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Jasmin Gröschl, Alexander Sandkamp

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Poschingerstr. 5, 81679 Munich, Germany
Telephone +49(0)89 9224 0, Telefax +49(0)89 985369, email ifo@ifo.de
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Flood Events and Plant Level Trade: A Chinese Experience*

Abstract

We quantify the impact of large flooding events on the plant-level trade of manufacturing firms in China. Constructing a panel data set of more than 685,000 geolocated plants and provincial city and county measures of flooding events derived from precise geolocated monthly flood areas, we show that the impact on production facilities can be considerable, although relatively short-lived. While the number of exporting plants remains below its pre-flood level for at least 12 months, the effect on the distribution of exporter market scope, on the average exporter scale or the sales distribution of plants vanish within a year. Privately owned plants are hit harder than state-owned enterprises, as they continuously produce fewer products, while their export value recovers. Producing products covered by the Chinese Communist's Party five-year plan tends to insulate firms against the negative effects of floods.

JEL code: F14; F18; Q54
Keywords: China, trade, firm heterogeneity, natural disasters

Jasmin Gröschl
ifo Institute – Leibniz Institute for Economic Research
at the University of Munich,
Poschingerstr. 5
81679 Munich, Germany
University of Munich, CESifo
groeschl@ifo.de

Alexander Sandkamp
Kiel University
Wilhelm-Seelig-Platz 1
24118 Kiel, Germany
Kiel Institute (IfW), CESifo
sandkamp@economics.uni-kiel.de

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1 Introduction

Natural disasters can impact international trade through a variety of different channels. They can destroy crucial transport infrastructure such as roads or ports, directly reducing the capacity of a firm to export. The export capacity of a firm may also be affected by the destruction of public and private assets (e.g. power plants, machinery, or production facilities) which are crucial for production. Established trading relationships with customers may be severed by negative flooding shocks, and supply chains for intermediate inputs and services can be affected (De Mel et al., 2012). As most research has examined this topic using annual data, the question remains of how firms adjust to such exogenous shocks in the short-term.

We merge monthly Chinese plant-level trade data with geoinformation on flood data to identify the impact of exogenous flood events on the intensive and extensive margins of plant-level trade. For the years 2000-2006, we find that the effects of flooding events are relatively short-lived. While the effect on the number of exporting plants is persistent for at least 12 months, the effect on the distribution of exporter market scope, on the average exporter scale or the sales distribution of firms vanish within a year. These effects are driven by production facilities, with wholesalers being barely affected. This suggests that flooding events reduce a firm's export capacity not by destroying infrastructure (as this ought to equally affect wholesalers) but through their impact on a firm's production capability. Looking at different firm-ownership structures, we find that privately owned plants are hit harder than state-owned enterprises. They produce continuously fewer products, while their export value and average sales per product recover (potentially due to higher value products). Plants that produce within an industry supported by the five-year plans of the Chinese Communist Party perform better than those producing in industries not supported by the 5-year plans.

China is an ideal laboratory to investigate these dependencies, since it is a large and diverse country, offering substantial variation for statistical identification. It is frequently affected by natural disasters of different types. Historically, China has many flood-prone areas with large rivers, like the Yangtze River, the Yellow River, or the Mekong River, and long coastal areas. In the last decades, floods were among the most frequent natural disasters in China. Due to climate change, extreme weather events are expected to become even more numerous or severe and the effects of floods will be magnified by continuing urbanization and economic growth.[1] These phenomena concentrate large numbers of people and assets around an ever-increasing number of growing urban centres and, as a result, the likelihood of a flood affecting a densely populated urban area has risen steeply.[2] According to a report by Munich Re, floods present

[1] While climate change is causing heavier downpours, the rapid growth of cities further exacerbates flooding by covering up surfaces that could otherwise absorb rain water.

[2] Between 2000 and 2006 alone, EM-DAT records that 4.190 people have died, 364.8mn people were affected, and 42.9bn US$ adjusted damage have been reported from flooding events in China. These numbers magnify if we look at a longer time span, i.e., 1980 to 2021: deaths 44.921; total affected 2.1bn people; total damage 426.9bn US$.

growing threats for the economic development of China, as in total only 2% of economic losses are insured (Munich Re, 2021). Using Chinese firm-level customs data which include information on plant location allows us to map economic activity measured at the firm-plant-level to geo-referenced disaster data. China is also an interesting object of study because it allows us to investigate the role of the state in mitigating the impact of natural disasters.

The literature has investigated the impact of natural disasters on economic activity using aggregate data with measures of negative shocks at the annual level, or firm-level data with a different focus on supply chains. While evidence on the long-run growth effects of disasters exists (Noy, 2009; Loayza et al., 2012; Felbermayr and Gröschl, 2014; Hsiang and Jina, 2014; Dell et al., 2014; Berlemann and Wenzel, 2018), it tends to be mixed and effects are typically small. One reason for this may be that most disaster effects occur in the very short-run, and that it is helpful to look at individual firm behaviour. Firms react quickly with their reconstruction efforts. For example, De Mel et al. (2012) report that three months after the December 2004 tsunami, more than 80 percent of Sri Lankan firms had repaired at least part of the damage caused. After Hurricane Katrina, Walmart reopened nearly 90 percent of its stores within less than two weeks (Shughart, 2006).

Disaster-struck firms have a profit maximization motive to recover quickly from a shock as they can expect to increase their sales as the disaster has literally knocked out part of their competition (Runyan, 2006). Also, trade-related infrastructure is rebuilt rather quickly. Chang (2010) finds that after the 1995 Kobe earthquake had destroyed Kobe's port, container cargo trade recovered two-thirds of its pre-disaster level within six months. Hence, shocks identified directly from annual data, at best, are hard to interpret and will likely underestimate the size of the adjustment process in trade patterns after a disaster event (see Felbermayr et al. (2021) who estimate monthly aggregate supply and demand conditions from bilateral global trade data). We thus contribute to the literature by investigating how firms adjust their export behaviour within the first twelve months of the disaster.

Several challenges exist when conducting a micro-level analysis of flooding events. When modelling the impact of flood events on firms, it is important to consider the complex local nature of floods. Considerable progress has been achieved in modelling the precise extent of flood areas (Kocornik-Mina et al., 2020); we employ this in our economic modelling. The perhaps greatest challenge is to precisely localize the economic agents of interest and match them to the flood impact. The challenge, however, is that the majority of available firm data do not provide (exact) locations.

In this paper, we investigate the impact of large flooding events on the extensive and intensive margin of plant-level exports in China on a monthly basis. We attempt to overcome the challenges by explicitly linking the panel of Chinese trading plants to precise flood areas, while also controlling for potential climatic confounding factors (local rainfall, temperature, and typhoons). As two-thirds of Chinese territory suffers from the threat of flooding, China represents an ideal country to study. Importantly, these flooding events have caused considerable damage to economically relevant areas where most of the manufacturing activity is located. We contribute by using the geo-information provided in the panel of Chinese exporting firms and match it with precise geo-information on flooding areas. By matching the flood and plant-level information, we are able to quantify the impact of floods on plant-level export performance. We further contribute to the current literature by providing insights on the channels through which the effect of flooding events on firm exports operate along the extensive or intensive margin of trade based on indicators proposed by Bernard et al. (2007); Eaton et al. (2011), and Arkolakis et al. (2021). We examine the flooding effects on Chinese exporting firms along four components: market exit (the number of firms), the distribution of exporter market scope (the number of products), the intensive margin (value per product per firm), and the average exporter scale or sales distribution (average product sales).

There are a number of papers related to the impact of shocks on firm-level indicators. A paper that looks at firm productivity in relation to flood hit regions is Leiter et al. (2009) who examine the impact on firms being located within a flood hit region. However, their data do not allow them to identify whether any individual firm was inundated. Their results show that firms in flooded areas experience stronger growth in employment and capital accumulation in the short-run compared to unaffected firms, although they also find a short-term negative impact on productivity. Similarly, Coelli and Manasse (2014) examine the impact of flooding on firm input and productivity in Italy. They find that two years after a flood, Italian firms generate nearly 7% higher value added than unaffected firms. This growth effect is partially driven by government aid. In line with their findings, we show that state owned firms and those producing products mentioned by the Chinese government's five-year plan are less strongly affected by natural disasters. Several papers look at disaster shocks and business survival. Cole et al. (2019) study the 1995 Kobe earthquake in relation to building level damage. They find that manufacturing plant survival depends significantly and negatively on building level damage up to seven years after the event. Productivity temporarily increases following the earthquake event, consistent with a build back better effect. Basker and Miranda (2018) examine business survival in the aftermath of the Hurricane Katrina, where firms located close to banks and facilities that belong to large chains were more likely to recover from major structural damage. Elliott et al. (2019) quantify the impact of typhoons on manufacturing plants in China. They find that plant sales decrease considerably, but effects are short-lived. Some buffering exists through an increase in debt and a reduction in liquidity. Plants shift their focus to foreign markets, they reduce sales to domestic buyers and purchase rather from foreign suppliers.

The small research area most closely connected to our paper examines a channel through which natural disasters can impact firms: international trade. Gassebner et al. (2010) and Oh and Reuveny (2010) use bilateral trade flows to assess the impact of global disaster occurrence on international trade. They find that an additional disaster reduces imports by 0.2% and exports by 0.1%. Ando and Kimura (2012) study the impact of the Great East Japan earthquake of 2011 on Japanese trade. They find a dramatic short-term decline in exports, while at the same time imports increased substantially. Using a gravity framework, Felbermayr and Gröschl (2013) show that large disasters increase imports of an affected country. Felbermayr et al. (2021) estimate monthly aggregate supply and demand conditions from bilateral global trade data. They find large, persistent, negative effects of earthquakes and storms on supply and demand for credit-constrained countries, while supply is only temporarily depressed in other economies.

Finally, a small strand of the literature considers the impact of natural disasters on supply chains and production networks. Henriet et al. (2012) show theoretically how the role of imports to replace a firm's domestic suppliers can either dampen or magnify the effect of a natural disaster. One of the first papers in this area by Altay and Ramirez (2010) demonstrates that all sectors within a supply chain are affected by a disaster, and that the effect on firm turnover depends on the position of a firm within the supply chain. More recently, Inoue and Todo (2019) examine Japanese firm supply chains and find that firms substitute damaged for undamaged suppliers and that the structure of the supply network plays an important role for the size of any direct impact on firms. Looking at the 2011 floods in Thailand and Japanese owned affiliates in Thailand, Hayakawa et al. (2015) find that damaged firms reduced local purchases, particularly from other Japanese affiliates in Thailand and increased their imports from China and Japan. Feng and Li (2021) show that exposure to natural disasters in major trading partners reduces stock market returns in the home-country. Barrot and Sauvagnat (2016) document that firm-level shocks propagate in production networks, considering major natural disasters in the past 30 years in the United States. In a similar spirit, results by Boehm et al. (2019) suggest that global supply chains play an important role in the cross-country transmission of shocks. Particularly, they show that the 2011 Tokohu earthquake triggered a large drop in imports and output in the U.S. affiliates of Japanese multinationals in the months following the event. Carvalho et al. (2021) use the same event to quantify the role of input-output linkages as a mechanism for the upstream and downstream propagation and amplification of shocks in supply chains. Using a general equilibrium model of production networks, they calculate that the earthquake resulted in a 0.47 percentage point decline in the real GDP growth of Japan in the year following the event.

The remainder of the paper is organized as follows. In Section 2 we describe our data, the construction of our plant level panel, and our baseline estimating equation. In Section 3 we present our econometric results. The final section provides some concluding remarks.

2 Data and methodology

2.1 Geographic region

We focus our analysis on the effects of floods on plants located in China. For floods, the plants that are most likely to be damaged are those geographically located along rivers and river basins. For completeness, we took the data intensive decision to include all plants to ensure that we capture all possible locations hit by floods.

2.2 Plant-level data

The plant level data stem from the Chinese Customs Trade Statistics released by the Chinese Customs Office for the period January 2000 to December 2006. It is an unbalanced panel, but by combining a 10-digit firm code and a 5-digit administration code, we are able to follow each plant across our sample period that also allows us to follow plants over time. The data includes a number of plant-level variables relevant for our analysis, including export and import values on the HS8 product level, information on agents versus production plants, firm types, transport mode, and transport regime. For the analysis, we create indicators based on Bernard et al. (2007); Lawless (2009) and Arkolakis et al. (2021), particularly, the number of exporting firms, the number of exported products per firm, the export value per firm, and the average sales per product per firm.

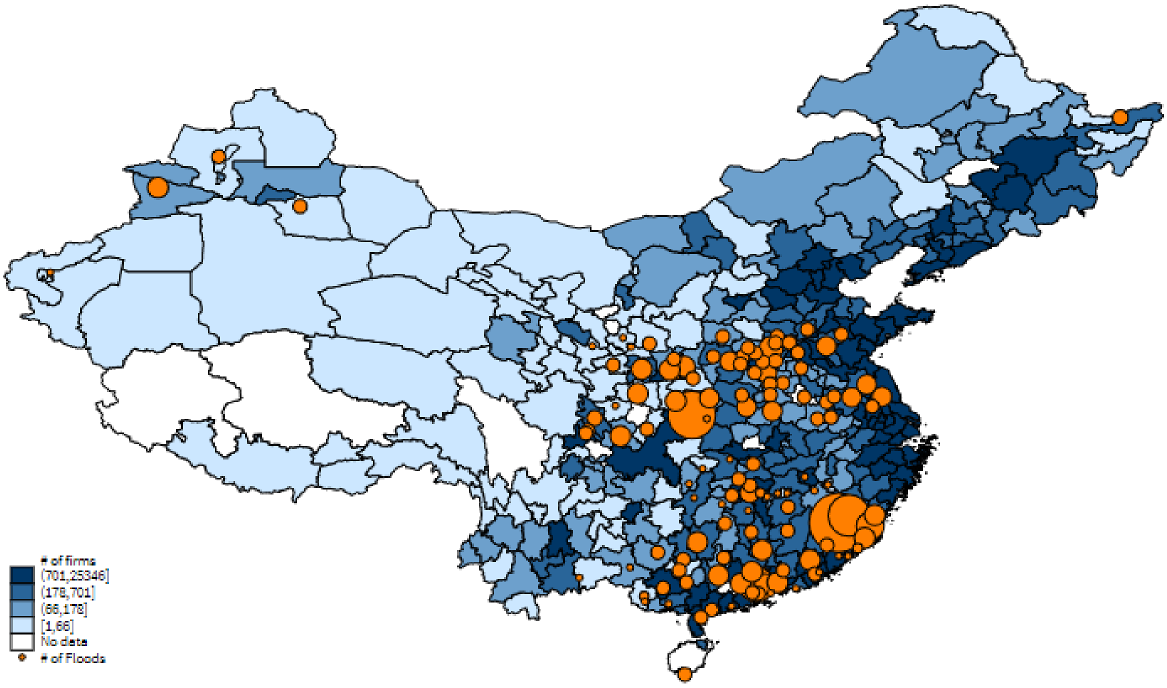
2.3 Geolocation of plants

A critical task for our analysis is to determine the geolocation of plants. To do this, we use 5-digit administration code information on the location of each plant on the provincial city and county level. This gives us the geological boundaries (shape maps/polygons) of each provincial city and county in each month for 81.6% of the plants. After geolocating plants and excluding any observations where we were unable to construct all of our performance indicators, our final sample of plants consists of 820,962 unique plants, meaning that we dropped approximately 5.2% of plants.

2.4 Provincial city and county flood data

To model floods, we use data from the Dartmouth Flood Observatory (DFO). Floods have been imaged by satellite and translated at DFO into individual maps of inundation extents. It provides shape maps for discrete flood events including flood catalogue numbers, centroids, and the area affected outlines.[3] A total of 132 floods struck China between 2000 and 2006. We use the provided shape maps of these flood events and match them to our Chinese provincial city and county information using polygon identifiers of the flood outlines. Originally, floods are assessed on a 1 to 2 scale with three flood categories led by severity. Class 1 floods are large events (10-20 year interval); class 2 floods are very large events (20 to 100 year interval, >5000 sq.km); class 3 floods are extreme events (>100 year interval). We create an indicator variable which is one if the flood event is class 2 or higher.

Figure 1: Number of Plants and Flood Occurrence, 2000 - 2006



Note: Raw data from the Dartmouth Flood Observatory.

Figure 1 shows the number of plants per provincial city and county and respective flood occurrence between 2000 and 2006. Darker colour means a higher number of plants in the area. As can be seen, plants are disproportionately located along the coast. One may want to note in this regard that this distribution pattern also coincides with the distribution of population within China. The size of the bubbles shows the number of floods that hit a certain area in our sample period.

[3]It also includes river flooding caused in connection to tropical storms. We correct for these events in our data by controlling for tropical storms in the regression.

2.5 Controls

Tyhoons As some river flooding events in the coastal region might be connected to tropical storms or typhoons, we model typhoons by deploying the Gridded GAME database of Felbermayr et al. (2022).[4] Raw data on storm tracks stem from the International Best Track Archive for Climate Stewardship (IBTrACS) the World Meteorological Organization (WMO) and the US National Oceanic and Atmospheric Administration (NOAA). The data provides the position of the eye of the storm and the maximum wind speed in knots on a six hourly basis on all tropical cyclones. Hence, we observe the exact locations and paths of hurricane centres (latitude, longitude). Typhoons are mapped using a wind field model provided by Geiger et al. (2017). A total of 44 storms struck China between 2000 and 2006. We match gridded data centre points to provincial city and county polygons. Note that typhoons are mapped to grid cells using a radial geodesic buffer around the exact geographical path. We then calculate a population-weighted arithmetic mean and scale wind speed data by population density within a grid cell to account for the fact that the impact of a typhoon on economic activity depends on whether the affected area is densely or sparsely populated. We then create an indicator variable for typhoons, which equals one if the wind speed exceeded 88 kt on the Saffir-Simpson hurricane category scale; a category 2 storm. Figure A1 in the Appendix shows the number of plants per provincial city and county and typhoon occurrence between 2000 and 2006. Darker color means a higher number of plants in the area. The size of the bubble shows the strengths of the typhoon wind speed that hits a certain area.

Auffhammer et al. (2013) demonstrate that different climatic phenomena may impact economic activity. Likewise, Zhang et al. (2018) examine the impact of temperature changes on the productivity of Chinese plants and find that output could fall by up to 12% based on 2050 predictions of climate change under the assumption of no adaptation. High temperatures have also been linked to lower economic activity by Hsiang (2010) and Chen and Yang (2019). Hence, to control for other potentially confounding factors, we construct localized measures of rainfall and temperature to include as additional controls in our estimations.

Rainfall To capture local rainfall, we use data from the University of East Anglia Climatic Research Unit Time-Series (CRU TS 3.23). CRU compiles and homogenizes hourly station data from numerous sources into a consistent format through sophisticated reanalysis methods. Felbermayr et al. (2022) map monthly precipitation in mm to a 0.5-degree by 0.5-degree resolution in their Gridded GAME database. Calculating a population-weighted arithmetic mean for precipitation within a grid cell and matching each centroid of the grid cells to provincial city and county boundaries using geospatial information, we obtain monthly population-weighted mean

[4] For a detailed description of the database, its primary data sources, and the spatio-temporal aggregation procedures used see Felbermayr et al. (2022) and `https://www.ifo.de/en/game-lights-gridded-meteorological-events-and-night-light-emission-database`.

daily rainfall per provincial city and county.

Temperature To construct monthly mean daily temperature for each provincial city and county, we take data from the Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration (NOAA). They provide daily data on land surface temperature in degree Celsius for several hundred weather stations across China. This data set combines two large sources of station observations collected from the Global Historical Climatology Network (GHCN) v2 and the Climate Anomaly Monitoring System (CAMS). It provides spatio-temporal coverage and consistency using unique reanalysis methods. Again, Felbermayr et al. (2022) map monthly temperature to a 0.5-degree by 0.5-degree resolution in their Gridded GAME database. Calculating a population-weighted arithmetic mean for temperature by grid cell and matching each grid's centroid to provincial city and county boundaries, we obtain monthly population-weighted mean daily temperature per provincial city and county.

2.6 Summary statistics

Table A1 in the Appendix provides summary statistics for our sample for the main variables we use in our regression analysis. Export volumes vary considerably across plants, ranging from one to 3.1 billion US$ with a mean of 431,289 US$. In terms of our other variables, plants have average export sales per product of up to 3.1 billion US$. The number of exporting firms per provincial city or county varies between 1 and 192,172 plants, with a mean of 15,569 plants. Looking at the number of exported products per firm per provincial city or county, we find that firms export up to 9,057 products or 7.5 products in the mean. One may want to note that of the 820,962 unique plants in our final data set, 9.4% experience a flood event at least once during the period of our study.

2.7 Baseline regression

To investigate the impact of flooding events on Chinese manufacturing plants, we experiment with a variety of firm-level, trade-related dependent variables based on Bernard et al. (2007), Eaton et al. (2011), and Arkolakis et al. (2021).

Specifically, we decompose the aggregate value of exports into four factors. At the extensive margin, we examine the number of plants exporting and the number of products exported per plant (exporter market scope). At the intensive margin, we look at the value of exports per plant and the average sales per product per plant (Arkolakis et al., 2021).[5] At the firm-level, we estimate the following regression

[5]The value of exports per firm and the average sales per product per firm depend on both the prices charged for the products and the quantities shipped in case of a flood.

$$\ln X_{i,c,p,t} = \sum_{j=0}^{J} \alpha_j FL_{c,p,t-j} + \sum_{j=0}^{J} \delta_j C_{c,p,t-j} + \mu_{i,p,t} + \delta_c f(m) + \varepsilon_{i,c,p,t} \quad (1)$$

where $\ln X_{i,c,p,t}$ is our dependent variable of interest for enterprise i in provincial city or county c in province p at time t (a particular month m in a particular year y). A plant is defined as an enterprise-county combination i, c.[6] $FL_{c,p,t-j}$ are contemporaneous and lagged measures of flooding events. J defines the maximum number of periods a flood is allowed to influence the dependent variable, e.g. firm exports. Floods are measured by an indicator variable that takes a value of one if a flood falls into class 2 or higher and zero otherwise. In our baseline regression, we set $J = 12$, meaning that we regress our dependent variable on contemporary floods as well as 12 lags, ranging from 1 to 12 months. $C_{c,p,t-j}$ are our typhoon events and climatic controls (average daily temperature and rainfall).

We take a comprehensive fixed effects approach, to control for unobservables that might be correlated with our regressors while at the same time affecting the dependent variable. $\mu_{i,p,t}$ is a firm-province-time fixed effect. It controls for both time invariant and time-varying firm specific unobservables, including ownership structure. At the same time, the fixed effect controls for province specific geographic time trends as well as for any time invariant firm and location specific factors that may be related to disaster exposure, but also any firm specific trends related to local trends in flood occurrence. Additionally, $\delta_c f(m)$ is a linear county specific monthly time trend that accounts for regional seasonality in flooding. It also controls for any time-invariant unobservable variable on the province, city and county level.

The coefficients of interest, namely the contemporaneous and lagged effects of floods events, are unbiased from an economic decision-making perspective. More specifically, the battery of included fixed effects controls for any factors that may be related to flood exposure. Our typhoon and climatic controls capture any other confounding factors that might be correlated with floods, (Auffhammer et al., 2013). Therefore, FL will, after all of these controls, arguably simply be random realizations drawn from the local flood distribution.

$\varepsilon_{i,c,p,t}$ is the error term. We adjust standard errors for heteroscedasticity and cluster at the provincial city and county level as unobserved components might cause flood outcomes for firms within clusters not to be independent. With the number of plants as dependent variable, the estimation equation becomes

[6]The dataset does not differentiate between different plants within a county belonging to the same firm. If a firm operates more than one plant within a county, these plants cannot be disentangled.

$$\ln X_{c,p,t} = \sum_{j=0}^{J} \alpha_j FL_{c,p,t-j} + \sum_{j=0}^{J} \delta_j C_{c,p,t-j} + \mu_{p,t} + \delta_c f(m) + \varepsilon_{c,p,t} \tag{2}$$

3 Regression Results

3.1 Baseline

This section examines the effect of floods on the four firm-level, trade-related dependent variables based on Bernard et al. (2007), Eaton et al. (2011), and Arkolakis et al. (2021). We start by examining whether the effects of flood events on Chinese exporting firms operate through the extensive margin of market entry (the number of exporting firms). Columns (1) to (3) of Table 1 provide estimates for the margins of adjustment. Using fixed effects, we find that a large flood event reduces the number of exporting firms on average by 29.3% in the month of occurrence (Column 1). The effect persists throughout the year following the event. Including the climatic controls (Column 2) suggested by Auffhammer et al. (2013) and controlling for large typhoons, we find similarly high numbers of firms exiting the export market; 27.5% in the month of occurrence.

Controlling for regional seasonality in flooding reduces the extensive margin of market entry to 12.6% in the month of occurrence (Column 3). In the two months following the event, the number of exporting firms is 8% and 6.9% lower than before the flood, respectively.[7] Three months after the event, the number of firms is only 3.5% lower than before the flooding. The numbers decrease further, up to half a year after the event. Still, within a year, the exit of exporting firms hit by a large flood increases again to 8.5%. These numbers are statistically significant at the 1%-level.

In Columns (4) to (6), we look at the distribution of exporter market scope (the number of products). Controlling for fixed effects, climatic controls and regional seasonality in Column (6), we find that large floods decrease the number of products exported per firm within the first three months after the event. The number of products exported per firm is reduced by 5.5% on average in the month when the firm is hit by a large flood, followed by a reduction of 6.6% and 7.9% in the months following the flooding. After that, effects vanish and cease to be statistically significant.

The intensive margin (the value of exports per firm and the average sales per product per firm) depend on both the prices charged for the products and the quantities shipped in case of a flood. We examine the intensive margin (export value per firm) in Columns (7) to (9) of Table 1. We find that a flood decreases the export value per firm by 9.7% on average in the month of occurrence (Column 9). A large flood reduces the intensive margin of a firm up to 10.4% within

[7]Note that for brevity, we only report estimated coefficients for one, two, three and 12-month lags. Full details for the 12 monthly lags are reported in Table A2 in the appendix.

the first two months after the hit. These effects are not persistent statistically, they vanish following the third month after the flood.

Table 1: Effect of Floods on Plant-level Trade, Monthly (2000 - 2006)

Dep. Var.:	**# of plants**			**# of products per plant**		
	(1)	(2)	(3)	(4)	(5)	(6)
Flood, cat. >1.5	−0.3464***	−0.3221***	−0.1352***	−0.0732	−0.0634	−0.0571*
	(0.04)	(0.04)	(0.01)	(0.04)	(0.04)	(0.03)
t-1	−0.3819***	−0.3523***	−0.0846***	−0.0853*	−0.0771*	−0.0687**
	(0.04)	(0.04)	(0.01)	(0.04)	(0.04)	(0.03)
t-2	−0.4372***	−0.4144***	−0.0724***	−0.1110**	−0.0927*	−0.0826**
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.04)
t-3	−0.4462***	−0.4109***	−0.0361***	−0.0732	−0.0319	−0.0427
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.04)
t-12	−0.2712***	−0.2726***	−0.0886***	0.0565	0.0541	0.0565
	(0.05)	(0.05)	(0.02)	(0.05)	(0.05)	(0.04)
Fixed Effects	yes	yes	yes	yes	yes	yes
Regional Seasonality			yes			yes
Climate Controls		yes	yes		yes	yes
R^2	0.642	0.665	0.926	0.355	0.381	0.541
Observations	213,902	213,902	213,887	213,902	213,902	213,887
Dep. Var.:	**export value per plant**			**average sales per product per plant**		
	(7)	(8)	(9)	(10)	(11)	(12)
Flood, cat. >1.5	−0.1665***	−0.1334**	−0.1017**	−0.0977*	−0.0797	−0.0829*
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)
t-1	−0.1608***	−0.1253**	−0.0814*	−0.0990**	−0.0809*	−0.0845**
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)
t-2	−0.2095***	−0.1691***	−0.1100**	−0.1285**	−0.1055*	−0.1186**
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
t-3	−0.1306**	−0.0813	−0.0319	−0.0637	−0.031	−0.0559
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
t-12	0.0572	0.0457	0.0919	0.067	0.0634	0.0575
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)
Fixed Effects	yes	yes	yes	yes	yes	yes
Regional Seasonality			yes			yes
Climate Controls		yes	yes		yes	yes
R^2	0.411	0.430	0.515	0.580	0.593	0.649
Observations	213,902	213,902	213,887	213,902	213,902	213,887

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale. All indicators are on the provincial county/city level. Full details for the 12 monthly lags included are reported in Table A2 in the Appendix.

Finally, we look at the average exporter scale that constitutes the sales distribution of exporting firms (average product sales per firm, Arkolakis et al. (2021)), in Columns (10) to (12). Firms are hit by a demand and/or supply shock when they are affected by a flooding event. We find that firms sell on average 8.0% (8.1% and 11.2%) less per product in the month of a large flood (in the first and second months after the flooding, Column 12). These effects are statistically significant at the 10%-level and the 5%-level. The effect is not persistent and vanishes after that.

Overall exporting firms, when hit by a large flood, focus on their core competency meaning they export fewer products and focus on fewer shipments.

3.2 Wholesalers

The data allow us to decompose results to firms that act as wholesalers and to the production facilities of firms. Following the approach by Manova and Zhang (2012), who use keywords in firms' names, we categorize enterprises that are pure export-import companies. These firms serve exclusively as intermediaries between domestic producers and foreign buyers and do not engage in manufacturing. Table 2 indicates that only a third of export transactions is done by wholesalers. In our sample, 1.2% of all export transactions by firms, 1.1% or transactions by production facilities, and 1.4% of transactions by agents are affected by at least one large scale flooding event.

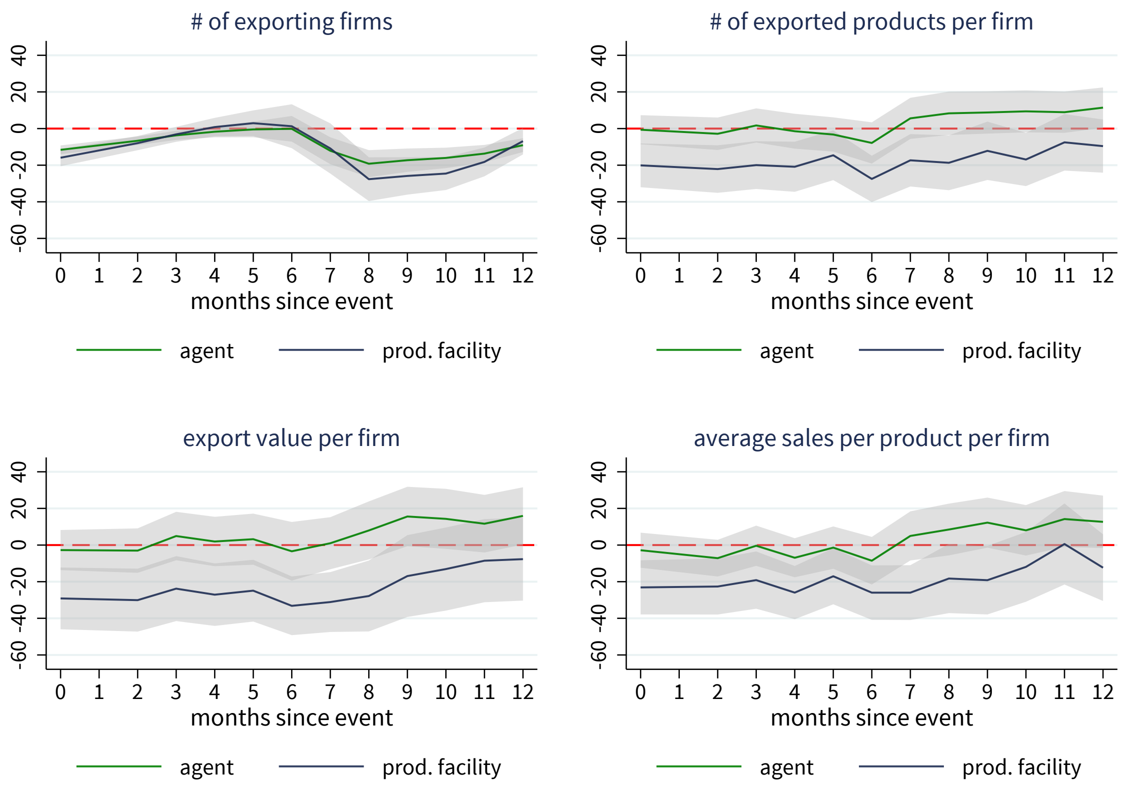
Table 2: Summary Statistics

		production facilities
# of firms	239,337	
# of unique plants	685,883	
# of agents	45,808	
# of agent dist. fac.	337,556	
# of prod. firms	193,529	348,327
# of export transactions	7,646,351	5,294,207
# of transactions by agents	2,352,144	

	Flood Events affect	
# of transactions	92,769 (1.2%)	
# of prod. firm transactions	60,253 (1.1%)	
# of agent transactions	32,516 (1.4%)	

We decompose the sample into wholesalers and production facilities of plants, again looking at the four components; two for the extensive and the two for the intensive margin. Results are depicted in Figure 2; and in Table A3 in the appendix. We find that while the number of agents is similarly reduced by a large flooding event compared to the number of exporting production facilities (top left panel of Figure 2), there is a large difference in the other three components. The distribution of exporter market scope only matters for production facilities of firms in case of a flood, while the same is true for the export value and average sales per product. For wholesalers, we do not find any negative statistically significant effects with respect to the number of exported products, the export value or the average sales per product per firm. More so, it seems as if substitution effects are at work, shifting export activity away from production facilities towards wholesalers. Agents can generate statistically positive effects on the number of products, the export value and average sales per product following the first nine months after a flooding event. Overall aggregate results are clearly driven by production facilities.

Figure 2: Percentage Changes on Agents versus Production Facilities



Note: Full results can be found in Table A3 in the Appendix.

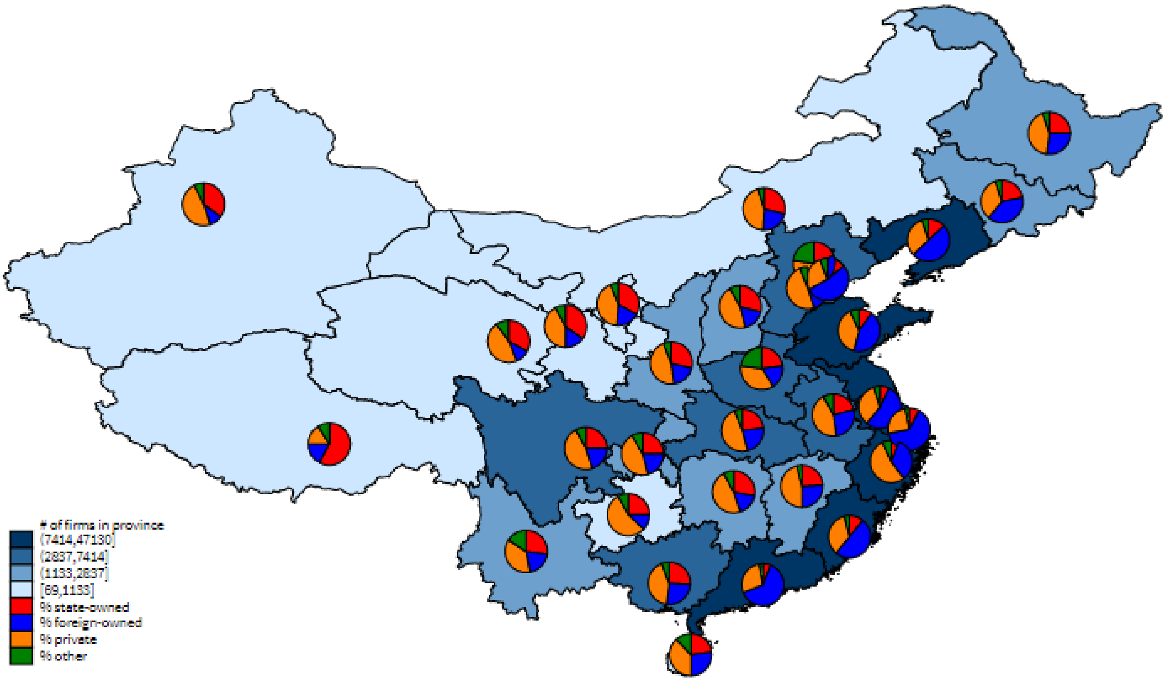
3.3 Firm types

Next, we examine whether different firm types experience different effects from flooding. Our data distinguish state-owned enterprises, foreign enterprises (sino-foreign contractual joint venture, sino-foreign equity joint venture, foreign-owned enterprises), private enterprises and other firms (collective enterprises and other).

Figure 3 shows the number of firms per province and the share of enterprises by firm type in percent. We see that not only are most firms located in the most productive provinces along the coast, but firm types also vary across provinces. Along the coast, the majority of firms are either foreign or private enterprises. While the share of foreign firms decreases, that of state-owned firms increases if we move inland.

To get an idea of how affected specific firm types are by large flooding events, Table 3 provides information on the percentage share of how many wholesalers, production facilities, firms that do not indicate whether they are a wholesaler or a production facility, or all firms respective of the firm type are hit by a large flood. Overall, 8.5% of firms in our sample are SOEs followed

Figure 3: Location of Firms by Shares of Firm Types



Note: Based on Chinese Customs Trade Data. The figure shows the number of firms per province and the share of enterprises by firm type in percent.

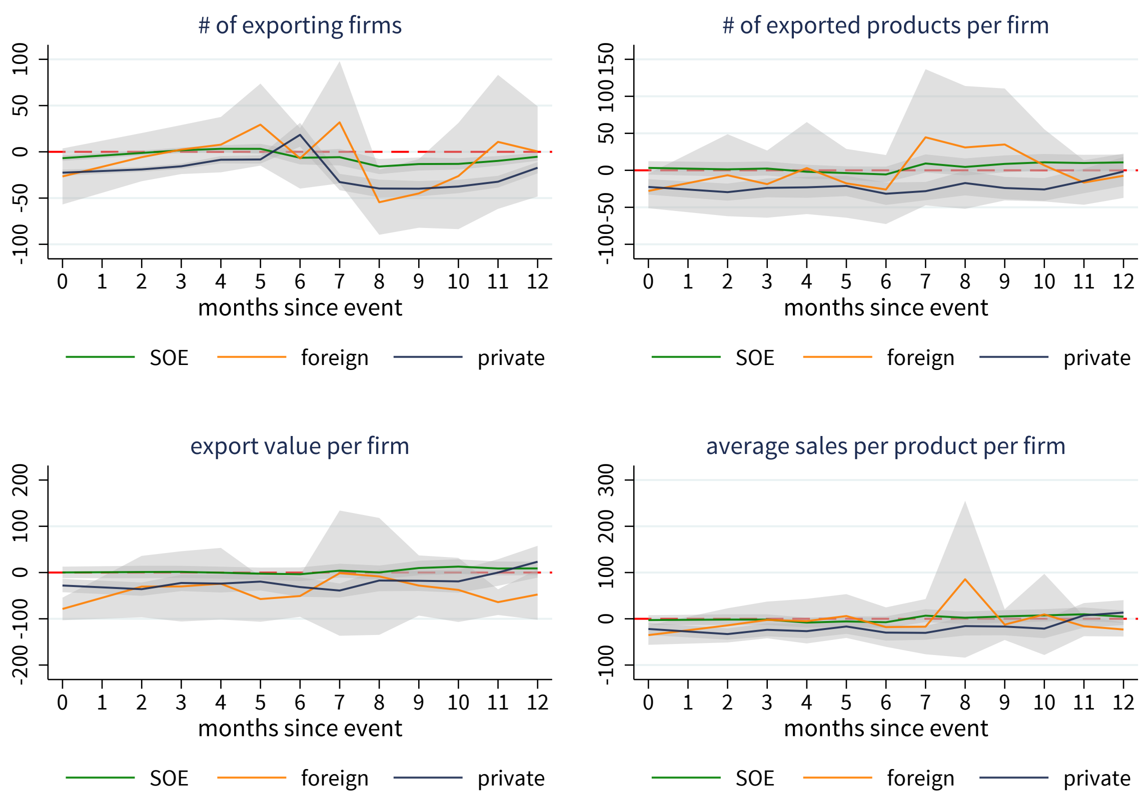
by 43.0% of foreign enterprises and 42.7% are private firms. Looking at SOEs, 2.3% are hit by a flood. Nearly 40% of SEOs are wholesalers, another 40% are production facilities and 20% of SOEs do not indicate. 1.3% of SOE agents are hit by at least one flood event in the period of observation, while 0.8% of SOE production facilities are subject to a large flood. Numbers look slightly different for foreign firms. 43.0% of the firms in our sample are foreign owned, of which 10.6% are affected by a large flood. Only 0.9% of foreign firms are agents of which 0.04% are affected by a flood. A quarter of the foreign owned plants both produce and trade goods, 7.3% of these are hit by a large flooding event. While those that do not indicate are about 18.1% of foreign owned firms, 3.2% of which experience a large flood. Turning to private firms, these constitute 42.7% of the universe of plants in our sample, 6.9% of which are affected by flooding. More than a third (14.7%) operate as agents, 3.6% of which experience a flood. 6.8% are production facilities, 1.2% of these are hit by a large flooding event. Half of private firms do not indicate and 2.2% of these are hit by a large flooding event. The remainder (5.8%) are collective and other plants not further specified in our sample, 0.8% of which experience a flood. We do not further consider these plants in our analysis.

Applying our fixed effects approach, we find that private firms take the largest share of the hit in all four export components when they are exposed to a flood (Figure 4). This is particularly true for the extensive margin, where effects persist for up to nine months for the number of exported

Table 3: Firm Types by Agent and Prod. Facilities Hit by a Flood, in %

Types:	Agent		Prod. Facility		Other		All	
	Total	Flood	Total	Flood	Total	Flood	Total	Flood
SOE	3.4	1.3	3.1	0.8	1.9	0.1	8.5	2.3
Foreign	0.9	0.04	24.0	7.3	18.1	3.2	43.0	10.6
Private	14.7	3.6	6.8	1.2	21.2	2.2	42.7	6.9
Other	1.1	0.3	2.7	0.4	2.0	0.1	5.8	0.8
Total	20.2	5.2	36.6	9.7	43.3	5.6	100.0	20.6

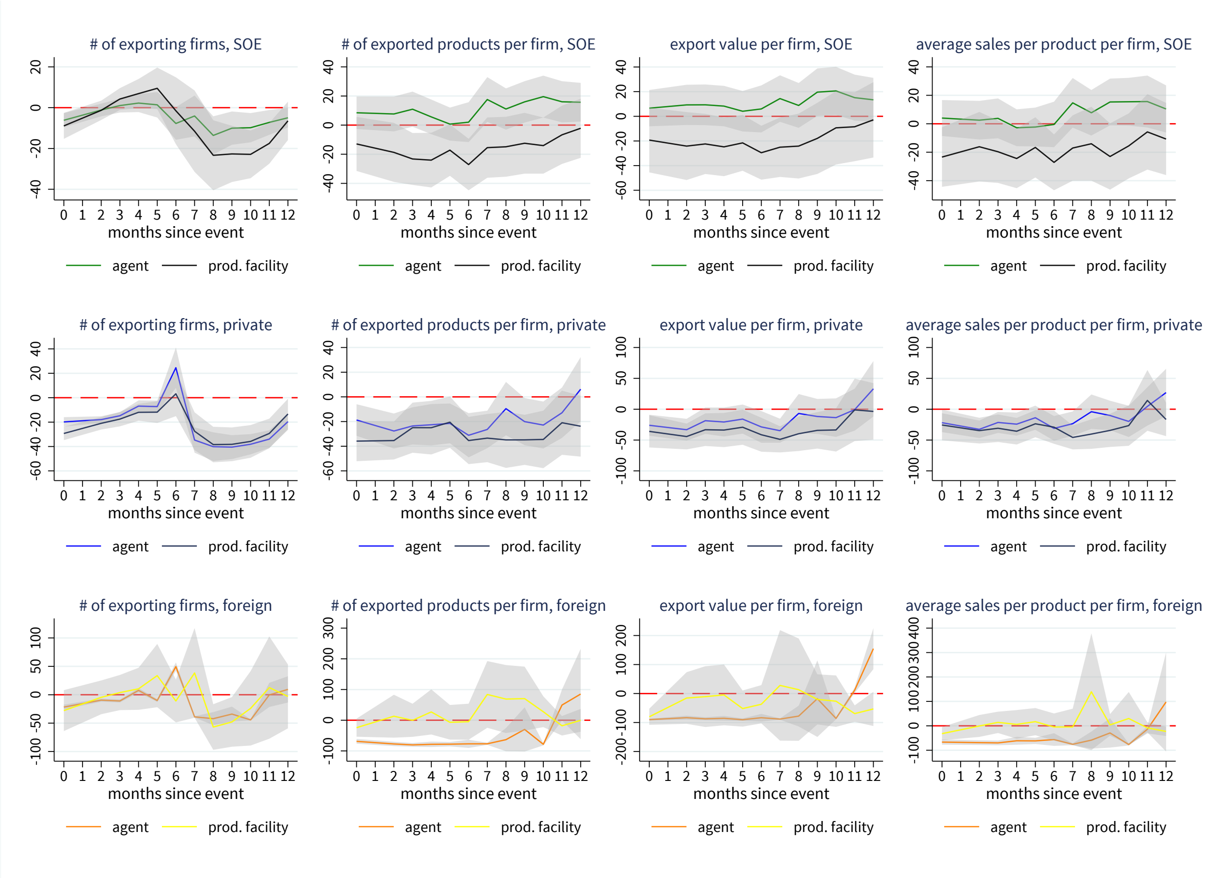
Figure 4: Percentage Changes by Firm Type



Note: The figure shows the effects of large scale flooding on various types of firms over time. Full results are shown in Table A4 in the Appendix.

products and up to 12 months for the number of exporting firms. Effects range between a reduction of private exporting firms by nearly a third (29.1%) in the month the flood hits and a reduction of privately produced products by 28.9%. At the intensive margin, effects level out earlier. The export value of private firms is reduced by 39.0% in the first month of the flooding and is statistically significant up to seven months after the event. Average sales per product of private plants are reduced by 28.2% in the month when the plant is hit by a flood and persists up to 10 months.

Figure 5: Percentage Changes by Firm Type, Agent and Production Facilities



Note: The figure shows the effects of large scale flooding on various types of firms split by agents and production facilities over time. Full results are shown in Table A5 in the Appendix.

SOEs show statistically negative effects only for the number of firms active after a flooding event; a reduction of 7.4% in the month of the flood. Yet, statistical significance vanishes and only returns between six and eight months after the event. Still, numbers are much lower compared to private enterprises. For all other components, effects for SOEs are statistically not distinguishable from zero. If at all, there are positive substitution effects away from private enterprises towards SOEs in the number of exported products nine months after the event. Foreign owned firms are special as they can potentially rely on foreign capital in the case of a flooding event and thus compensate faster for missing machinery or workers.

Following our previous findings that production facilities are more strongly affected by floods than wholesalers, we estimate separate effects by firm-type as well as by whether the firm is a wholesaler or a production facility. The results are depicted in Figure 5. Detailed results are provided in Table A5 in the appendix. Once again, it can be seen that aggregate effects are driven by production facilities. With regard to the number of exported products, export value as well as average sales per product, SOEs that are wholesalers are not affected at all, while SOEs' production facilities experience significantly negative and persistent effects. For the number of exporting firms, this only holds for the second half of the year following the flood. For private firms, both agents and production facilities are negatively affected by floods, although effects are stronger for the latter. Foreign firms behave somehow differently, as agents are significantly affected by floods, while production facilities are not. However, given the very small number of foreign agents affected by floods, this result may be driven by outliers.

Overall, it becomes clear that not all firms are affected equally by floods. Private firms are affected more strongly than SOEs and production facilities are hit more than wholesalers. Hence, while privately owned production facilities are hit hardest, SOE wholesalers remain more or less unaffected.

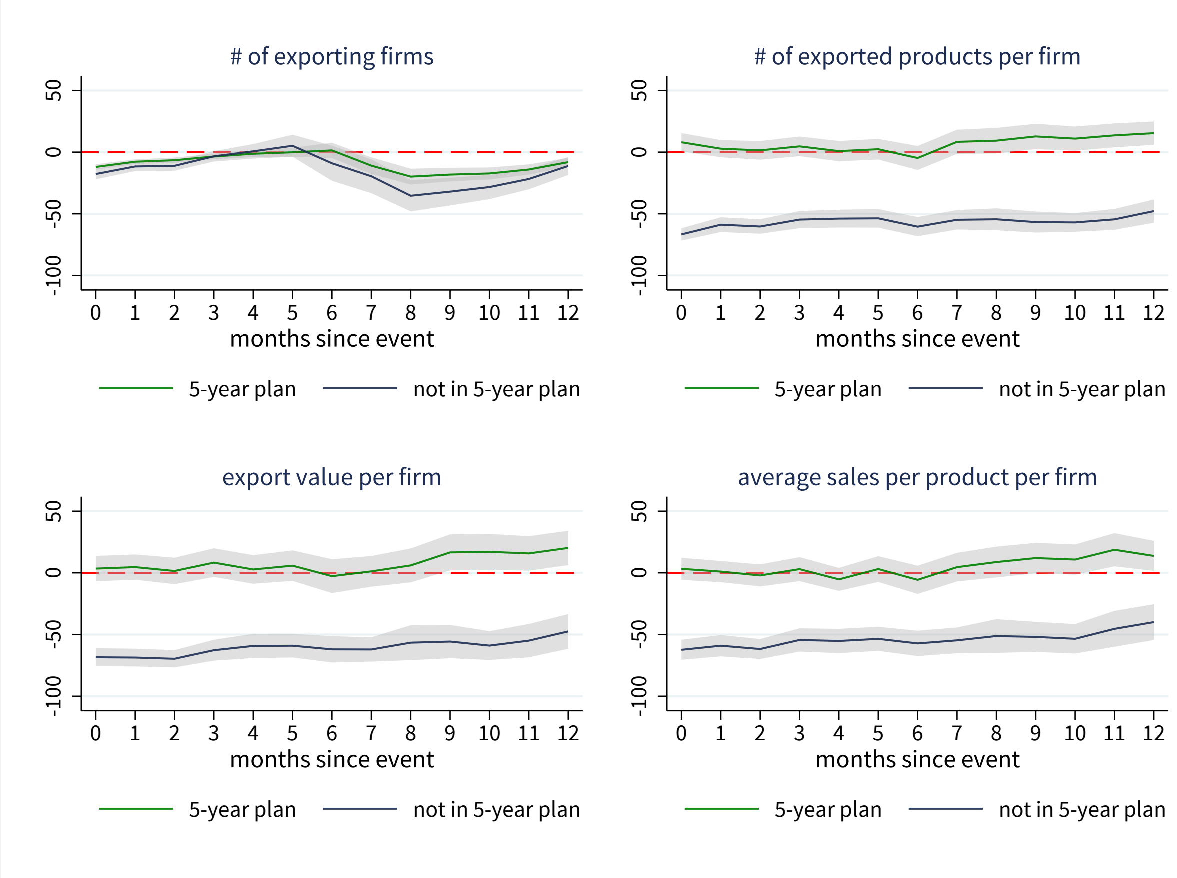
3.4 Five-Year Plan

We also investigate whether firms producing products that are explicitly mentioned in the Chinese Communist Party's five-year plan react to shocks differently than firms that do not (compare Table A8 in the appendix). In its 5-year plans, the Chinese government names specific sectors which it aims to promote and support. Our sample period overlaps with three different five-year plans, providing us with at least some variation over time.[8] As shown in Figure 6 (detailed results provided in Table A6 in the appendix), firms producing products covered by the Chinese government's five-year plan remain almost unaffected (except for the number of firms), while the negative impact on firms not producing products covered by the five-year plan is strong and long-lasting. This is true for both wholesalers and production facilities (see Figures A2 and A3 in the appendix), although production facilities covered by the five-year plan experience at least modest negative effects.

Differences between products covered by the five-year plan and those that are not persist also when controlling for firm-type (Figure 7 and Table A7 in the appendix). SOEs producing products covered by the five-year plan experience almost no, sometimes even positive effects following a flood. SOEs not covered by the five-year plan experience significantly negative effects. A similar picture emerges for private firms, which experience strong negative effects if producing products not covered by the five-year plan and only mild negative effects for products that are covered. For foreign-owned firms, results are mostly insignificant, independent of coverage.

[8] These are the ninth five-year plan (1996 to 2000, China Report No. 32 (1996)), the tenth five-year plan (2001 to 2005, Rongji (2001)) and the eleventh five-year plan (2006 to 2010, State Council of China (2006)).

Figure 6: Percentage Changes by Five-Year Plan



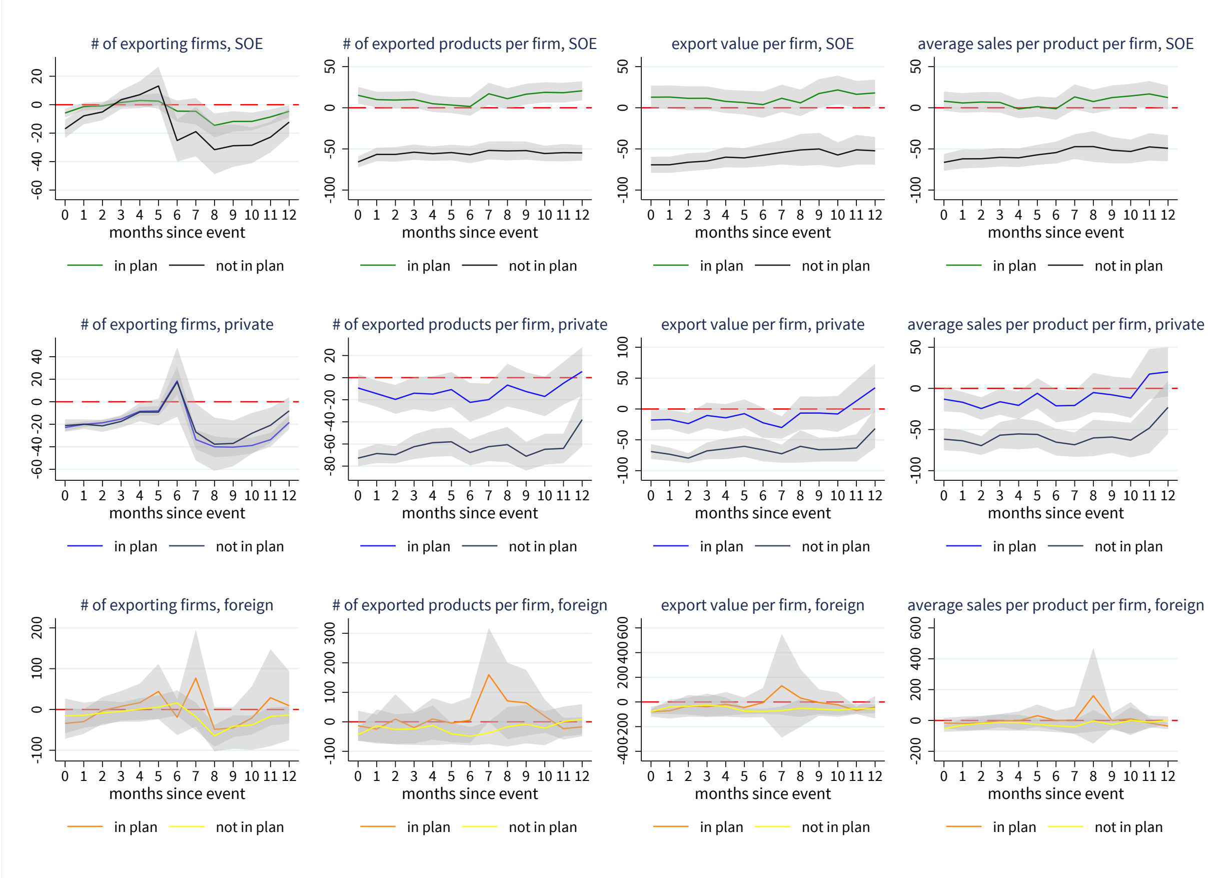
Note: The figure shows the effects of large scale flooding on firms exporting products covered by the 5-year plans of the Chinese Communist Party. Full results are shown in Table A6 in the Appendix.

4 Conclusion

With extreme weather events becoming more and more frequent in an era of climate change, understanding their impacts on firms and trade becomes ever more important. In this paper, we use a panel of monthly Chinese manufacturing export data merged with geo-information on flood events to document the short-term effects of floods on firm export performance at the plant-level. We show that floods reduce the number of exporting plants in affected areas, the number of products exported per plant, export value as well as average sales per product. Except for the number of exports, most effects are, however, short-lived.

Aggregate effects are driven by production facilities, as wholesalers are barely affected. This indicates that effects are driven by the destruction of capital, reducing firms' production capabilities. If the reduction in exports was caused by the destruction of infrastructure, one would expect wholesalers to be equally affected. For production facilities, negative effects persist for several months.

Figure 7: Percentage Changes by Five-Year Plan and Firm-Type



Note: The figure shows the effects of large scale flooding on various types of firms split by whether the plants export products covered by the 5-year plans of the Chinese Communist Party. Full results are shown in Table A7 in the Appendix.

Private firms are more strongly affected than SOEs. Within both ownership types, production facilities suffer more than wholesalers, with SOE wholesalers not being affected at all. Firms that produce products covered by the Chinese government's five-year plan suffer less from floods, with SOEs producing covered products not being affected at all. This suggests that being covered by the five-year plan gives firms better access to resources, allowing them to recover faster.

Overall, we have demonstrated that flood events strongly affect plant export performance in the short-run, indicating that studies using annual data underestimate the impact of natural disasters. Firm responses are extremely heterogeneous across different ownership types and also depend on whether products are covered by the five-year plan. This suggests that - at least in China - being closely associated with the state gives firms a competitive edge in the aftermath of extreme weather events.

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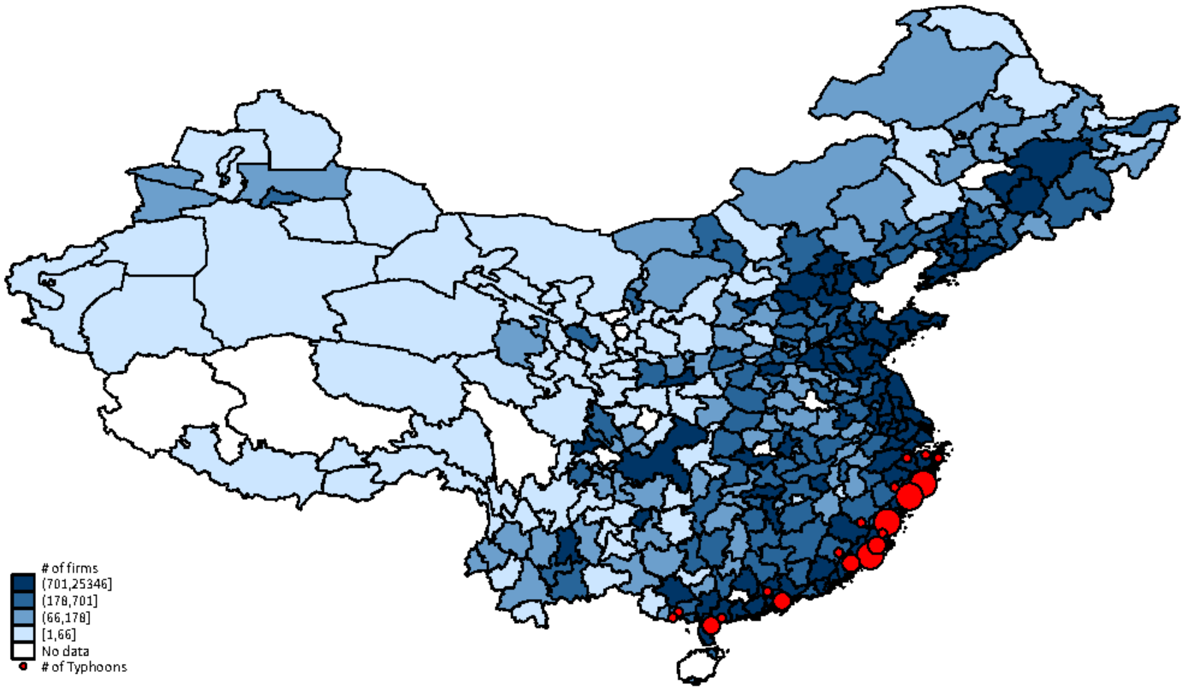
Appendix

Figure A1: Number of Plants and Typhoon Occurrence, 2000 - 2006



Note: Raw data from International Best Track Archive for Climate Stewardship (IBTrACS) v03r07. Wind field model and mapping by Gridded GAME database of Felbermayr et al. (2022).

Figure A2: Percentage Changes by 5-year plan on agents

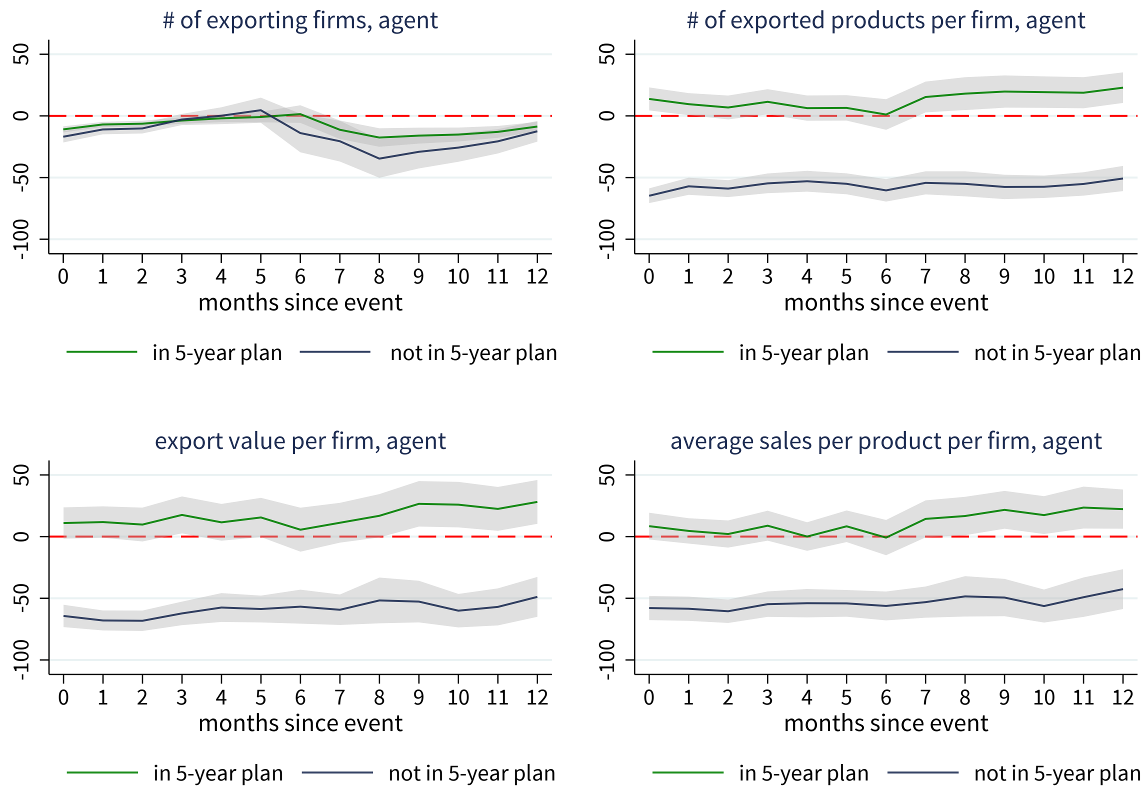


Figure A3: Percentage Changes by 5-year plan on production facilities

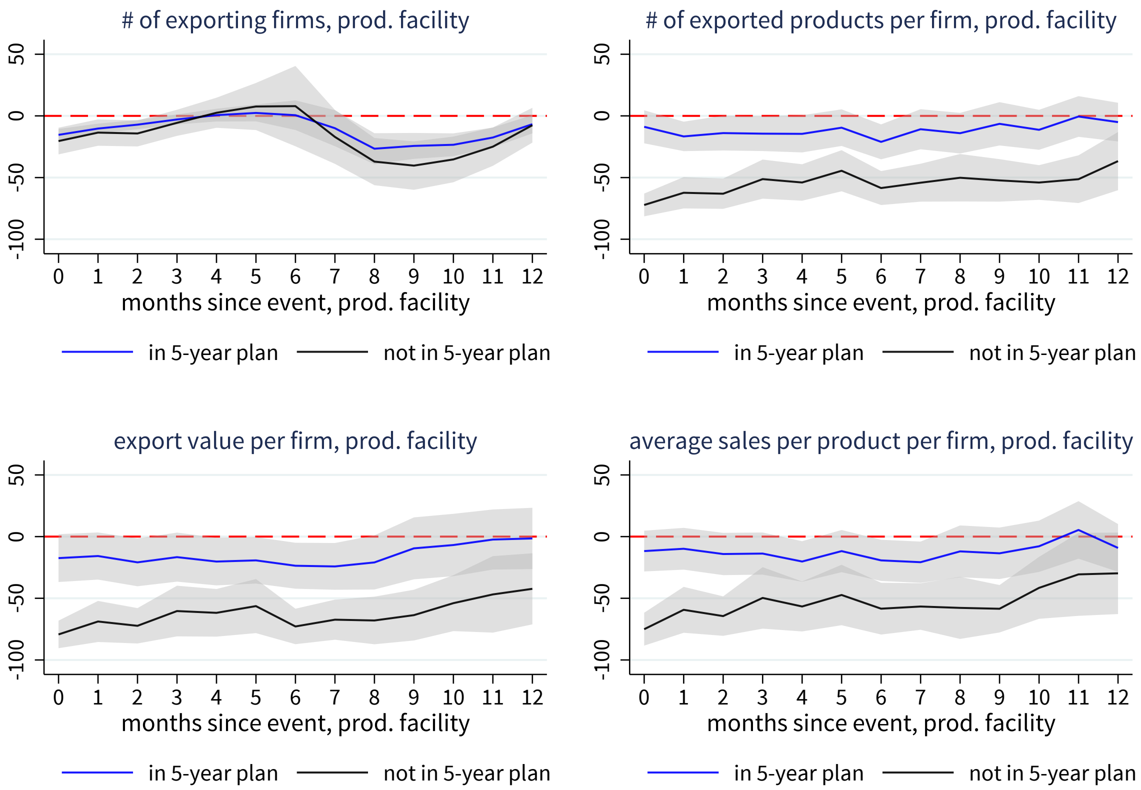


Table A1: Summary Statistics

Variable	Obs	Mean	Std. dev.	Min	Max
year	8,249,391	2003.77	1.91	2000	2006
month	8,249,391	6.77	3.42	1	12
firm type	8,249,391	3.67	1.91	1	9
agent	6,720,306	0.39	0.49	0	1
five-year plan 96-00	8,249,391	0.60	0.49	0	1
five-year plan 01-05	8,249,391	0.78	0.42	0	1
five-year plan 06-10	8,249,391	0.64	0.48	0	1
flood event	8,249,391	0.01	0.11	0	1
wind event	8,249,391	0	0.04	0	1
mean precipitation	8,249,391	64.24	108.7	0	835.3
mean temperature	8,249,391	10.28	11.24	-28.99	36.13
ln # of plants in provincial county	8,249,391	8.45	1.81	0	12.17
ln # of exported products per plant	8,249,391	1.07	1.11	0	9.11
ln export volume per plant	8,249,391	10.95	1.93	0	21.85
ln average sales per product per plant	8,249,391	11.24	1.92	0	21.85
# of plants in provincial county	8,249,391	15,569.69	27,006.62	1	192,172
# of exported products per plant	8,249,391	7.5	41.22	1	9,056
export volume per plant	8,249,391	431,289.1	574,5770	1	3.09E+09
average sales per plant	8,249,391	523,680.5	600,2522	1	3.09E+09

Table A2: Effect of Floods on Plant-level Trade, Monthly (2000 - 2006)

Dep. Var.:	**# of firms**			**# of products per firm**		
	(1)	(2)	(3)	(4)	(5)	(6)
Flood, cat. >1.5	−0.3464***	−0.3221***	−0.1352***	−0.0732	−0.0634	−0.0571*
	(0.04)	(0.04)	(0.01)	(0.04)	(0.04)	(0.03)
t-1	−0.3819***	−0.3523***	−0.0846***	−0.0853*	−0.0771*	−0.0687**
	(0.04)	(0.04)	(0.01)	(0.04)	(0.04)	(0.03)
t-2	−0.4372***	−0.4144***	−0.0724***	−0.1110**	−0.0927*	−0.0826**
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.04)
t-3	−0.4462***	−0.4109***	−0.0361***	−0.0732	−0.0319	−0.0427
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.04)
t-4	−0.4594***	−0.4194***	−0.0109	−0.0921*	−0.0497	−0.0703*
	(0.05)	(0.05)	(0.01)	(0.05)	(0.05)	(0.04)
t-5	−0.4326***	−0.3910***	0.0036	−0.0504	−0.0147	−0.0654
	(0.05)	(0.05)	(0.02)	(0.05)	(0.05)	(0.04)
t-6	−0.4797***	−0.4537***	0.0024	−0.0463	−0.02	−0.1426***
	(0.05)	(0.05)	(0.03)	(0.05)	(0.05)	(0.05)
t-7	−0.4517***	−0.4093***	−0.1260***	−0.0317	−0.0038	−0.0071
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.04)
t-8	−0.3663***	−0.3439***	−0.2406***	−0.0011	0.0098	0.0081
	(0.05)	(0.05)	(0.04)	(0.05)	(0.05)	(0.05)
t-9	−0.3877***	−0.3749***	−0.2172***	−0.0046	0.0205	0.0315
	(0.05)	(0.05)	(0.03)	(0.06)	(0.06)	(0.05)
t-10	−0.3689***	−0.3599***	−0.2017***	0.008	0.0236	0.0215
	(0.05)	(0.05)	(0.03)	(0.06)	(0.06)	(0.04)
t-11	−0.3315***	−0.3383***	−0.1604***	0.0321	0.0359	0.0435
	(0.05)	(0.05)	(0.02)	(0.06)	(0.06)	(0.04)
t-12	−0.2712***	−0.2726***	−0.0886***	0.0565	0.0541	0.0565
	(0.05)	(0.05)	(0.02)	(0.05)	(0.05)	(0.04)
Fixed Effects	yes	yes	yes	yes	yes	yes
Regional Seasonality			yes			yes
Climate Controls		yes	yes		yes	yes
R^2	0.642	0.665	0.926	0.355	0.381	0.541
Observations	213,902	213,902	213,887	213,902	213,902	213,887
Dep. Var.:	**export value per firm**			**average sales per product per firm**		
	(7)	(8)	(9)	(10)	(11)	(12)
Flood, cat. >1.5	−0.1665***	−0.1334**	−0.1017**	−0.0977*	−0.0797	−0.0829*
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)
t-1	−0.1608***	−0.1253**	−0.0814*	−0.0990**	−0.0809*	−0.0845**
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.04)
t-2	−0.2095***	−0.1691***	−0.1100**	−0.1285**	−0.1055*	−0.1186**
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
t-3	−0.1306**	−0.0813	−0.0319	−0.0637	−0.031	−0.0559
	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)
t-4	−0.1634***	−0.1161*	−0.0663	−0.1341**	−0.0999*	−0.1299***
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
t-5	−0.1135*	−0.0716	−0.0493	−0.0354	−0.0052	−0.0584
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.05)
t-6	−0.1723**	−0.1412**	−0.1280*	−0.0998*	−0.0711	−0.1428**
	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
t-7	−0.1494**	−0.1222*	−0.0861	−0.0731	−0.0493	−0.0387
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)
t-8	−0.0543	−0.0455	−0.0244	−0.0051	0.0068	0.0096
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
t-9	0.0041	0.026	0.0639	0.0076	0.0237	0.0352
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)
t-10	0.0191	0.0333	0.0654	0.0179	0.0273	0.0265
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)
t-11	0.0202	0.0149	0.0597	0.0964	0.0982	0.1001*
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)
t-12	0.0572	0.0457	0.0919	0.067	0.0634	0.0575
	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)	(0.05)
Fixed Effects	yes	yes	yes	yes	yes	yes
Regional Seasonality			yes			yes
Climate Controls		yes	yes		yes	yes
R^2	0.411	0.430	0.515	0.580	0.593	0.649
Observations	213,902	213,902	213,887	213,902	213,902	213,887

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and firm type, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale.

Table A3: Agents versus Production Facilities, Monthly (2000 - 2006)

Dep. Var.:	**# of firms**		**# of products per firm**		**export value per firm**		**average sales per product per firm**	
	agent	prod. facility	agent	prod. facility	agent	prod. facility	agent	prod. facility
Flood, cat. >1.5	−0.1235***	−0.1736***	−0.0063	−0.2243***	−0.0277	−0.3443***	−0.0285	−0.2629***
	(0.01)	(0.03)	(0.04)	−0.08	(0.06)	(0.12)	(0.05)	(0.10)
t-1	−0.0762***	−0.1114***	−0.0075	−0.2677***	−0.0197	−0.2789**	−0.0519	−0.1894**
	(0.01)	(0.02)	(0.04)	(0.07)	(0.06)	(0.12)	(0.05)	(0.09)
t-2	−0.0690***	−0.0829***	−0.0289	−0.2500***	−0.0307	−0.3577***	−0.0741	−0.2565**
	(0.01)	(0.02)	(0.05)	(0.08)	(0.06)	(0.13)	(0.06)	(0.10)
t-3	−0.0377***	−0.032	0.0169	−0.2225***	0.0481	−0.2716**	−0.0037	−0.2124**
	(0.01)	(0.02)	(0.05)	(0.08)	(0.06)	(0.12)	(0.06)	(0.10)
t-4	−0.0173	0.0081	−0.0145	−0.2339***	0.0192	−0.3159***	−0.0718	−0.3006***
	(0.02)	(0.03)	(0.05)	(0.09)	(0.07)	(0.11)	(0.06)	(0.10)
t-5	−0.0048	0.0289	−0.0329	−0.1575*	0.0317	−0.2864**	−0.014	−0.1867**
	(0.02)	(0.03)	(0.05)	(0.08)	(0.07)	(0.11)	(0.06)	(0.09)
t-6	−0.0013	0.0125	−0.0818	−0.3214***	−0.0346	−0.4030***	−0.0894	−0.3009***
	(0.04)	(0.06)	(0.06)	(0.09)	(0.08)	(0.11)	(0.07)	(0.10)
t-7	−0.1293***	−0.1148	0.0542	−0.1903**	0.0099	−0.3728***	0.0487	−0.3008***
	(0.04)	(0.08)	(0.05)	(0.09)	(0.07)	(0.11)	(0.07)	(0.10)
t-8	−0.2130***	−0.3235***	0.08	−0.2069**	0.0768	−0.3261**	0.0815	−0.2019*
	(0.05)	(0.08)	(0.06)	(0.09)	(0.07)	(0.14)	(0.07)	(0.12)
t-9	−0.1896***	−0.2992***	0.0843	−0.1297	0.1449**	−0.1855	0.1156*	−0.2130*
	(0.04)	(0.07)	(0.05)	(0.09)	(0.07)	(0.14)	(0.06)	(0.12)
t-10	−0.1748***	−0.2819***	0.0900*	−0.1849**	0.1337*	−0.1405	0.0774	−0.1269
	(0.03)	(0.06)	(0.05)	(0.09)	(0.07)	(0.13)	(0.07)	(0.11)
t-11	−0.1471***	−0.2012***	0.0856	−0.0782	0.1103	−0.0892	0.1329*	0.0057
	(0.03)	(0.05)	(0.05)	(0.09)	(0.07)	(0.13)	(0.07)	(0.11)
t-12	−0.0950***	−0.0712*	0.1082**	−0.1007	0.1477**	−0.0799	0.1194*	−0.1317
	(0.02)	(0.04)	(0.05)	(0.08)	(0.07)	(0.13)	(0.06)	(0.11)
R^2	0.926		0.541		0.515		0.649	
Observations	213,887		213,887		213,887		213,887	

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and firm type, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale.

Table A4: Firm Types, Monthly (2000 - 2006)

Dep. Var.:	**# of firms**			**# of products per firm**		
	SOE	Foreign	Private	SOE	Foreign	Private
Flood, cat. >1.5	−0.0710***	−0.3094	−0.2552***	0.0322	−0.3270**	−0.2539***
	(0.02)	(0.21)	(0.02)	(0.04)	(0.16)	(0.07)
t-1	−0.0187	−0.2367	−0.2224***	0.0167	−0.1782	−0.2758***
	(0.01)	(0.15)	(0.02)	(0.04)	(0.24)	(0.07)
t-2	−0.0124	−0.0591	−0.2109***	0.0136	−0.0685	−0.3491***
	(0.01)	(0.14)	(0.02)	(0.05)	(0.30)	(0.08)
t-3	0.0167	0.0242	−0.1702***	0.0241	−0.206	−0.2708***
	(0.01)	(0.13)	(0.02)	(0.05)	(0.28)	(0.09)
t-4	0.0323*	0.0747	−0.0892***	−0.0195	0.0301	−0.2611***
	(0.02)	(0.14)	(0.02)	(0.05)	(0.31)	(0.09)
t-5	0.0321	0.2578	−0.0861***	−0.0375	−0.1933	−0.2371***
	(0.03)	(0.17)	(0.02)	(0.05)	(0.29)	(0.09)
t-6	−0.0663*	−0.0733	0.1690***	−0.0573	−0.3006	−0.3802***
	(0.04)	(0.18)	(0.06)	(0.06)	(0.32)	(0.11)
t-7	−0.0594	0.2769	−0.3952***	0.0886	0.3691	−0.3302***
	(0.05)	(0.26)	(0.07)	(0.06)	(0.32)	(0.09)
t-8	−0.1732***	−0.7873**	−0.5053***	0.0445	0.2698	−0.1890*
	(0.05)	(0.39)	(0.08)	(0.06)	(0.32)	(0.10)
t-9	−0.1413***	−0.5969*	−0.5084***	0.0833	0.2995	−0.2730***
	(0.04)	(0.34)	(0.07)	(0.05)	(0.29)	(0.10)
t-10	−0.1397***	−0.3036	−0.4698***	0.1025**	0.0648	−0.2989***
	(0.04)	(0.40)	(0.06)	(0.05)	(0.23)	(0.11)
t-11	−0.1030***	0.1022	−0.3899***	0.0941*	−0.1801	−0.156
	(0.03)	(0.33)	(0.05)	(0.05)	(0.18)	(0.10)
t-12	−0.0547**	0.0043	−0.1887***	0.1022**	−0.0765	−0.016
	(0.02)	(0.25)	(0.04)	(0.05)	(0.16)	(0.10)
R^2		0.926			0.541	
Observations		213,887			213,887	
	export value per firm			**average sales per product per firm**		
	SOE	Foreign	Private	SOE	Foreign	Private
Flood, cat. >1.5	0.0028	−1.5473***	−0.3294***	−0.0283	−0.4356***	−0.2485***
	(0.06)	(0.58)	(0.10)	(0.06)	(0.17)	(0.09)
t-1	0.0131	−0.8034	−0.3229***	−0.029	−0.2675	−0.2815***
	(0.06)	(0.59)	(0.10)	(0.06)	(0.21)	(0.08)
t-2	0.0113	−0.3621	−0.4458***	−0.0172	−0.1535	−0.4009***
	(0.07)	(0.49)	(0.11)	(0.06)	(0.22)	(0.09)
t-3	0.0142	−0.3565	−0.2554**	−0.0183	−0.0249	−0.2715***
	(0.07)	(0.55)	(0.12)	(0.06)	(0.21)	(0.09)
t-4	−0.0028	−0.2767	−0.2742**	−0.0853	−0.0523	−0.3111***
	(0.07)	(0.52)	(0.13)	(0.06)	(0.26)	(0.11)
t-5	−0.0245	−0.8519	−0.2169*	−0.0592	0.0578	−0.1820*
	(0.07)	(0.59)	(0.12)	(0.06)	(0.23)	(0.10)
t-6	−0.0374	−0.7091	−0.3768**	−0.0769	−0.1979	−0.3544***
	(0.08)	(0.47)	(0.16)	(0.07)	(0.27)	(0.13)
t-7	0.0399	−0.0139	−0.4922***	0.065	−0.1868	−0.3630***
	(0.07)	(0.70)	(0.13)	(0.07)	(0.37)	(0.11)
t-8	0.0026	−0.0875	−0.1895	0.0223	0.6182	−0.1716
	(0.08)	(0.70)	(0.14)	(0.07)	(0.47)	(0.12)
t-9	0.0931	−0.3297	−0.1959	0.0509	−0.1348	−0.1838
	(0.07)	(0.46)	(0.14)	(0.07)	(0.19)	(0.12)
t-10	0.1207*	−0.471	−0.2123	0.0711	0.09	−0.2393*
	(0.07)	(0.57)	(0.15)	(0.06)	(0.41)	(0.13)
t-11	0.0839	−1.0230***	−0.0004	0.0931	−0.1765	0.0714
	(0.07)	(0.39)	(0.15)	(0.07)	(0.13)	(0.13)
t-12	0.0854	−0.6438	0.2101	0.0459	−0.2632***	0.1257
	(0.07)	(0.53)	(0.14)	(0.07)	(0.10)	(0.12)
R^2		0.515			0.649	
Observations		213,887			213,887	

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and firm type, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale.

Table A5: Firm Types: Agents versus Production Facilities, Monthly (2000 - 2006)

Dep. Var.:	**# of firms**						**# of products per firm**					
	SOE		Foreign		Private		SOE		Foreign		Private	
	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.
Flood, cat. >1.5	−0.0636***	−0.0934***	−0.2450***	−0.3277	−0.2212***	−0.3466***	0.0814	−0.1384	−1.1622***	−0.2778	−0.2078***	−0.4439***
	(0.02)	(0.04)	(0.03)	(0.26)	(0.02)	(0.04)	(0.05)	(0.11)	(0.13)	(0.20)	(0.08)	(0.13)
t-1	−0.0126	−0.0381	−0.1981***	−0.2599	−0.2040***	−0.2693***	0.0856*	−0.2348**	−1.1798***	−0.0521	−0.2413***	−0.4296***
	(0.01)	(0.03)	(0.03)	(0.18)	(0.02)	(0.03)	(0.05)	(0.11)	(0.16)	(0.27)	(0.08)	(0.12)
t-2	−0.0115	−0.013	−0.0991***	−0.0466	−0.1979***	−0.2357***	0.0738	−0.2072	−1.4817***	0.1228	−0.3238***	−0.4372***
	(0.02)	(0.02)	(0.02)	(0.16)	(0.02)	(0.03)	(0.06)	(0.13)	(0.16)	(0.32)	(0.10)	(0.12)
t-3	0.0102	0.0415	−0.1159***	0.0381	−0.1600***	−0.1930***	0.1038*	−0.2644**	−1.6281***	−0.0017	−0.2683***	−0.2873**
	(0.02)	(0.03)	(0.02)	(0.15)	(0.02)	(0.04)	(0.06)	(0.12)	(0.16)	(0.28)	(0.10)	(0.14)
t-4	0.0224	0.0668*	0.0748***	0.0994	−0.0712***	−0.1273***	0.0552	−0.2750**	−1.5379***	0.2388	−0.2561**	−0.2873*
	(0.02)	(0.03)	(0.02)	(0.17)	(0.03)	(0.04)	(0.06)	(0.13)	(0.21)	(0.30)	(0.11)	(0.15)
t-5	0.014	0.0907*	−0.1070***	0.2906	−0.0755***	−0.1258**	0.0069	−0.1887*	−1.5176***	−0.0697	−0.2418**	−0.2296*
	(0.03)	(0.05)	(0.01)	(0.21)	(0.03)	(0.05)	(0.06)	(0.11)	(0.17)	(0.31)	(0.10)	(0.13)
t-6	−0.0805*	−0.0153	0.4028***	−0.1164	0.2201***	0.0318	0.0201	−0.3158**	−1.4669***	−0.0488	−0.3727***	−0.4366***
	(0.04)	(0.09)	(0.03)	(0.22)	(0.07)	(0.09)	(0.07)	(0.12)	(0.30)	(0.31)	(0.13)	(0.15)
t-7	−0.0415	−0.1225	−0.4933***	0.3251	−0.4262***	−0.3212***	0.1620**	−0.1679	−1.4615***	0.6096**	−0.3063***	−0.4066***
	(0.05)	(0.12)	(0.01)	(0.29)	(0.08)	(0.11)	(0.07)	(0.12)	(0.08)	(0.30)	(0.11)	(0.15)
t-8	−0.1461***	−0.2657**	−0.5463***	−0.8399*	−0.5130***	−0.4846***	0.1049	−0.161	−1.0022*	0.5247	−0.1003	−0.4288**
	(0.06)	(0.11)	(0.10)	(0.47)	(0.10)	(0.12)	(0.07)	(0.12)	(0.53)	(0.33)	(0.12)	(0.18)
t-9	−0.1057**	−0.2571***	−0.4149***	−0.6505	−0.5193***	−0.4813***	0.1481**	−0.1329	−0.3561	0.5329*	−0.2237*	−0.4280***
	(0.05)	(0.09)	(0.10)	(0.43)	(0.08)	(0.11)	(0.06)	(0.12)	(0.53)	(0.31)	(0.12)	(0.16)
t-10	−0.1033**	−0.2597***	−0.5848***	−0.2739	−0.4805***	−0.4434***	0.1788***	−0.1516	−1.5347***	0.2444	−0.2593**	−0.4228**
	(0.04)	(0.08)	(0.01)	(0.44)	(0.07)	(0.11)	(0.06)	(0.11)	(0.09)	(0.20)	(0.13)	(0.18)
t-11	−0.0750**	−0.1925***	−0.0028	0.1185	−0.4144***	−0.3468***	0.1486**	−0.0689	0.4018**	−0.2003	−0.1379	−0.2351
	(0.03)	(0.06)	(0.11)	(0.41)	(0.06)	(0.09)	(0.06)	(0.11)	(0.17)	(0.20)	(0.12)	(0.17)
t-12	−0.0506**	−0.0667	0.0903	−0.0297	−0.2182***	−0.1432*	0.1460**	−0.0219	0.6167	−0.0027	0.0605	−0.2718*
	(0.03)	(0.05)	(0.11)	(0.30)	(0.04)	(0.07)	(0.06)	(0.11)	(0.41)	(0.19)	(0.12)	(0.16)
R^2	0.926						0.541					
Observations	213,887						213,887					

Dep. Var.:	**export value per firm**						average sales per product per firm					
	SOE		Foreign		Private		SOE		Foreign		Private	
	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.	agent	prod. fac.
Flood, cat. >1.5	0.0639	−0.2141	−2.2938***	−1.6149**	−0.3016**	−0.4450**	0.0397	−0.2665*	−1.0975***	−0.3865*	−0.2458**	−0.2950*
	(0.07)	(0.17)	(0.15)	(0.71)	(0.12)	(0.21)	(0.06)	(0.14)	(0.16)	(0.20)	(0.10)	(0.17)
t-1	0.0626	−0.1602	−2.0181***	−0.6954	−0.2953***	−0.4407**	0.0132	−0.1752	−1.3696***	−0.1184	−0.2948***	−0.2754*
	(0.07)	(0.16)	(0.16)	(0.71)	(0.11)	(0.19)	(0.06)	(0.14)	(0.18)	(0.22)	(0.09)	(0.16)
t-2	0.0887	−0.2763	−1.7878***	−0.1675	−0.4038***	−0.5844***	0.0251	−0.1757	−1.1663***	−0.0057	−0.3943***	−0.4265***
	(0.08)	(0.19)	(0.21)	(0.54)	(0.13)	(0.19)	(0.07)	(0.15)	(0.16)	(0.23)	(0.11)	(0.16)
t-3	0.0891	−0.2537	−2.0478***	−0.1121	−0.2063	−0.4037**	0.0375	−0.2185	−1.2015***	0.1321	−0.2416**	−0.3689**
	(0.08)	(0.16)	(0.21)	(0.60)	(0.13)	(0.20)	(0.07)	(0.14)	(0.16)	(0.20)	(0.11)	(0.16)
t-4	0.0797	−0.2847*	−1.9199***	−0.0483	−0.2322	−0.4119*	−0.0283	−0.2796**	−0.9472***	0.0573	−0.2773**	−0.4416***
	(0.08)	(0.16)	(0.29)	(0.56)	(0.15)	(0.21)	(0.07)	(0.14)	(0.21)	(0.28)	(0.13)	(0.17)
t-5	0.0404	−0.2428*	−2.3180***	−0.7289	−0.1741	−0.3452*	−0.0228	−0.1814	−0.9591***	0.1575	−0.1484	−0.2690*
	(0.08)	(0.15)	(0.23)	(0.66)	(0.14)	(0.20)	(0.07)	(0.13)	(0.17)	(0.24)	(0.12)	(0.15)
t-6	0.0581	−0.3501**	−1.7925***	−0.4609	−0.3378*	−0.5340**	−0.0045	−0.3160**	−0.8256***	−0.0499	−0.3719**	−0.3445*
	(0.09)	(0.16)	(0.40)	(0.53)	(0.18)	(0.24)	(0.08)	(0.14)	(0.30)	(0.30)	(0.15)	(0.19)
t-7	0.1344	−0.2882*	−2.1243***	0.2481	−0.4284***	−0.6710***	0.1375*	−0.1867	−1.4123***	−0.0459	−0.2673**	−0.6118***
	(0.08)	(0.16)	(0.10)	(0.76)	(0.15)	(0.21)	(0.08)	(0.14)	(0.08)	(0.40)	(0.13)	(0.18)
t-8	0.0845	−0.2766	−1.4993*	0.1259	−0.0712	−0.5058**	0.0746	−0.1511	−0.8828**	0.8733*	−0.041	−0.5156**
	(0.09)	(0.18)	(0.82)	(0.79)	(0.17)	(0.24)	(0.08)	(0.15)	(0.43)	(0.51)	(0.15)	(0.20)
t-9	0.1791**	−0.1971	−0.1949	−0.2244	−0.1247	−0.4194*	0.1427**	−0.2613*	−0.3435	0.0387	−0.107	−0.4200**
	(0.08)	(0.18)	(0.82)	(0.55)	(0.16)	(0.23)	(0.07)	(0.15)	(0.43)	(0.22)	(0.14)	(0.21)
t-10	0.1872**	−0.0979	−1.9430***	−0.3051	−0.1467	−0.4095	0.1440*	−0.1689	−1.4516***	0.2626	−0.2203	−0.3085
	(0.08)	(0.17)	(0.12)	(0.61)	(0.18)	(0.27)	(0.07)	(0.14)	(0.09)	(0.43)	(0.16)	(0.23)
t-11	0.1409*	−0.0886	0.1107**	−1.1759**	−0.0074	−0.0106	0.1453*	−0.0586	−0.1498*	−0.087	0.0445	0.1333
	(0.08)	(0.16)	(0.04)	(0.47)	(0.17)	(0.26)	(0.08)	(0.14)	(0.08)	(0.13)	(0.15)	(0.22)
t-12	0.1255	−0.0291	0.9355***	−0.7564	0.2856*	−0.0361	0.0991	−0.1131	0.6809	−0.2613**	0.2387	−0.1813
	(0.08)	(0.16)	(0.14)	(0.64)	(0.17)	(0.24)	(0.08)	(0.14)	(0.52)	(0.12)	(0.15)	(0.17)
R^2	0.516						0.650					
Observations	213,887						213,887					

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and firm type, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale.

Table A6: Five-Year Plans, Monthly (2000 - 2006)

Dep. Var.:	**# of firms**		**# of products per firm**		**export value per firm**		average sales per product per firm	
	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan
Flood, cat. >1.5	−0.1277***	−0.1953***	0.0773**	−1.0998***	0.0342	−1.1521***	0.0322	−0.9771***
	(0.01)	(0.03)	(0.04)	(0.08)	(0.05)	(0.12)	(0.04)	(0.11)
t-1	−0.0803***	−0.1234***	0.0277	−0.8871***	0.0456	−1.1604***	0.0102	−0.8929***
	(0.01)	(0.02)	(0.03)	(0.07)	(0.05)	(0.12)	(0.04)	(0.11)
t-2	−0.0676***	−0.1172***	0.0146	−0.9237***	0.0153	−1.1923***	−0.021	−0.9607***
	(0.01)	(0.02)	(0.04)	(0.08)	(0.05)	(0.12)	(0.05)	(0.11)
t-3	−0.0359***	−0.0345	0.046	−0.7915***	0.0799	−0.9862***	0.0299	−0.7854***
	(0.01)	(0.02)	(0.04)	(0.08)	(0.05)	(0.12)	(0.05)	(0.11)
t-4	−0.013	0.0067	0.0084	−0.7738***	0.0271	−0.8978***	−0.0543	−0.8032***
	(0.01)	(0.03)	(0.04)	(0.08)	(0.06)	(0.12)	(0.05)	(0.11)
t-5	−0.0009	0.0506	0.0237	−0.7694***	0.0567	−0.8929***	0.0304	−0.7657***
	(0.02)	(0.04)	(0.04)	(0.08)	(0.06)	(0.12)	(0.05)	(0.11)
t-6	0.0142	−0.0944	−0.0486	−0.9265***	−0.0272	−0.9674***	−0.0581	−0.8481***
	(0.03)	(0.08)	(0.05)	(0.10)	(0.07)	(0.14)	(0.06)	(0.12)
t-7	−0.1159***	−0.2178**	0.0805*	−0.7947***	0.0123	−0.9699***	0.0452	−0.7923***
	(0.04)	(0.09)	(0.05)	(0.09)	(0.06)	(0.13)	(0.06)	(0.12)
t-8	−0.2214***	−0.4364***	0.0891*	−0.7862***	0.0587	−0.8345***	0.0841	−0.7176***
	(0.04)	(0.10)	(0.05)	(0.10)	(0.07)	(0.17)	(0.06)	(0.14)
t-9	−0.2006***	−0.3861***	0.1200***	−0.8367***	0.1535**	−0.8141***	0.1132**	−0.7324***
	(0.03)	(0.08)	(0.05)	(0.10)	(0.06)	(0.16)	(0.06)	(0.13)
t-10	−0.1897***	−0.3326***	0.1043**	−0.8434***	0.1574**	−0.8909***	0.1026*	−0.7649***
	(0.03)	(0.07)	(0.05)	(0.09)	(0.06)	(0.15)	(0.06)	(0.13)
t-11	−0.1518***	−0.2454***	0.1275***	−0.7873***	0.1463**	−0.7975***	0.1717***	−0.6047***
	(0.02)	(0.05)	(0.04)	(0.09)	(0.06)	(0.15)	(0.06)	(0.14)
t-12	−0.0846***	−0.1192***	0.1433***	−0.6504***	0.1839***	−0.6440***	0.1288**	−0.5098***
	(0.02)	(0.04)	(0.04)	(0.09)	(0.06)	(0.14)	(0.05)	(0.12)
R^2	0.926		0.545		0.518		0.651	
Observations	213,887		213,887		213,887		213,887	

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and firm type, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale.

Table A7: Five-Year Plans: Firm Types, Monthly (2000 - 2006)

Dep. Var.:	**# of firms**						**# of products per firm**					
	SOE		Foreign		Private		SOE		Foreign		Private	
	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan
Flood, cat. >1.5	−0.0598***	−0.1856***	−0.4161	−0.1697	−0.2592***	−0.2380***	0.1417***	−1.0734***	−0.1435	−0.5697***	−0.098	−1.3018***
	(0.02)	(0.04)	(0.29)	(0.26)	(0.02)	(0.04)	(0.05)	(0.10)	(0.30)	(0.19)	(0.07)	(0.14)
t-1	−0.0132	−0.0813**	−0.3539	−0.1529	−0.2239***	−0.2220***	0.0944**	−0.8362***	−0.2826	−0.1485	−0.1564**	−1.1586***
	(0.01)	(0.03)	(0.22)	(0.18)	(0.02)	(0.03)	(0.04)	(0.10)	(0.33)	(0.33)	(0.07)	(0.14)
t-2	−0.0086	−0.0520*	−0.0248	−0.0907	−0.2068***	−0.2408***	0.0902*	−0.8367***	0.0885	−0.295	−0.2188***	−1.1943***
	(0.01)	(0.03)	(0.17)	(0.17)	(0.02)	(0.03)	(0.05)	(0.11)	(0.39)	(0.35)	(0.08)	(0.13)
t-3	0.0159	0.0346	0.073	−0.0479	−0.1671***	−0.1918***	0.0968**	−0.7755***	−0.2172	−0.2765	−0.1515*	−0.9797***
	(0.02)	(0.03)	(0.18)	(0.12)	(0.02)	(0.03)	(0.05)	(0.10)	(0.34)	(0.36)	(0.09)	(0.15)
t-4	0.0295	0.0682	0.1547	0.0114	−0.0886***	−0.0962**	0.0478	−0.8163***	0.0927	−0.126	−0.1609*	−0.8878***
	(0.02)	(0.05)	(0.20)	(0.13)	(0.02)	(0.05)	(0.05)	(0.10)	(0.33)	(0.39)	(0.10)	(0.16)
t-5	0.0251	0.1235**	0.3652	0.0553	−0.0844***	−0.0961	0.0327	−0.7853***	−0.0444	−0.5171*	−0.1141	−0.8678***
	(0.03)	(0.06)	(0.24)	(0.14)	(0.02)	(0.07)	(0.05)	(0.11)	(0.34)	(0.30)	(0.09)	(0.16)
t-6	−0.0461	−0.2900***	−0.2112	0.1483	0.1703***	0.162	0.0152	−0.8448***	0.0516	−0.6673**	−0.2528**	−1.1288***
	(0.04)	(0.10)	(0.28)	(0.14)	(0.05)	(0.13)	(0.06)	(0.12)	(0.38)	(0.31)	(0.12)	(0.19)
t-7	−0.0473	−0.2094*	0.5703*	−0.1921	−0.4087***	−0.3133*	0.1574***	−0.7306***	0.9541***	−0.4702	−0.2207**	−0.9774***
	(0.05)	(0.11)	(0.34)	(0.21)	(0.07)	(0.18)	(0.06)	(0.12)	(0.31)	(0.31)	(0.09)	(0.18)
t-8	−0.1572***	−0.3802***	−0.6654	−1.0417***	−0.5109***	−0.4726**	0.1050*	−0.7428***	0.5344	−0.1838	−0.0695	−0.9313***
	(0.05)	(0.13)	(0.54)	(0.38)	(0.08)	(0.19)	(0.06)	(0.12)	(0.39)	(0.41)	(0.11)	(0.21)
t-9	−0.1249***	−0.3399***	−0.6023	−0.5279**	−0.5162***	−0.4619***	0.1530***	−0.7342***	0.4975	−0.0824	−0.134	−1.2407***
	(0.04)	(0.11)	(0.48)	(0.23)	(0.07)	(0.16)	(0.06)	(0.12)	(0.35)	(0.36)	(0.10)	(0.23)
t-10	−0.1251***	−0.3352***	−0.2367	−0.4785**	−0.4915***	−0.3290**	0.1723***	−0.8112***	0.1739	−0.2404	−0.1863*	−1.0435***
	(0.04)	(0.09)	(0.50)	(0.19)	(0.06)	(0.13)	(0.05)	(0.11)	(0.24)	(0.37)	(0.11)	(0.20)
t-11	−0.0900***	−0.2586***	0.2535	−0.1891	−0.4109***	−0.2340**	0.1683***	−0.7882***	−0.2644	0.0101	−0.052	−1.0216***
	(0.03)	(0.07)	(0.47)	(0.13)	(0.05)	(0.10)	(0.05)	(0.12)	(0.25)	(0.26)	(0.10)	(0.19
t-12	−0.0477**	−0.1303**	0.0884	−0.1447	−0.2026***	−0.084	0.1875***	−0.7935***	−0.1846	0.0816	0.0539	−0.4777**
	(0.02)	(0.06)	(0.40)	(0.12)	(0.04)	(0.07)	(0.05)	(0.11)	(0.20)	(0.24)	(0.11)	(0.20)
R^2	0.926						0.545					
Observations	213,887						213,887					

Dep. Var.:	**export value per firm**						average sales per product per firm					
	SOE		Foreign		Private		SOE		Foreign		Private	
	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan	5-year plan	not in 5-year plan
Flood, cat. >1.5	0.1210*	−1.1817***	−1.5797	−1.5430***	−0.1972*	−1.1706***	0.0775	−1.0894***	−0.1799	−0.7279***	−0.1401	−0.9606***
	(0.06)	(0.16)	(1.00)	(0.43)	(0.10)	(0.20)	(0.06)	(0.16)	(0.20)	(0.23)	(0.09)	(0.18)
t-1	0.1226*	−1.1781***	−1.244	−0.5017	−0.1868*	−1.3214***	0.0572	−0.9697***	−0.2113	−0.3616	−0.1837**	−1.0114***
	(0.06)	(0.16)	(1.13)	(0.49)	(0.10)	(0.20)	(0.06)	(0.16)	(0.28)	(0.29)	(0.08)	(0.18)
t-2	0.1087	−1.0850***	−0.3699	−0.4077	−0.2701**	−1.5929***	0.0675	−0.9657***	−0.1767	−0.2021	−0.2804***	−1.1880***
	(0.07)	(0.16)	(0.65)	(0.53)	(0.11)	(0.20)	(0.06)	(0.15)	(0.28)	(0.28)	(0.09)	(0.19)
t-3	0.1098*	−1.0415***	−0.4922	−0.286	−0.1116	−1.1350***	0.063	−0.9217***	−0.0102	−0.1395	−0.1760*	−0.8393***
	(0.07)	(0.15)	(0.70)	(0.62)	(0.12)	(0.22)	(0.06)	(0.14)	(0.22)	(0.31)	(0.10)	(0.19)
t-4	0.0749	−0.9173***	−0.2176	−0.4478	−0.1537	−1.0300***	−0.0139	−0.9362***	−0.0165	−0.1541	−0.2301**	−0.8051***
	(0.07)	(0.16)	(0.63)	(0.59)	(0.13)	(0.24)	(0.06)	(0.15)	(0.31)	(0.31)	(0.11)	(0.21)
t-5	0.0613	−0.9386***	−0.5923	−1.3492***	−0.0782	−0.9298***	0.0141	−0.8480***	0.271	−0.3037	−0.0607	−0.8181***
	(0.07)	(0.15)	(0.75)	(0.50)	(0.13)	(0.22)	(0.06)	(0.14)	(0.28)	(0.29)	(0.10)	(0.19)
t-6	0.0382	−0.8593***	−0.0484	−1.4203***	−0.2533	−1.0869***	−0.0115	−0.7870***	−0.0006	−0.4279	−0.2375*	−1.0578***
	(0.08)	(0.17)	(0.64)	(0.45)	(0.16)	(0.28)	(0.07)	(0.15)	(0.32)	(0.32)	(0.13)	(0.24)
t-7	0.1092	−0.7817***	0.8396	−1.2025**	−0.3573***	−1.2926***	0.1243*	−0.6392***	0.0198	−0.5276	−0.2320**	−1.1530***
	(0.08)	(0.16)	(0.93)	(0.57)	(0.13)	(0.27)	(0.07)	(0.15)	(0.45)	(0.38)	(0.11)	(0.24)
t-8	0.0582	−0.7186***	0.28	−0.712	−0.0684	−0.9297***	0.073	−0.6381***	0.9582	−0.021	−0.0517	−0.9212***
	(0.08)	(0.20)	(0.91)	(0.75)	(0.15)	(0.34)	(0.07)	(0.18)	(0.61)	(0.36)	(0.13)	(0.28)
t-9	0.1603**	−0.6943***	−0.0507	−0.8638*	−0.0674	−1.0807***	0.1170*	−0.7249***	−0.0059	−0.3063	−0.081	−0.8929***
	(0.08)	(0.20)	(0.57)	(0.50)	(0.14)	(0.29)	(0.07)	(0.17)	(0.24)	(0.24)	(0.12)	(0.24)
t-10	0.1960***	−0.8525***	−0.2509	−1.0514*	−0.0839	−1.0558***	0.1343**	−0.7560***	0.1087	0.0083	−0.1247	−0.9905***
	(0.07)	(0.18)	(0.65)	(0.60)	(0.16)	(0.29)	(0.07)	(0.16)	(0.49)	(0.43)	(0.14)	(0.29)
t-11	0.1520**	−0.7157***	−1.1867**	−0.7718*	0.1231	−0.9994***	0.1556**	−0.6446***	−0.1751	−0.1081	0.1611	−0.6577**
	(0.07)	(0.19)	(0.49)	(0.43)	(0.16)	(0.31)	(0.07)	(0.16)	(0.17)	(0.23)	(0.13)	(0.30)
t-12	0.1663**	−0.7395***	−0.5419	−0.8153**	0.2953**	−0.383	0.1164*	−0.6769***	−0.4479***	0.0125	0.1831	−0.2617
	(0.07)	(0.18)	(0.80)	(0.41)	(0.15)	(0.23)	(0.07)	(0.16)	(0.16)	(0.13)	(0.13)	(0.21)
R^2	0.519						0.652					
Observations	213,887						213,887					

Notes: ***, **, * denote significance at the 1%, 5%, 10% levels, respectively. All models estimated use a fixed effects (FE) regression with heteroskedasticity robust standard errors clustered at the provincial city or county level (in parentheses). Fixed effects include time (month-year), firm, province, and firm type, and the combination thereof. Regional seasonality includes a monthly time trend for province city and counties. Climatic controls include average daily temperature, rainfall, and large typhoons above the category 2 on the Saffir-Simpson Hurricane Scale.

Table A8: Products Covered in 5-Year Plans

HS2	Industry	Products	1996-2000	2001-2005	2006-2010
12	Vegetable Products	oil seeds and oleaginous fruits; grains, seeds and fruit, industrial or medicinal plants; straw and fodder	yes		yes
25	Mineral Products	salt; sulphur; earths, stone; plastering materials, lime and cement	yes	yes	yes
26	Mineral Products	ores, slag and ash		yes	
27	Mineral Products	mineral fuels, oils and products of distillation; bituminous substances; mineral waxes	yes	yes	yes
28	Chemicals	inorganic chemicals; organic compounds of precious metals, rare earth metals, of radio-active elements and isotopes		yes	yes
29	Chemicals	organic chemicals		yes	yes
30	Chemicals	pharmaceutical products		yes	yes
31	Chemicals	fertilizers		yes	yes
32	Chemicals	tanning or dyes, pigments; paints, varnishes; putty, mastics; inks		yes	yes
33	Chemicals	essential; perfumery, cosmetic or toilet preparations		yes	yes
34	Chemicals	soap, organic surface-active agents; washing, lubricating, polishing; waxes, candles, modelling pastes, dental waxes and preparations		yes	yes
35	Chemicals	albuminoidal substances; modified starches; glues; enzymes		yes	yes
36	Chemicals	explosives; pyrotechnic products; matches		yes	yes
37	Chemicals	photographic or cinematographic goods		yes	yes
38	Chemicals	chemical products n.e.c.		yes	yes
39	Plastics / Rubbers	plastics	yes	yes	
40	Plastics / Rubbers	rubber	yes	yes	
44	Wood & Wood Products	wood and articles of wood; wood charcoal	yes	yes	
51	Textiles	wool, fine or coarse animal hair; horsehair yarn and woven fabric	yes	yes	yes
52	Textiles	cotton	yes		yes
54	Textiles	man-made filaments; strip	yes	yes	yes
55	Textiles	man-made staple fibres	yes	yes	yes
56	Textiles	wadding, felt and nonwovens; special yarns; twine, cordage, ropes and cables	yes	yes	yes
57	Textiles	carpets and other textile floor coverings	yes	yes	yes
61	Textiles	knitted or crocheted apparel and clothing	yes	yes	yes
62	Textiles	non knitted or crocheted apparel and clothing	yes	yes	yes
64	Footwear / Headgear	footwear, gaiters	yes	yes	
65	Footwear / Headgear	headgear	yes	yes	
66	Footwear / Headgear	umbrellas, walking sticks, seat-sticks, whips, riding-crops	yes	yes	
72	Metals	iron and steel		yes	yes
73	Metals	articles of iron or steel		yes	yes
74	Metals	copper		yes	yes
75	Metals	nickel		yes	yes
76	Metals	aluminium		yes	yes
78	Metals	lead		yes	yes
79	Metals	zinc		yes	yes
80	Metals	tin		yes	yes
84	Machinery / Electrical	nuclear reactors, boilers		yes	yes
85	Machinery / Electrical	electrical machinery and equipment; sound recorders and reproducers, television image	yes	yes	yes
86	Transportation	railway or tramway locomotives; tracks; traffic signalling	yes	yes	yes
87	Transportation	vehicles other than railway or tramway rolling stock	yes	yes	yes
88	Transportation	aircraft, spacecraft		yes	
89	Transportation	ships, boats and floating structures		yes	yes
93	Miscellaneous	arms and ammunition		yes	
94	Miscellaneous	furniture; bedding; luminaires and lighting fittings; prefabricated buildings	yes	yes	
95	Miscellaneous	toys, games and sports requisites	yes	yes	yes
96	Miscellaneous	miscellaneous manufactured articles	yes	yes	

Notes: The Table indicates the HS2 product categories covered by the 5-year plans of the Chinese Communist Party. Source: Rongji (2001); State Council of China (2006); China Report No. 32 (1996)