CROSS-BORDER SPILLOVERS OF NATURAL DISASTERS THROUGH SUPPLY CHAIN LINKAGES

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Large disasters, such as storms and floods, can cause significant disruptions to economic activities, by shutting down factories, paralyzing transportation systems, and destroying the wealth of households. The COVID-19 pandemic is a recent reminder about the disruptive power of these disasters: the public health disaster has forced many countries around the world to lock down cities, halt industrial production, and urgently reorganize economic resources to save lives.

These negative effects of disasters are not only confined to the local economy but can be felt beyond country borders. With today’s highly complex and interconnected global supply chain, it is estimated that disruptions to supply due to COVID-19 lockdowns reduced global seaborne trade by 10 percent between February and March 2020. Similar examples are abundant. The severe flood in Thailand in 2011, which claimed hundreds of lives, affected millions locally and effectively put a halt to automobile parts production in the country. As a result, Japanese carmakers that used Thailand as a key supplier in Southeast Asia reportedly had to pause their car production and sales globally.

The cross-border implications of disasters through the global supply chain deserve in-depth analysis to inform policy, especially in the age of climate change, when climate-related disasters are set to rise in frequency and intensity. Are climate disasters propagated through international trade linkages? How are sectors in foreign countries affected? How does that change our thinking about macro-financial policies related to climate change?

**Global spillover index of climate shock exposures**

Global supply chains redistribute the exposures to climate change risk across countries. Industries in inland countries are no longer entirely shielded from the risk of sea-level rise if they are interconnected with other vulnerable countries through the supply chain. To capture this risk, a recent IMF working paper constructs a spillover index using the inverse of the standard deviation of climate disaster exposures through upstream and downstream trade in the cross-country sample. The spillover index across countries increased between the 1970s and late 2000s before a slight decline after the global financial crisis (Figure 1). This indicates that, over the past several decades, country-level exposures to climate change risk have spread out more across countries, mainly thanks to the rise in globalization. Understanding these cross-country risk exposures is therefore an important aspect in evaluating climate-related risks and in financing climate change adaptation and mitigation.

**Figure 1. Global Spillover Index of Climate Shock Exposures**

![Graph showing the spillover index of upstream and downstream climate shock exposures](image)

Source: IMF staff calculations.

Note: This figure plots the spillover indices of upstream and downstream climate shock exposures. The spillover index is defined as the inverse of the standard deviation of climate disaster exposures through upstream and downstream trade in the cross-country sample. The spillover indices increased between the 1970s and late 2000s before a slight decline after the global financial crisis.

**Cross-border spillover effects on equity markets from natural disasters**

Combining bilateral trade data between countries and historical data on climate disasters, we use an event study approach to measure the cross-border spillovers of climate disasters. Climate disasters, such as heat waves, floods, and storms, lower the stock market valuation of major trade partners, both upstream due to disruption to demand and downstream due to disruption to supply. On average, a climate disaster lowers the aggregate stock market valuation by 0.5 percent in the main importing partner and by 0.4 percent in the main exporting partner of the country that is directly hit by the disaster (Figure 2). For the average country,
this amounts to a monetary loss of $6.1 billion from the average disaster in the upstream countries and $6.6 billion from the average disaster in the downstream countries. These magnitudes are comparable to the effects of climate disasters on the domestic valuation loss.

Figure 2. Cross-Border Spillover Effects of Climate Disasters on the Aggregate Equity Market

1. Cumulative Loss in Aggregate Stock Market Following Disasters, Main Importing Partner Country

2. Cumulative Loss in Aggregate Stock Market Following Disasters, Main Exporting Partner Country

The spillover effect is heterogeneous across sectors. This is, perhaps, not surprising as some sectors are more heavily involved in the global supply chain than other sectors. For example, the automobile sector, a tradables sector that depends on foreign supply and demand, on average loses 1.3 percent from an upstream disaster and about 1.2 percent from a downstream disaster (Figure 3). This translates to roughly $564 million from the average upstream disaster and $480 million from the average downstream disaster in monetary terms. On the contrary, most non-tradables sectors, such as media and telecommunications, do not respond significantly to foreign climate disasters. These results suggest that the international trade network is an important channel for the cross-border propagation of climate disasters.

Figure 3. Cross-Border Spillover Effects of Climate Disasters on the Equity Valuation of Tradables and Non-Tradables Sectors

Concluding remarks

The COVID-19 crisis has reminded us that, in today’s interconnected world, a shock in one country can propagate to other countries through supply chain linkages. One of the key lessons we have learned during the COVID-19 pandemic is the importance of collective action across countries for building resilience. Investments in climate adaptation infrastructure and supply chains today not only increase domestic resilience against future climate shocks but also strengthen the financial stability and economic ties of all trade partners sharing the same network.