	−0.170
Quarters 2-3	1.975	−0.088	−0.683**	−0.554	−0.648**
Year 1	4.634*	0.850	−1.092	−0.573	−0.680
Year 2	7.066	0.131	−0.697	−0.725	−0.207
Year 3	5.212**	1.735	−0.380	1.168	−0.131
Observations	22471	18933	8191	9167	12639
R^2	0.055	0.045	0.050	0.174	0.060

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Shows estimated impact for 75th percentile disaster. Underlying regression coefficients in tables 10 through 14 in appendix. Quarter 0 is the quarter the disaster takes place. Year 1 is quarters 0 through 3 combined, year 2 is quarters 4 through 7, year 3 is quarters 8 through 11.

housing price inflation. Inflation in the remainder of the index is estimated to be lower by 0.33pp in the first year following the flood.

The 75th percentile drought is estimated to increase headline inflation by 1.36pp in the start quarter, and by 1.30pp in the subsequent quarter.[4] The impact on food price inflation is typically positive, although insignificant. The impact on housing and CPIxFHE price inflation is negative, significantly so in the second and third quarters following the start of the drought.

4.3 Impact by level of development

Previous research has highlighted that disasters have greater impact on activity in developing economies than in advanced economies (Noy, 2009; Raddatz, 2009; Fomby et al., 2013). We investigate whether this finding holds for the impact on inflation by estimating equation (4) separately for advanced countries, other high income countries and for the remaining countries. There are insufficient observations for low income countries, particularly for the sub-indices, to merit estimating these countries separately. The estimated impact for the 75th percentile disaster in each country group is shown in table 4. The underlying coefficient estimates are provided in tables 15, 16 and 18 in the appendix. Given the relative lack of individual sub-indices for housing and energy in middle and low income countries, we use the combined housing and energy sub-index that is more widely available in these countries.

Disasters do not have significant impact on either headline, food or energy price inflation in advanced countries. Housing price inflation is significantly lower in the second year after the disaster, by 0.25pp for the 75th percentile disaster. CPIxFHE inflation is significantly lower in the first year following the disaster, by 0.09pp.

In other high income countries, the 75th percentile disaster is estimated to increase headline inflation 2.97pp over the first year, but only the increase in quarters 2 and 3 is significant. There are significant increases in the second and third year after the disaster, by 0.95pp and 0.69pp respectively. Food price inflation is significantly increased in the first two years following the disaster, conversely energy prices fall. There are no significant impacts on the other sub-indices.

There are insufficient events to consider the impact by disaster separately for advanced and other high income countries, so table 17 in the appendix considers

[4] Note that unlike the other disasters considered here, droughts may continue for several quarters, indeed even years. The 75th percentile drought is also much greater in impact than the 75th percentile of the other disasters.

Table 4: Impact of disasters by level of development

Advanced countries

	Headline	Food	Housing	Energy	CPIxFHE
Quarter 0	0.005	0.054	−0.126	−0.050	−0.007
Quarter 1	−0.017	0.097*	−0.018	−0.143	−0.034
Quarters 2-3	−0.076*	−0.074	−0.080	−0.061	−0.049
Year 1	−0.088	0.076	−0.224	−0.254	−0.091*
Year 2	−0.054	−0.162*	−0.251*	−0.221	−0.017
Year 3	0.124	0.121	0.229	0.143	0.067
Observations	2783	2741	2167	2715	2591
R^2	0.302	0.247	0.172	0.507	0.361

Other high income countries

	Headline	Food	Housing	Energy	CPI ex FHE
Quarter 0	1.066	0.135	−0.013	−2.454**	0.045
Quarter 1	1.144	0.297	0.060	−0.525*	−0.175
Quarters 2-3	0.755*	0.353	0.034	0.949*	−0.075
Year 1	2.965	0.785*	0.081	−2.031**	−0.205
Year 2	0.950*	0.915***	0.084	0.221	−0.195
Year 3	0.691*	0.070	0.078	−0.169	0.101
Observations	4887	4106	2486	2465	2852
R^2	0.093	0.134	0.116	0.295	0.139

Middle and low income countries

	Headline	Food	Housing & Energy	CPI ex FHE
Quarter 0	0.267**	0.177**	0.056	0.022
Quarter 1	0.176*	0.160*	−0.043	−0.079
Quarters 2-3	0.179	−0.230*	0.051	−0.142
Year 1	0.621*	0.107	0.065	−0.200
Year 2	1.005	−0.022	−0.001	−0.121
Year 3	0.831**	0.306	−0.080	0.053
Observations	14801	12086	7301	7196
R^2	0.057	0.042	0.064	0.057

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Shows estimated impact for disaster in 75th percentile. Underlying regression coefficients in tables 15, 16 and 18 in appendix. Quarter 0 is the quarter the disaster takes place. Year 1 is quarters 0 through 3 combined, year 2 is quarters 4 through 7, year 3 is quarters 8 through 11.

the impact by type of disaster for all high income countries. The 75th percentile earthquake in high income countries has no significant effect on headline inflation, but significantly reduces CPIxFHE inflation by 1.43pp in the first year, by 1.62 in the second year and by 1.61pp in the third year . The 75th percentile storm has a positive impact on headline inflation. Over the first year, the estimated impact is 4.59pp, although this is insignificant. For the second and third year the impact is positive and significant at 1.50pp and 0.96pp respectively. Food price inflation is higher by 0.96pp in the first year and by 1.27pp in the second year.

For middle and low income countries, the 75th percentile disaster is estimated to increase headline inflation by 0.62pp in the first year, by (an insignificant) 1.01pp in the second year and by 0.83pp in the third year. By sub-component, food price inflation is significantly higher in the quarter that the disaster takes place and in quarter 1. But in the subsequent two quarters, this higher inflation is partly reversed, such that the combined impact for the first year is insignificant. Disasters do not have significant impact on the other sub-components in middle and low income countries. Split by type of disaster (see table 19 in the appendix), earthquakes lower CPIxFHE inflation, and the 75th percentile drought has a large and positive impact on headline inflation: 4.99pp in the first year, 7.34pp (insignificant) in the second year and 5.37pp in the third year.

4.4 Impact by severity of disaster

Given the heavily skewed distribution of disaster impacts, it is possible that there are non-linearities in their effect on inflation. We construct a series for the impact of severe disasters, $SEVIMP_{t,i}$ in an analogous fashion to equations (2) and (3), but set the cutoff threshold to be the 75th percentile of the distribution. Thus the upper quartile of disasters – 337 disasters in total – are classified as 'severe'. We then estimate equation (4) including both $IMP_{t,i}$ and $SEVIMP_{t,i}$ in the vector of impact variables, $D_{i,t}$. The estimated coefficients on the $IMP_{t,i}$ variables represent the impact of major disasters (those in the first three quartiles of disaster impact) on inflation. The coefficients on $SEVIMP_{t,i}$ capture any additional effect on inflation from severe disasters.

Given that the effect of disasters differs by level of development (section 4.3), we estimate high income countries separate from middle and low income countries. Table 5 shows the estimated impact on inflation of a (severe) disaster in the 90th percentile, split by level of development.

For high income countries, there is a significant positive impact on inflation in the first two years following a severe disaster (table 21 in the appendix). The impact

Table 5: Impact of severe disasters on inflation

High income countries

	Headline	Food	Housing	Energy	CPI ex FHE
Quarter 0	1.647	0.183	−0.488**	−3.732	0.103
Quarter 1	1.961	0.480	−0.130	−0.374	−0.490
Quarters 2-3	0.397	−0.104	−0.509**	0.583	−0.224
Year 1	4.004*	0.558	−1.128***	−3.523	−0.611
Year 2	0.887*	0.717	−0.758*	−0.624	−0.656*
Year 3	0.410	−0.751	0.236	−0.131	−0.181
Observations	7670	6847	4653	5180	5443
R^2	0.077	0.136	0.103	0.340	0.160

Middle and low income countries

	Headline	Food	Housing & Energy	CPI ex FHE
Quarter 0	0.619*	0.550**	0.293	0.036
Quarter 1	0.469	0.413*	−0.100	−0.269
Quarters 2-3	0.627	−0.468	0.188	−0.348
Year 1	1.715	0.496	0.381	−0.581
Year 2	3.227	−0.059	−0.009	−0.339
Year 3	2.671*	1.123	−0.041	0.263
Observations	14801	12086	7301	7196
R^2	0.058	0.044	0.066	0.059

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Shows estimated impact for disaster in 90th percentile. Underlying regression coefficients in tables 20 through 23 in appendix. Quarter 0 is the quarter the disaster takes place. Year 1 is quarters 0 through 3 combined, year 2 is quarters 4 through 7, year 3 is quarters 8 through 11.

on housing price inflation is negative for the first two years. A split by disaster type is not worthwhile for high income countries. There are only 23 severe disasters, and individual types are concentrated in certain countries. For example, the four earthquakes are split evenly between Chile and New Zealand, with the two New Zealand earthquakes taking place less than six months apart.

For middle and low income countries, there are a number of significant coefficients on the severe disaster variables. The reversal in the impact on headline and food price inflation typically seen in quarters 2 and 3 is not as pronounced, and is no longer significant. The impact on the other sub-indices is more positive for severe relative to major disasters, significantly so in the third year following the disaster, although the aggregate impact of severe disasters on these sub-indices remains insignificant. The impact of severe disasters by type of disaster in middle and low income countries is similar in pattern to that when all disasters are combined (table 24 in the appendix).

4.5 Alternative measures

For the purposes of robustness, we also consider alternative measures of the impact of disasters that have been used in studies of the impact on output. The first measure uses the information contained in the EM-DAT database on damage. We calculate an intensity measure as the ratio of measured damage to GDP, using annual GDP data from the World Bank's *World Development Indicators*. To account for the potential contemporaneous impact of the disaster on output we use the GDP figure from the year prior to the disaster. As with our previous intensity measure, we set the intensity of a disaster to zero if the ratio of damage to GDP is less than 0.1 percent. Given the lower level of coverage for damages in the EM-DAT database, we have estimates for the damage intensity for 525 disasters that meet the threshold.

We estimate equation (4) using the intensity measure based on damage. The estimated impact for the 75th percentile disaster on the damage measure is markedly smaller than that based on the population-based intensity (table 6). There is no significant impact on headline inflation in the first two years following the disasters. The qualitative impact on food prices is similar - higher inflation in the quarter that the disaster takes place and the first quarter after, followed by lower inflation in the succeeding two quarters. The impact on housing is negative, although insignificant. Finally the impact on CPIxFHE inflation is negative in the first two years, significantly so in the second year.

There are a number of reasons why the estimated impact differs between the

Table 6: Impact of disasters on inflation - alternative measures

Damage relative to GDP

	Headline	Food	Housing	Energy	CPIxFHE
Quarter 0	0.041	0.080***	−0.133	0.629	−0.002
Quarter 1	0.014	0.042	0.086	0.571	−0.038
Quarters 2-3	−0.020	−0.113**	−0.036	−0.499	−0.027
Year 1	0.034	0.009	−0.083	0.701	−0.066
Year 2	0.142	−0.005	−0.302	2.203*	−0.050*
Year 3	0.175*	0.161*	−0.131	−0.468	0.092
Observations	22471	18933	8191	9167	12639
R^2	0.047	0.042	0.044	0.172	0.053

Number of disasters - high income countries

	Headline	Food	Housing	Energy	CPI ex FHE
Quarter 0	0.477	0.277	0.109	−0.804*	−0.076
Quarter 1	0.815*	0.595*	0.400	−0.329	0.151
Quarters 2-3	0.642	0.051	0.312	0.579	−0.041
Year 1	1.934**	0.923*	0.820	−0.553	0.033
Year 2	0.087	0.195	−0.610	−0.719	−0.114
Year 3	0.007	0.222	−0.188	−0.168	0.386
Observations	7670	6847	4653	5180	5443
R^2	0.076	0.134	0.099	0.336	0.159

Number of disasters - middle and low income countries

	Headline	Food	Housing & energy	CPIxFHE
Quarter 0	0.578*	0.319**	−0.229	−0.024
Quarter 1	0.212	0.051	−0.128	−0.126
Quarters 2-3	−0.175	−0.681**	−0.259	−0.308**
Year 1	0.615	−0.311	−0.616	−0.458**
Year 2	1.383	−0.177	−0.082	−0.128
Year 3	1.702	0.147	−0.760**	−0.413
Observations	14801	12086	7301	7196
R^2	0.056	0.043	0.065	0.057

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Shows estimated impact for disaster in 75th percentile of damage caused. Underlying regression coefficients in tables 25 through 27 in appendix. Quarter 0 is the quarter the disaster takes place. Year 1 is quarters 0 through 3 combined, year 2 is quarters 4 through 7, year 3 is quarters 8 through 11.

two measures of intensity. The intensity measure based on population has an upper bound of 100 (where the disaster kills the entire population), with the highest calculated intensity in our panel being 47. Conversely, damages can exceed annual GDP, with the highest damage intensity in the panel 221. Excluding the 11 disasters that exceed a damage intensity of 50, the short-run impact on inflation of the two measures of intensity is closer.

The smaller coverage of the disaster intensity measure also biases the estimation in two dimensions. First, coverage for damage intensity is patchier in middle and low income countries, which have a different profile for the inflation impact than high income countries. There is a further composition bias, given that droughts, which typically have a more positive inflationary impact, are proportionately less represented in the damage data. Further, the lack of coverage of the damage caused by disasters introduces measurement error, since some observations are now incorrectly classified as being disaster free.

Given the lack of coverage for damage, we also estimate equation (4) using the number of disasters as our measure of intensity, which has been used previously as a measure of impact (see, e.g. Skidmore and Toya, 2002). This alternative estimation calculates the average impact for all disasters and does not allow for varying impacts by size of disaster. The results are summarised in table 6, with separate estimations for high income countries and middle and low income countries. The results for high income countries are for the most part qualitatively similar to the those estimated under the original specification. Headline and food price inflation is positively affected over the course of the first year. Energy price inflation is lower on impact. Conversely, housing price inflation is no longer significantly affected.

For middle and low income countries, the familiar pattern of food price inflation initially higher, before reversal in quarters 2 and 3 is evident. There is a negative impact on CPIxFHE inflation in the first year.

5 Conclusion

This paper has analysed the impact of disasters on inflation, using a panel of consumer price indices for 212 countries. It is the first to systematically analyse this impact, with previous studies confined to case studies of a small number of events, or to small geographical regions. The findings point to a considerable heterogeneity in the impact of disasters by type of disaster, by sub-index of CPI, by level of development and by timing.

There is a clear differentiation in the inflation impact of disasters by level of development. The impact of disasters in advanced countries is for the most part insignificant, and even where there is a significant impact on a sub-index, its magnitude is negligible. Conversely, the impact for less developed countries is more marked, with significant effects on headline inflation persisting even three years post-disaster. That said, there is a significant impact in high income countries from severe disasters (those in the upper quartile).

In terms of sub-indices, the impact on food price inflation is in general positive, if short lived. The impact on housing and other sub-indices is in general negative. Differences in expenditure weights on these sub-indices will in part explain the differences witnessed in headline inflation numbers by level of development.

Earthquakes do not significantly affect headline inflation, but do significantly reduce CPI inflation excluding food, housing and energy. Storms cause an immediate increase in food price inflation for the first six months, although this impact is reversed in the subsequent two quarters, resulting in no significant impact over the entire first year, or beyond. Floods increase headline inflation in the quarter that the flooding occurs in middle and low income countries, but have no significant impacts in subsequent quarters. In high income countries, the impact on headline inflation is negative, although insignificant. Droughts increase headline inflation for a number of years.

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A Appendix – country classifications

Table 7: Country groupings

Advanced			
Australia	France	Japan	Spain
Austria	Germany	Luxembourg	Sweden
Belgium	Greece	Netherlands	Switzerland
Canada	Iceland	New Zealand	United Kingdom
Denmark	Ireland	Norway	United States
Finland	Italy	Portugal	
Other high income			
Andorra	Cyprus	Korea Rep	Russian Federation
Antigua and Barbuda	Czech Republic	Kuwait	San Marino
Aruba	Equatorial Guinea	Latvia	Saudi Arabia
Bahamas	Estonia	Lithuania	Singapore
Bahrain	Faeroe Islands	Macau	Sint Maarten
Barbados	French Polynesia	Malta	Slovakia
Bermuda	Guam	New Caledonia	Slovenia
Brunei Darussalam	Guernsey	North. Mariana Is.	St Kitts and Nevis
Cayman Islands	Hong Kong	Oman	Trinidad and Tobago
Chile	Isle of Man	Poland	Uruguay
Croatia	Israel	Puerto Rico	
Curacao	Jersey	Qatar	

Middle income			
Albania	El Salvador	Macedonia, FYR	Sao Tome et Principe
Algeria	FS Micronesia	Malaysia	Senegal
American Samoa	Fiji	Maldives	Serbia
Argentina	Gabon	Marshall Is.	Seychelles
Armenia	Georgia	Mauritania	Solomon Islands
Azerbaijan	Ghana	Mauritius	South Africa
Belarus	Grenada	Mexico	Sri Lanka
Belize	Guatemala	Moldova	St Lucia
Bolivia	Guyana	Mongolia	St Vincent & Gren.
Botswana	Honduras	Montenegro	Sudan
Brazil	Hungary	Morocco	Suriname
Bulgaria	India	Namibia	Swaziland
Cameroon	Indonesia	Nicaragua	Syria
Cape Verde Is.	Iran	Nigeria	Thailand
China, PR	Jamaica	Pakistan	Tonga
Colombia	Jordan	Palau	Tunisia
Congo	Kazakhstan	Palestinian Territories	Turkey
Costa Rica	Kiribati	Panama	Tuvalu
Cote d'Ivoire	Kosovo	Papua New Guinea	Ukraine
Djibouti	Kyrgyzstan	Paraguay	Vanuatu
Dominica	Lao, PDR	Peru	Venezuela
Dominican Rep.	Lebanon	Philippines	Viet Nam
Ecuador	Lesotho	Romania	Yemen
Egypt	Libya	Samoa	Zambia
Low income			
Bangladesh	Congo, DR	Madagascar	Sierra Leone
Benin	Ethiopia	Malawi	Tajikistan
Burkina Faso	Gambia, The	Mali	Tanzania
Burundi	Guinea	Mozambique	Togo
Cambodia	Guinea Bissau	Myanmar	Uganda
Central African Republic	Haiti	Nepal	Zimbabwe
Chad	Kenya	Niger	
Comoros	Liberia	Rwanda	

B Appendix – regression coefficients

Table 8: Impact of disasters on inflation – regression coefficients

	Headline	Food	Housing	Energy	CPIxFHE
totimp	0.160**	0.100**	−0.042	−0.090	0.010
	(0.055)	(0.035)	(0.045)	(0.094)	(0.033)
totimp_{t-1}	0.112*	0.096*	−0.035	−0.090	−0.061*
	(0.051)	(0.040)	(0.031)	(0.086)	(0.029)
totimp_{t-2}	0.069	−0.067	−0.069**	−0.128*	−0.035
	(0.070)	(0.043)	(0.022)	(0.064)	(0.031)
totimp_{t-3}	0.028	−0.067	−0.071***	0.056	−0.038
	(0.052)	(0.037)	(0.018)	(0.075)	(0.034)
totimp_{t-4}	0.095	−0.010	−0.085**	0.028	0.022
	(0.099)	(0.029)	(0.026)	(0.078)	(0.025)
totimp_{t-5}	0.121	−0.056	−0.037	0.030	−0.070
	(0.117)	(0.037)	(0.028)	(0.061)	(0.037)
totimp_{t-6}	0.162	0.024	−0.074*	0.014	−0.017
	(0.099)	(0.047)	(0.035)	(0.056)	(0.018)
totimp_{t-7}	0.175	0.024	−0.017	0.020	−0.022
	(0.151)	(0.031)	(0.027)	(0.032)	(0.020)
totimp_{t-8}	0.150	0.035	−0.077	0.088	0.065
	(0.085)	(0.053)	(0.046)	(0.097)	(0.039)
totimp_{t-9}	0.117	0.035	0.061	−0.067*	−0.073
	(0.085)	(0.051)	(0.080)	(0.028)	(0.052)
totimp_{t-10}	0.125	0.014	0.004	−0.006	0.050
	(0.065)	(0.060)	(0.030)	(0.048)	(0.057)
totimp_{t-11}	0.075	0.084	−0.068*	0.110	−0.021
	(0.052)	(0.048)	(0.027)	(0.154)	(0.020)
Observations	22471	18933	8191	9167	12639
R^2	0.050	0.042	0.046	0.171	0.054

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 9: Impact of disasters on inflation, balanced panel regression coefficients

	Headline	Food	Housing & energy	CPIxFHE
totimp	0.009	0.037	−0.008	−0.046
	(0.036)	(0.099)	(0.059)	(0.079)
totimp_{t-1}	0.048	0.192	−0.113	−0.077
	(0.052)	(0.101)	(0.070)	(0.049)
totimp_{t-2}	−0.062	−0.005	−0.070	−0.109*
	(0.049)	(0.129)	(0.057)	(0.053)
totimp_{t-3}	−0.133*	−0.209*	0.021	−0.087
	(0.056)	(0.093)	(0.061)	(0.088)
totimp_{t-4}	0.007	−0.087	0.085	0.066
	(0.031)	(0.091)	(0.069)	(0.060)
totimp_{t-5}	−0.040	0.018	−0.072	−0.103**
	(0.031)	(0.070)	(0.068)	(0.037)
totimp_{t-6}	−0.132***	−0.158*	−0.122*	−0.126***
	(0.033)	(0.065)	(0.059)	(0.033)
totimp_{t-7}	−0.062	−0.133**	0.036	−0.019
	(0.032)	(0.045)	(0.088)	(0.032)
totimp_{t-8}	−0.031	−0.113*	−0.046	0.046
	(0.034)	(0.056)	(0.057)	(0.045)
totimp_{t-9}	−0.054	0.051	−0.096	−0.152***
	(0.050)	(0.102)	(0.087)	(0.040)
totimp_{t-10}	−0.069	−0.035	−0.029	−0.103
	(0.037)	(0.067)	(0.052)	(0.053)
totimp_{t-11}	−0.091**	−0.115**	−0.160**	−0.032
	(0.027)	(0.041)	(0.059)	(0.031)
Observations	5226	5226	5226	5226
R^2	0.077	0.086	0.131	0.039

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 10: Impact of disasters by type: earthquake coefficients

	Headline	Food	Housing	Energy	CPIxFHE
eqimp	0.239	0.249	−0.033	−0.301	−0.096
	(0.124)	(0.126)	(0.121)	(0.417)	(0.054)
$eqimp_{t-1}$	0.050	−0.088	0.191*	0.822**	−0.245***
	(0.160)	(0.133)	(0.084)	(0.278)	(0.047)
$eqimp_{t-2}$	−0.021	−0.102	−0.084	−0.044	−0.175***
	(0.153)	(0.106)	(0.100)	(0.233)	(0.047)
$eqimp_{t-3}$	−0.005	−0.071	−0.119*	−0.452	−0.141***
	(0.135)	(0.058)	(0.051)	(0.346)	(0.039)
$eqimp_{t-4}$	0.140	0.098	0.059	−0.131	−0.147**
	(0.130)	(0.100)	(0.080)	(0.339)	(0.044)
$eqimp_{t-5}$	0.109	0.061	0.033	0.787	−0.107*
	(0.115)	(0.100)	(0.083)	(0.539)	(0.043)
$eqimp_{t-6}$	0.095	0.118	−0.042	0.646	−0.099
	(0.127)	(0.194)	(0.057)	(0.616)	(0.058)
$eqimp_{t-7}$	0.037	0.009	−0.023	0.719	−0.119***
	(0.135)	(0.127)	(0.064)	(0.933)	(0.033)
$eqimp_{t-8}$	0.001	0.043	−0.131	−0.469	−0.119
	(0.155)	(0.087)	(0.134)	(0.453)	(0.064)
$eqimp_{t-9}$	0.091	0.002	−0.007	−0.424	−0.133**
	(0.139)	(0.109)	(0.066)	(0.247)	(0.045)
$eqimp_{t-10}$	0.052	0.151	−0.118	−0.525**	−0.077
	(0.157)	(0.110)	(0.094)	(0.158)	(0.046)
$eqimp_{t-11}$	0.086	0.220	−0.018	0.648	−0.044
	(0.157)	(0.184)	(0.085)	(1.210)	(0.063)
Observations	22471	18933	8191	9167	12639
R^2	0.055	0.045	0.050	0.174	0.060

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 10 through 14 estimated jointly.

Table 11: Impact of disasters by type: storm coefficients

	Headline	Food	Housing	Energy	CPIxFHE
stimp	0.076	0.117*	−0.064	−0.394	0.016
	(0.053)	(0.053)	(0.060)	(0.418)	(0.048)
stimp_{t-1}	0.042	0.163**	−0.029	−0.240	−0.074
	(0.053)	(0.059)	(0.080)	(0.188)	(0.058)
stimp_{t-2}	−0.062*	−0.125*	−0.097*	−0.221	0.019
	(0.030)	(0.050)	(0.042)	(0.135)	(0.060)
stimp_{t-3}	−0.056	−0.126*	−0.099**	0.223	−0.066*
	(0.046)	(0.051)	(0.032)	(0.189)	(0.029)
stimp_{t-4}	−0.034	−0.017	−0.132**	0.116	−0.027
	(0.024)	(0.029)	(0.041)	(0.080)	(0.021)
stimp_{t-5}	−0.040	−0.026	−0.138***	−0.050	−0.051
	(0.031)	(0.050)	(0.022)	(0.101)	(0.034)
stimp_{t-6}	0.021	0.063	−0.135***	−0.122	−0.000
	(0.052)	(0.063)	(0.028)	(0.078)	(0.034)
stimp_{t-7}	−0.040	−0.026	−0.079***	0.112	−0.006
	(0.037)	(0.044)	(0.022)	(0.080)	(0.047)
stimp_{t-8}	−0.009	0.006	−0.096*	0.094	0.117
	(0.052)	(0.097)	(0.038)	(0.080)	(0.067)
stimp_{t-9}	−0.024	0.089	−0.017	−0.131	−0.080
	(0.023)	(0.085)	(0.064)	(0.122)	(0.114)
stimp_{t-10}	−0.029	−0.065	−0.061	0.108	0.116
	(0.020)	(0.044)	(0.035)	(0.155)	(0.107)
stimp_{t-11}	0.011	0.014	−0.117**	0.051	−0.001
	(0.036)	(0.037)	(0.038)	(0.111)	(0.041)
Observations	22471	18933	8191	9167	12639
R^2	0.055	0.045	0.050	0.174	0.060

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 10 through 14 estimated jointly.

Table 12: Impact of disasters by type: flood coefficients

	Headline	Food	Housing	Energy	CPIxFHE
flimp	0.433*	0.165	−0.091	−0.277	−0.166
	(0.170)	(0.105)	(0.090)	(0.211)	(0.108)
flimp_{t-1}	0.194	0.081	−0.079	−0.374	−0.182**
	(0.193)	(0.108)	(0.083)	(0.516)	(0.064)
flimp_{t-2}	0.190	−0.219	0.012	−0.322	−0.012
	(0.278)	(0.186)	(0.061)	(0.258)	(0.069)
flimp_{t-3}	0.232	0.032	−0.017	0.040	−0.020
	(0.189)	(0.159)	(0.091)	(0.300)	(0.079)
flimp_{t-4}	0.166	0.012	−0.059	0.165	0.051
	(0.216)	(0.111)	(0.077)	(0.198)	(0.065)
flimp_{t-5}	0.395	−0.145	−0.081	0.492*	−0.110*
	(0.413)	(0.088)	(0.075)	(0.206)	(0.046)
flimp_{t-6}	0.858	−0.033	−0.177	0.554**	−0.022
	(0.654)	(0.105)	(0.091)	(0.196)	(0.056)
flimp_{t-7}	0.471	0.132	−0.060	0.171	0.011
	(0.282)	(0.112)	(0.114)	(0.221)	(0.059)
flimp_{t-8}	1.169	0.194	−0.105	−0.415	0.314*
	(0.677)	(0.103)	(0.089)	(0.259)	(0.155)
flimp_{t-9}	0.237	−0.100	0.100	0.182	−0.056
	(0.322)	(0.084)	(0.179)	(0.225)	(0.108)
flimp_{t-10}	0.134	0.056	0.010	0.170	−0.064
	(0.227)	(0.142)	(0.119)	(0.359)	(0.049)
flimp_{t-11}	0.136	0.141	−0.139	0.004	−0.143**
	(0.132)	(0.131)	(0.077)	(0.161)	(0.043)
Observations	22471	18933	8191	9167	12639
R^2	0.055	0.045	0.050	0.174	0.060

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 10 through 14 estimated jointly.

Table 13: Impact of disasters by type: drought coefficients

	Headline	Food	Housing	Energy	CPIxFHE
drimp	0.235*	0.093	−0.020	0.039	0.024
	(0.109)	(0.054)	(0.077)	(0.050)	(0.035)
drimp_{t-1}	0.224*	0.069	−0.051	−0.042	−0.029
	(0.102)	(0.081)	(0.038)	(0.107)	(0.030)
drimp_{t-2}	0.199	−0.026	−0.057*	−0.098	−0.072**
	(0.129)	(0.104)	(0.026)	(0.087)	(0.024)
drimp_{t-3}	0.142	0.011	−0.061**	0.002	−0.039
	(0.081)	(0.055)	(0.023)	(0.073)	(0.025)
drimp_{t-4}	0.251	0.028	−0.077*	−0.047	0.021
	(0.210)	(0.046)	(0.033)	(0.086)	(0.041)
drimp_{t-5}	0.307	−0.071	−0.023	−0.026	−0.016
	(0.250)	(0.053)	(0.027)	(0.065)	(0.029)
drimp_{t-6}	0.257	0.008	−0.035	−0.028	−0.016
	(0.184)	(0.073)	(0.029)	(0.047)	(0.025)
drimp_{t-7}	0.404	0.057	0.015	−0.025	−0.024
	(0.306)	(0.085)	(0.020)	(0.041)	(0.016)
drimp_{t-8}	0.210	0.063	−0.022	0.142	−0.005
	(0.112)	(0.046)	(0.029)	(0.129)	(0.030)
drimp_{t-9}	0.270	0.019	−0.003	−0.033	−0.040
	(0.152)	(0.077)	(0.049)	(0.036)	(0.023)
drimp_{t-10}	0.284**	0.094	−0.014	−0.056	0.031
	(0.107)	(0.112)	(0.027)	(0.068)	(0.033)
drimp_{t-11}	0.136	0.124	−0.026	0.149	−0.008
	(0.103)	(0.108)	(0.026)	(0.223)	(0.021)
Observations	22471	18933	8191	9167	12639
R^2	0.055	0.045	0.050	0.174	0.060

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 10 through 14 estimated jointly.

Table 14: Impact of disasters by type: other disaster coefficients

	Headline	Food	Housing	Energy	CPIxFHE
otimp	−0.205	−0.153	−0.034	0.072	0.085
	(0.192)	(0.205)	(0.079)	(0.254)	(0.161)
otimp_{t-1}	−0.252	−0.001	0.016	−0.021	0.096
	(0.200)	(0.187)	(0.056)	(0.146)	(0.175)
otimp_{t-2}	−0.009	0.415	−0.133	−0.082	−0.202
	(0.134)	(0.242)	(0.078)	(0.082)	(0.113)
otimp_{t-3}	−0.217	−0.116	−0.054	−0.032	0.131
	(0.260)	(0.136)	(0.052)	(0.182)	(0.378)
otimp_{t-4}	−0.269	−0.369	−0.014	0.248	0.317
	(0.190)	(0.220)	(0.106)	(0.282)	(0.236)
otimp_{t-5}	−0.238	−0.023	0.115	0.273	−0.457
	(0.159)	(0.054)	(0.141)	(0.308)	(0.460)
otimp_{t-6}	−0.295	−0.148	−0.169	0.288	−0.031
	(0.168)	(0.121)	(0.171)	(0.146)	(0.035)
otimp_{t-7}	−0.110	0.079	−0.051	0.015	−0.063
	(0.208)	(0.145)	(0.101)	(0.157)	(0.067)
otimp_{t-8}	−0.258*	−0.291***	−0.301	0.064	−0.015
	(0.122)	(0.049)	(0.277)	(0.185)	(0.040)
otimp_{t-9}	−0.302	−0.121	0.600	−0.316*	−0.240
	(0.171)	(0.304)	(0.640)	(0.124)	(0.160)
otimp_{t-10}	−0.087	0.010	0.176	0.053	−0.086
	(0.128)	(0.227)	(0.263)	(0.145)	(0.115)
otimp_{t-11}	0.043	0.255	−0.177	−0.154	−0.034
	(0.248)	(0.225)	(0.128)	(0.171)	(0.091)
Observations	22471	18933	8191	9167	12639
R^2	0.055	0.045	0.050	0.174	0.060

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 10 through 14 estimated jointly.

Table 15: Impact of disasters in advanced countries – regression coefficients

	(1) Headline	(2) Food	(3) Housing	(4) Energy	(5) CPIxFHE
totimp	0.005	0.049	−0.116	−0.046	−0.007
	(0.034)	(0.043)	(0.066)	(0.068)	(0.023)
totimp$_{t-1}$	−0.016	0.089*	−0.016	−0.132	−0.032
	(0.021)	(0.041)	(0.070)	(0.084)	(0.024)
totimp$_{t-2}$	−0.038	−0.096	0.014	−0.152	−0.032
	(0.024)	(0.059)	(0.042)	(0.172)	(0.033)
totimp$_{t-3}$	−0.032	0.028	−0.088**	0.096	−0.013
	(0.034)	(0.081)	(0.028)	(0.067)	(0.031)
totimp$_{t-4}$	0.003	0.019	−0.109*	−0.101	−0.021
	(0.036)	(0.050)	(0.042)	(0.095)	(0.030)
totimp$_{t-5}$	−0.039	−0.127	−0.092	−0.179**	0.016
	(0.026)	(0.073)	(0.072)	(0.054)	(0.037)
totimp$_{t-6}$	0.018	−0.042	−0.010	0.197	−0.023
	(0.036)	(0.040)	(0.039)	(0.107)	(0.029)
totimp$_{t-7}$	−0.033	0.000	−0.020	−0.120*	0.013
	(0.033)	(0.062)	(0.032)	(0.048)	(0.035)
totimp$_{t-8}$	0.018	0.033	0.135	−0.010	−0.031
	(0.034)	(0.056)	(0.171)	(0.035)	(0.024)
totimp$_{t-9}$	0.044*	−0.011	0.169	0.034	0.041
	(0.021)	(0.059)	(0.190)	(0.064)	(0.043)
totimp$_{t-10}$	0.009	0.036	−0.110	0.032	0.007
	(0.038)	(0.033)	(0.114)	(0.067)	(0.048)
totimp$_{t-11}$	0.042	0.053	0.018	0.076	0.044
	(0.035)	(0.064)	(0.082)	(0.073)	(0.024)
Observations	2783	2741	2167	2715	2591
R^2	0.302	0.247	0.172	0.507	0.361

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 16: Impact of disasters in other high income countries – regression coefficients

	Headline	Food	Housing	Energy	CPIxFHE
totimp	1.139	0.144	−0.014	−2.621**	0.048
	(1.006)	(0.121)	(0.033)	(0.850)	(0.089)
$totimp_{t-1}$	1.222	0.317	0.064	−0.561*	−0.187
	(1.038)	(0.161)	(0.099)	(0.248)	(0.107)
$totimp_{t-2}$	0.368*	0.275**	0.147	0.059	−0.182*
	(0.147)	(0.103)	(0.078)	(0.182)	(0.077)
$totimp_{t-3}$	0.439	0.102	−0.111	0.954***	0.102
	(0.253)	(0.115)	(0.152)	(0.280)	(0.119)
$totimp_{t-4}$	0.400*	0.340*	0.026	0.233	−0.104
	(0.186)	(0.141)	(0.050)	(0.140)	(0.056)
$totimp_{t-5}$	0.161	−0.062	0.035	0.148	−0.145
	(0.116)	(0.126)	(0.053)	(0.167)	(0.114)
$totimp_{t-6}$	0.187*	0.270*	−0.010	−0.249	0.044
	(0.082)	(0.132)	(0.048)	(0.259)	(0.136)
$totimp_{t-7}$	0.266	0.430***	0.039	0.104	−0.004
	(0.153)	(0.090)	(0.054)	(0.163)	(0.062)
$totimp_{t-8}$	0.273	0.087	0.089	−0.152	0.044
	(0.197)	(0.112)	(0.101)	(0.384)	(0.046)
$totimp_{t-9}$	0.075	−0.228	0.005	−0.096	0.051
	(0.080)	(0.122)	(0.065)	(0.159)	(0.081)
$totimp_{t-10}$	0.172*	0.196	0.054	0.514	−0.062
	(0.067)	(0.121)	(0.043)	(0.335)	(0.094)
$totimp_{t-11}$	0.217*	0.019	−0.064	−0.447*	0.075
	(0.101)	(0.130)	(0.080)	(0.178)	(0.106)
Observations	4887	4106	2486	2465	2852
R^2	0.093	0.134	0.116	0.295	0.139

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 17: Impact of disasters in high income countries, by type of disaster

	Headline	Food	Housing	Energy	CPIxFHE
Earthquakes					
Quarter 0	0.237	−0.493	−0.156	−1.055*	−0.247
Quarter 1	0.511	0.803	0.486***	0.678**	−0.327
Quarters 2-3	0.170	0.940	−0.162	−0.732**	−0.852**
Year 1	0.917	1.250	0.167	−1.109	−1.427**
Year 2	0.131	0.647	−0.134	−0.814	−1.621***
Year 3	0.847	1.688	−0.071	−4.991***	−1.614***
Storms					
Quarter 0	1.622	0.269	−0.034	−3.414***	0.160
Quarter 1	1.736	0.297	−0.052	−0.931***	−0.139
Quarters 2-3	1.232*	0.396	0.002	1.683***	0.135
Year 1	4.590	0.963**	−0.084	−2.661***	0.156
Year 2	1.497*	1.266***	−0.026	0.544	0.128
Year 3	0.958*	−0.079	−0.122	−0.013	0.327
Floods					
Quarter 0	−0.191	−0.080	0.017	0.405	−0.548**
Quarter 1	0.039	0.320	0.066	0.264	−0.282
Quarters 2-3	−0.656	−0.873*	0.129	−2.785	−0.732
Year 1	−0.807	−0.633	0.212	−2.117	−1.561*
Year 2	−1.687	−1.170	0.217	−0.302	−0.926
Year 3	−1.903	−1.022	0.353	0.279	−0.286
Observations	7670	6847	4653	5180	5443
R^2	0.086	0.143	0.106	0.353	0.164

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Underlying regression estimates available on request.

Table 18: Impact of disasters in middle and low income countries – regression coefficients

	Headline	Food	Housing & Energy	CPIxFHE
totimp	0.158**	0.104**	0.033	0.013
	(0.058)	(0.036)	(0.030)	(0.037)
$totimp_{t-1}$	0.104*	0.094*	−0.025	−0.047
	(0.051)	(0.042)	(0.032)	(0.029)
$totimp_{t-2}$	0.073	−0.070	−0.004	−0.033
	(0.074)	(0.046)	(0.027)	(0.032)
$totimp_{t-3}$	0.032	−0.066	0.035	−0.051
	(0.055)	(0.038)	(0.028)	(0.043)
$totimp_{t-4}$	0.101	−0.012	0.002	0.019
	(0.102)	(0.030)	(0.035)	(0.029)
$totimp_{t-5}$	0.135	−0.051	0.033	−0.059
	(0.121)	(0.038)	(0.028)	(0.041)
$totimp_{t-6}$	0.173	0.025	−0.021	−0.020
	(0.102)	(0.047)	(0.027)	(0.018)
$totimp_{t-7}$	0.185	0.025	−0.014	−0.011
	(0.156)	(0.031)	(0.028)	(0.020)
$totimp_{t-8}$	0.155	0.041	0.066	0.066
	(0.088)	(0.053)	(0.051)	(0.040)
$totimp_{t-9}$	0.124	0.036	−0.053	−0.065
	(0.087)	(0.052)	(0.033)	(0.049)
$totimp_{t-10}$	0.131	0.014	−0.042*	0.049
	(0.068)	(0.063)	(0.020)	(0.057)
$totimp_{t-11}$	0.080	0.091	−0.018	−0.018
	(0.053)	(0.050)	(0.040)	(0.020)
Observations	14801	12086	7301	7196
R^2	0.057	0.042	0.064	0.057

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 19: Impact of disasters in middle and low income countries, by type

	Headline	Food	Housing & Energy	CPIxFHE
Earthquakes				
Quarter 0	0.230	0.253*	0.073	−0.083
Quarter 1	0.028	−0.125	−0.022	−0.205***
Quarters 2-3	0.005	−0.224	−0.210***	−0.241***
Year 1	0.262	−0.096	−0.159	−0.530***
Year 2	0.413	0.221	0.017	−0.348**
Year 3	0.264	0.321	−0.327*	−0.267
Storms				
Quarter 0	0.044	0.181*	0.032	0.023
Quarter 1	−0.017	0.220*	−0.067	−0.076
Quarters 2-3	−0.216*	−0.378***	0.095	−0.123
Year 1	−0.189	0.023	0.060	−0.176
Year 2	−0.186	−0.046	−0.054	−0.140
Year 3	−0.118	0.065	−0.061	0.245
Floods				
Quarter 0	0.404**	0.155	−0.007	−0.141
Quarter 1	0.192	0.084	−0.006	−0.157**
Quarters 2-3	0.381	−0.159	0.002	−0.007
Year 1	0.978	0.080	−0.012	−0.305
Year 2	1.790	0.018	−0.015	−0.025
Year 3	1.552	0.276	−0.387	0.041
Droughts				
Quarter 0	1.453*	0.517	0.297	0.149
Quarter 1	1.376*	0.391	−0.103	−0.098
Quarters 2-3	2.165	0.058	−0.067	−0.590*
Year 1	4.994*	0.966	0.128	−0.540
Year 2	7.359	0.292	0.246	−0.028
Year 3	5.374*	1.856	−0.109	−0.099
Observations	14680	12031	7262	7157
R^2	0.063	0.045	0.068	0.065

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Underlying regression estimates available on request.

Table 20: Impact of severe disasters in high income countries – major disaster coefficients

	Headline	Food	Housing	Energy	CPIxFHE
totimp	−0.060	0.041	0.778*	0.047	−0.106
	(0.196)	(0.344)	(0.374)	(0.261)	(0.487)
$totimp_{t-1}$	0.218	1.305*	1.219*	−0.168	0.776
	(0.301)	(0.613)	(0.486)	(0.298)	(0.502)
$totimp_{t-2}$	0.097	−0.176	1.273*	−0.010	0.114
	(0.238)	(0.375)	(0.601)	(0.317)	(0.627)
$totimp_{t-3}$	0.014	0.628	0.263	0.713	0.198
	(0.213)	(0.355)	(0.593)	(0.496)	(0.337)
$totimp_{t-4}$	0.156	0.383	−1.154	−0.207	−0.244
	(0.132)	(0.437)	(0.729)	(0.226)	(0.374)
$totimp_{t-5}$	0.039	−0.152	−0.960*	−0.205	−0.017
	(0.114)	(0.382)	(0.446)	(0.188)	(0.286)
$totimp_{t-6}$	0.092	−0.375	−0.728	−0.030	−0.330
	(0.151)	(0.436)	(0.370)	(0.740)	(0.330)
$totimp_{t-7}$	−0.167	−0.350	−0.389	0.291	−0.019
	(0.188)	(0.335)	(0.348)	(0.440)	(0.199)
$totimp_{t-8}$	0.012	0.584	−0.541	0.092	0.096
	(0.171)	(0.440)	(0.409)	(0.215)	(0.284)
$totimp_{t-9}$	−0.101	0.851*	−0.474	−0.171	0.443
	(0.241)	(0.339)	(0.478)	(0.379)	(0.271)
$totimp_{t-10}$	−0.127	−0.343	−0.330	−0.073	0.217
	(0.127)	(0.281)	(0.385)	(0.297)	(0.292)
$totimp_{t-11}$	−0.257	−0.304	−0.245*	−0.557	−0.010
	(0.141)	(0.206)	(0.107)	(0.481)	(0.090)
Observations	7670	6847	4653	5180	5443
R^2	0.077	0.136	0.103	0.340	0.160

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 20 and 21 estimated jointly.

Table 21: Impact of severe disasters in high income countries – severe disaster coefficients

	Headline	Food	Housing	Energy	CPIxFHE
totsevimp	0.483	0.006	−0.904*	−1.007	0.133
	(0.385)	(0.352)	(0.383)	(0.946)	(0.504)
$totsevimp_{t-1}$	0.286	−1.181	−1.252*	0.072	−0.902
	(0.519)	(0.611)	(0.488)	(0.338)	(0.503)
$totsevimp_{t-2}$	−0.104	0.219	−1.290*	−0.226	−0.205
	(0.312)	(0.394)	(0.605)	(0.367)	(0.653)
$totsevimp_{t-3}$	0.095	−0.698	−0.377	−0.326	−0.165
	(0.241)	(0.366)	(0.583)	(0.603)	(0.351)
$totsevimp_{t-4}$	−0.048	−0.229	1.133	0.208	0.197
	(0.165)	(0.444)	(0.749)	(0.286)	(0.374)
$totsevimp_{t-5}$	−0.055	−0.026	0.886	0.131	−0.078
	(0.134)	(0.379)	(0.454)	(0.238)	(0.288)
$totsevimp_{t-6}$	−0.038	0.428	0.677	0.035	0.322
	(0.167)	(0.462)	(0.375)	(0.758)	(0.330)
$totsevimp_{t-7}$	0.249	0.506	0.340	−0.383	−0.001
	(0.198)	(0.373)	(0.349)	(0.448)	(0.196)
$totsevimp_{t-8}$	0.017	−0.643	0.632	−0.087	−0.144
	(0.190)	(0.447)	(0.404)	(0.342)	(0.307)
$totsevimp_{t-9}$	0.012	−1.128**	0.524	0.084	−0.476
	(0.255)	(0.345)	(0.477)	(0.405)	(0.279)
$totsevimp_{t-10}$	0.203	0.509	0.254	0.386	−0.253
	(0.134)	(0.297)	(0.406)	(0.448)	(0.341)
$totsevimp_{t-11}$	0.345*	0.282	0.241	0.292	0.080
	(0.137)	(0.202)	(0.151)	(0.519)	(0.121)
Observations	7670	6847	4653	5180	5443
R^2	0.077	0.136	0.103	0.340	0.160

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 20 and 21 estimated jointly.

Table 22: Impact of severe disasters in middle and low income countries – major disaster coefficients

	Headline	Food	Housing & energy	CPIxFHE
totimp	0.886	0.069	−0.257	0.072
	(0.823)	(0.165)	(0.153)	(0.130)
totimp_{t-1}	0.376	0.308	−0.156	0.019
	(0.243)	(0.195)	(0.207)	(0.142)
totimp_{t-2}	−0.152	−0.634**	−0.202	−0.143
	(0.191)	(0.188)	(0.125)	(0.090)
totimp_{t-3}	−0.002	−0.305	0.109	−0.213
	(0.198)	(0.173)	(0.151)	(0.108)
totimp_{t-4}	−0.129	0.041	−0.055	0.030
	(0.230)	(0.155)	(0.132)	(0.118)
totimp_{t-5}	0.161	0.070	0.063	0.096
	(0.176)	(0.209)	(0.107)	(0.148)
totimp_{t-6}	−0.017	−0.143	−0.036	−0.171
	(0.183)	(0.233)	(0.138)	(0.189)
totimp_{t-7}	−0.208	−0.142	−0.018	−0.152
	(0.193)	(0.131)	(0.176)	(0.092)
totimp_{t-8}	−0.073	−0.198	−0.173	−0.058
	(0.215)	(0.152)	(0.092)	(0.185)
totimp_{t-9}	−0.066	−0.039	−0.294*	−0.200
	(0.227)	(0.201)	(0.118)	(0.116)
totimp_{t-10}	−0.035	−0.267	−0.169*	−0.143
	(0.206)	(0.215)	(0.079)	(0.088)
totimp_{t-11}	−0.177	−0.469*	−0.312***	−0.045
	(0.154)	(0.181)	(0.074)	(0.083)
Observations	14801	12086	7301	7196
R^2	0.058	0.044	0.066	0.059

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 22 and 23 estimated jointly.

Table 23: Impact of severe disasters in middle and low income countries – severe disaster coefficients

	Headline	Food	Housing & energy	CPIxFHE
totsevimp	−0.765	0.038	0.314*	−0.065
	(0.836)	(0.170)	(0.157)	(0.127)
$totsevimp_{t-1}$	−0.285	−0.228	0.136	−0.071
	(0.257)	(0.192)	(0.210)	(0.151)
$totsevimp_{t-2}$	0.240	0.597**	0.210	0.115
	(0.202)	(0.199)	(0.129)	(0.101)
$totsevimp_{t-3}$	0.036	0.250	−0.080	0.173
	(0.195)	(0.169)	(0.152)	(0.130)
$totsevimp_{t-4}$	0.240	−0.059	0.059	−0.012
	(0.227)	(0.166)	(0.132)	(0.119)
$totsevimp_{t-5}$	−0.027	−0.128	−0.031	−0.165
	(0.169)	(0.213)	(0.109)	(0.161)
$totsevimp_{t-6}$	0.199	0.176	0.016	0.158
	(0.177)	(0.228)	(0.147)	(0.195)
$totsevimp_{t-7}$	0.410*	0.172	−0.000	0.150
	(0.206)	(0.133)	(0.167)	(0.097)
$totsevimp_{t-8}$	0.236	0.247	0.251*	0.129
	(0.204)	(0.167)	(0.109)	(0.184)
$totsevimp_{t-9}$	0.197	0.074	0.249*	0.140
	(0.204)	(0.219)	(0.106)	(0.137)
$totsevimp_{t-10}$	0.172	0.291	0.132	0.202
	(0.219)	(0.256)	(0.079)	(0.103)
$totsevimp_{t-11}$	0.265	0.580**	0.308**	0.026
	(0.167)	(0.205)	(0.096)	(0.088)
Observations	14801	12086	7301	7196
R^2	0.058	0.044	0.066	0.059

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported. Coefficients in tables 22 and 23 estimated jointly.

Table 24: Impact of severe disasters in middle and low income countries, by type of disaster

	Headline	Food	Housing & energy	CPIxFHE
Earthquakes				
Quarter 0	0.529	0.643*	0.177	−0.184
Quarter 1	−0.165	−0.300	−0.136	−0.493**
Quarters 2-3	0.005	−0.627	−0.492*	−0.631**
Year 1	0.369	−0.284	−0.451	−1.308***
Year 2	1.296	0.243	0.015	−0.955**
Year 3	1.069	0.848	−0.744	−0.682
Storms				
Quarter 0	0.104	0.655*	0.091	0.041
Quarter 1	−0.064	0.741*	−0.250	−0.276
Quarters 2-3	−0.709	−1.299***	0.380	−0.442
Year 1	−0.669	0.098	0.221	−0.676
Year 2	−0.563	−0.139	−0.218	−0.473
Year 3	−0.370	0.306	−0.197	0.898
Floods				
Quarter 0	1.141**	0.343	0.223	−0.416
Quarter 1	0.662	0.317	0.118	−0.414*
Quarters 2-3	1.339	−0.108	−0.070	0.200
Year 1	3.143	0.552	0.271	−0.630
Year 2	5.160	0.122	−0.008	0.024
Year 3	4.130	0.690	−0.834	0.210
Droughts				
Quarter 0	1.957*	1.141	0.949*	0.108
Quarter 1	2.396	0.264	−0.068	−0.250
Quarters 2-3	4.309	0.972	−0.088	−1.020*
Year 1	8.662*	2.378	0.793	−1.162
Year 2	15.317	0.567	0.456	−0.098
Year 3	11.454**	4.589	0.476	0.027
Observations	14801	12086	7301	7196
R^2	0.066	0.052	0.075	0.069

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Underlying regression estimates available on request.

Table 25: Impact of disasters, damage to GDP – regression coefficients

	Headline	Food	Housing	Energy	CPIxFHE
totdam	0.012	0.024***	−0.039	0.186	−0.001
	(0.009)	(0.007)	(0.025)	(0.138)	(0.004)
$totdam_{t-1}$	0.004	0.012	0.025	0.169	−0.011
	(0.006)	(0.007)	(0.023)	(0.100)	(0.007)
$totdam_{t-2}$	−0.003	−0.018**	−0.003	−0.136	0.000
	(0.009)	(0.006)	(0.035)	(0.090)	(0.008)
$totdam_{t-3}$	−0.003	−0.015	−0.007	−0.012	−0.008
	(0.007)	(0.008)	(0.035)	(0.055)	(0.005)
$totdam_{t-4}$	0.008	0.004	−0.074	0.263	−0.005
	(0.012)	(0.007)	(0.045)	(0.158)	(0.003)
$totdam_{t-5}$	0.011	−0.002	−0.032	−0.005	−0.006
	(0.013)	(0.009)	(0.023)	(0.068)	(0.005)
$totdam_{t-6}$	0.009	−0.001	0.013	0.141	0.002
	(0.011)	(0.008)	(0.030)	(0.107)	(0.004)
$totdam_{t-7}$	0.013	−0.002	0.003	0.254	−0.005
	(0.015)	(0.005)	(0.019)	(0.165)	(0.005)
$totdam_{t-8}$	0.020	0.018**	−0.085**	0.001	0.017
	(0.011)	(0.006)	(0.032)	(0.109)	(0.012)
$totdam_{t-9}$	0.024*	0.033*	0.020	−0.061	−0.004
	(0.010)	(0.015)	(0.036)	(0.100)	(0.020)
$totdam_{t-10}$	0.005	−0.003	0.034	−0.060	0.016
	(0.005)	(0.012)	(0.028)	(0.069)	(0.016)
$totdam_{t-11}$	0.004	−0.001	−0.008*	−0.018	−0.002
	(0.008)	(0.006)	(0.004)	(0.020)	(0.004)
Observations	22471	18933	8191	9167	12639
R^2	0.047	0.042	0.044	0.172	0.053

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 26: Impact of disasters by number in high income countries – regression coefficients

	Headline	Food	Housing	Energy	CPIxFHE
totnum	0.477	0.277	0.109	−0.804*	−0.076
	(0.315)	(0.215)	(0.157)	(0.387)	(0.137)
$totnum_{t-1}$	0.815*	0.595*	0.400	−0.329	0.151
	(0.361)	(0.263)	(0.225)	(0.565)	(0.193)
$totnum_{t-2}$	0.363	−0.003	0.244	−0.329	−0.081
	(0.278)	(0.157)	(0.177)	(0.564)	(0.142)
$totnum_{t-3}$	0.279	0.054	0.068	0.909*	0.040
	(0.172)	(0.171)	(0.271)	(0.402)	(0.115)
$totnum_{t-4}$	0.126	0.245	−0.092	−0.126	−0.192
	(0.143)	(0.235)	(0.229)	(0.288)	(0.136)
$totnum_{t-5}$	−0.081	−0.101	−0.289	−0.192	−0.053
	(0.168)	(0.244)	(0.175)	(0.268)	(0.157)
$totnum_{t-6}$	0.008	0.060	−0.202	−0.548	0.126
	(0.125)	(0.197)	(0.139)	(0.454)	(0.167)
$totnum_{t-7}$	0.033	−0.009	−0.026	0.147	0.005
	(0.160)	(0.190)	(0.160)	(0.350)	(0.131)
$totnum_{t-8}$	−0.024	0.126	0.062	0.118	−0.084
	(0.191)	(0.173)	(0.216)	(0.305)	(0.131)
$totnum_{t-9}$	0.066	0.242	0.019	−0.034	0.213
	(0.225)	(0.249)	(0.183)	(0.398)	(0.153)
$totnum_{t-10}$	0.010	0.047	−0.038	0.005	0.145
	(0.146)	(0.197)	(0.195)	(0.303)	(0.161)
$totnum_{t-11}$	−0.046	−0.193	−0.230	−0.257	0.112
	(0.192)	(0.203)	(0.231)	(0.325)	(0.125)
Observations	7670	6847	4653	5180	5443
R^2	0.076	0.134	0.099	0.336	0.159

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

Table 27: Impact of disasters by number in middle and low income countries – regression coefficients

	Headline	Food	Housing & energy	CPIxFHE
totnum	0.578*	0.319**	−0.229	−0.024
	(0.227)	(0.120)	(0.136)	(0.093)
$totnum_{t-1}$	0.212	0.051	−0.128	−0.126
	(0.233)	(0.131)	(0.104)	(0.073)
$totnum_{t-2}$	−0.204	−0.612***	−0.156	−0.107
	(0.214)	(0.179)	(0.109)	(0.084)
$totnum_{t-3}$	0.029	−0.068	−0.103	−0.200**
	(0.216)	(0.171)	(0.075)	(0.073)
$totnum_{t-4}$	0.171	0.109	−0.159	0.086
	(0.254)	(0.090)	(0.090)	(0.112)
$totnum_{t-5}$	0.236	−0.277*	0.040	−0.050
	(0.289)	(0.128)	(0.073)	(0.082)
$totnum_{t-6}$	0.412	−0.118	0.080	−0.131
	(0.274)	(0.127)	(0.097)	(0.075)
$totnum_{t-7}$	0.564	0.109	−0.043	−0.034
	(0.369)	(0.091)	(0.099)	(0.069)
$totnum_{t-8}$	0.622	0.213	−0.078	0.084
	(0.365)	(0.132)	(0.068)	(0.189)
$totnum_{t-9}$	0.326	−0.045	−0.240*	−0.296***
	(0.289)	(0.130)	(0.111)	(0.081)
$totnum_{t-10}$	0.343	−0.150	−0.125	−0.118
	(0.252)	(0.121)	(0.116)	(0.108)
$totnum_{t-11}$	0.410*	0.129	−0.317***	−0.082
	(0.200)	(0.121)	(0.090)	(0.062)
Observations	14801	12086	7301	7196
R^2	0.056	0.043	0.065	0.057

Notes: *, **,*** significant at 5, 1 and 0.1 percent level respectively. CPIxFHE is consumer prices excluding food, housing and energy. Driscoll and Kraay (1998) standard errors in parentheses. Country and quarterly time fixed effects included but not reported.

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