Typhoon strikes and trade resilience: A firm-level analysis in China

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Abstract

This study provides a quantitative analysis to explore the impact of typhoons on manufacturing firms in China, by using disaggregated firm-level trade data between 2000 and 2006. To precisely capture the impact of typhoons, a panel dataset has been constructed, including firm geo-location information and a firm-level measure of typhoon damage derived from storm track data and a wind field model. The empirical results show that typhoons have significant and negative impacts on firm exports and imports and the negative impacts are considerable. The estimations also suggest that firms experience the largest negative impacts on trade after 6 months since typhoons first hit, and firms get recovered after approximately 15 months. Specifically, processing firms suffer severely. Additionally, heterogeneous impacts can be found across different trade partners.

1. Introduction

There is ample evidence showing that natural disasters have significant impacts on the economies and trade of affected areas in the short, medium and long-run. Gassebner, Keck, and Teh (2010) applies the gravity model find that an addition of natural disasters leads to 2% reduction in imports and 0.1% reduction in exports in terms of trade volume across 170 countries. Felbermayr, Groschl, and Heid (2020) examines the impacts of earthquake and storms and find persistent negative impacts on supply and demand for credit constrained countries. Hsiang and Jina (2014) and Hsiang (2010) find the high temperature with cyclones is strongly correlated with economic losses which are substantially greater than previously thought.Wu (2023) find natural disasters may cause a structural downgrade of trade flows in the short run followed up by an upgrade in the long run. Gigout and London (2023) also find large and persistent disruptions to international buyer-supplier relationships. With the increasing of number and intensity of natural disasters, the accumulated economic loss caused by extreme weather and its catastrophic damage directly and indirectly counts for $26 billion annually and the weather anomalies become more frequent (Oh and Reuveny (2010);Mendelsohn, Emanuel, Chonabayashi, and Bakkensen (2012)).1 .The physical damage due to hurricanes, floods, and earthquakes to the building, infrastructure, and warehouse and indirect impacts through local spillover effect or the production chain were found although the results can be either negative or positive Elliott, Strobl, and Sun (2015); Elliott, Liu, Strobl, and M (2019); Del Valle, Elliott, Strobl, and Tong (2018); Elliott et al. (2019);Pelli, Tschopp, Bezmaternykh, and Eklou (2023);Cole, Elliott, Okubo, and Strobl (2019). Apart from the localized damage and economic resilience in the short and long-run, the impacts of natural disasters also leads to spillovers and indirect impacts on global production chain through temporally transportation shutdown and physically damage to trading firms. There are extensive literature show that infrastructure establishments and whether its' been affected by natural disasters is important for trade and economic resilience2 .Duranton, Morrow, and Turner (2014) show that the elasticity of highways on the weight of exports for the city is 0.5 while there are insignificant coefficients between the highway distance and export values. The establishment/lockdown of the infrastructure were found to have positive/negative impacts on international trade in developing countries (J. Martincus C.V; Blyde (2013); P. A. G. Martincus C.V;Carballo. J;Garcia (2014)). The Eyjafjallaj¨okull volcano eruption affects air freight trade due to airport closure (Besedeˇs (2014); Donaldson (2018)). Using monthly air freight data, the elasticity change of price due to volcanic ash caused by the temporary lockdown of airport and flight

cancellation is -0.553. The mechanism of economic resilience and impacts on global production chains after natural disasters was mostly investigated at the micro-level. Yoshida, Uchida, Nohara, and Hibiki (2006) find that the impacts of the flood on manufacturing firms survived reduce the amount of shipment and facilities in Japan within five years of the flood. There is also evidence of the "build back better" effect, especially in large firms. More recent analysis in India also finds the production switching to more comparative advantage sectors through "build-back" effects (Pelli and Tschopp (2017),Pelli et al. (2023). Using a port-level data, Friedt (2021) find that trade flows through shipping from ports that suffers Hurricane Katrina experienced lasting exports and imports reduction while adjacent ports exhibits a significant increase. Kashiwagi, Todo, and Matous (2021) also finds evidence of the intra-national propagation of the shock in the United States through supply-chain ties due to hurricane shocks. Using DID method, Wu (2023) find the natural disaster shock may cause structural downgrade in the short-run follows upgrading in the long-run. Using detailed firm-level data, Gigout and London (2023) and Freund, Mattoo, Mulabdic, and Ruta (2022) find restructuring of trade network to large multinational french firms and Japanese multinational firms tend to shift productions to developing countries rather than other top exports. After China joined the WTO, the impacts of "China shock" attracts many research analysis given its rapid growth and impacts on global production chain. The processing trade counts the largest proportion of trading values since the year 2000 (Figure A2) while the ordinary trade gradually surpass and become the largest proportion of trade by the end of our sample period. On the other hand, processing firms are mainly geographically clustered in the southeast coastal regions which is very likely to suffer natural disasters such as typhoon or flood4 . L¨angle, Xu, and Tian (2021) use hurricane Katrina 2005 as the external shock to examine the impacts on manufacturing processing firms in China. They found that the reduction of exports for Chinese manufacturing firms is short-lived while those processing traders with more diversified suppliers are less likely to be affected by the disasters shocks from the US. In this paper, we use plant level monthly trade data in China in combine with typhoon strike damage model to examine the magnitude of typhoon damage to imports and exports and its mechanism of trade loss and structure changes. We are interested at the role of natural disasters during this structural changes and to examine the industrial upgrading through potential "build-back better"(Cole et al. (2019)). The remainder of this paper is organized as follows. In section 2, we review literature related and highlight our contributions. In section 3, we introduce the data we use and the methodology. In section 4, we present our empirical hypothesis, econometric model, and regression results. We give conclusions and policy implications in section 5.