

# Recovery from Disasters

June 5, 2022

## Agenda:

1. We should discuss the feasibility of using firm-level data on India (Arti told me it is a rotating sample, so it's usually problematic to use)
2. We should discuss the paper on production networks and decide whether we can follow similar strategy (Couttenier et al)
3. + from conversation with Arti: adding productivity decomposition
4. Just a reminder: I always report tables separately for a sample in 2007-2013 and 2009-2013, since VA (and, consequently, productivity) is not reported in 2007-2008. They are mostly consistent except for sales response. If you look at Table 4 and Table 5, 0th and 1st lags, you will see that in 2007-2013 sample, the sales go up after storms, in 2009-13 they go down. Same in Tables 1 and 2.
5. This memo has 2 sections: regressions with exposure frequency interaction and Jorda method (that is an alternative to distributed lags model)

## 1. Vietnam: repeated exposure interaction, corrected

To control for repeated exposures to the disaster, we run the following regressions:

$$100 * \ln(y_{it}) = \sum_{l=0}^5 (\beta_{1l} Storm_{i,t-l} + \beta_{2l} Storm_{i,t-l} \times Rep_{i,t}) + \beta_3 Rep_{i,t} + \alpha_i + \gamma_t + \varepsilon_{it}, \quad (1)$$

where  $y_{it}$  is an outcome of a firm  $i$  in year  $t$ .  $Storm_{i,t-l}$  is a measure of storm (speed or number of storms) aggregated at an ADM2 level, lagged 5 times.  $Rep_{i,t-l}$  is a continuous variable from 0 to 5 that shows how many years out of last 5 was that area exposed to storms (at least some populated area gets a storm).  $\alpha_i$  is plant/firm fixed effect,  $\gamma_t$  is year fixed effect. We cluster standard errors  $\varepsilon_{it}$  at the plant/firm and region-by-year level.

Table 1: 2007-2013 (dropping VA and Materials since they are not reported in 2007-2008)

	(1) 100Log(Sales)	(2) 100Log(L)	(3) 100Log(K)	(4) 100Log(L Cost)	(5) 100Log(Avg Wage)
N of Storms	1.401 (2.650)	-3.679*** (1.032)	-6.452 (3.792)	2.014 (1.914)	3.951*** (1.030)
Rep	0.265 (1.810)	2.923*** (0.643)	5.994** (2.183)	2.742* (1.079)	-2.294*** (0.557)
N of Storms $\times$ Rep	-0.226 (0.812)	1.067** (0.328)	2.694* (1.206)	-1.356* (0.675)	-1.215*** (0.319)
Lag 1	16.77*** (3.150)	-5.273*** (1.229)	-36.43*** (3.676)	-14.70*** (2.390)	3.628** (1.127)
Lag 1 $\times$ Rep	-4.202*** (0.850)	1.343*** (0.341)	9.171*** (1.128)	6.974*** (0.856)	-0.262 (0.305)
Lag 2	15.57*** (3.559)	-1.951 (1.247)	-22.52*** (3.865)	0.223 (1.959)	2.446* (0.978)
Lag 2 $\times$ Rep	-4.502*** (1.136)	-0.659 (0.402)	0.660 (1.230)	-2.412*** (0.724)	-0.370 (0.317)
Lag 3	-1.817 (3.628)	-2.780** (0.986)	-7.179* (3.275)	-3.356* (1.544)	-0.473 (0.978)
Lag 3 $\times$ Rep	1.801 (1.169)	0.119 (0.356)	-1.079 (1.193)	-0.242 (0.577)	0.307 (0.314)
Lag 4	-6.082* (3.090)	-2.202* (0.859)	-17.77*** (2.709)	-6.310*** (1.362)	-0.478 (0.779)
Lag 4 $\times$ Rep	3.618*** (0.918)	0.391 (0.275)	2.157* (0.907)	2.408*** (0.454)	0.591* (0.248)
Lag 5	-2.365 (1.876)	-5.454*** (0.821)	-44.91*** (4.606)	-2.166 (1.404)	1.336 (0.816)
Lag 5 $\times$ Rep	2.320** (0.726)	1.186*** (0.319)	11.10*** (1.667)	0.523 (0.607)	0.470 (0.294)
N	1363767	1363767	1363767	1363767	1363767
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.739	0.832	0.654	0.703	0.574

Standard errors in parentheses

Plant and year fixed effects are included in each specification. All variables are real values.

Errors are clustered on both plant-level and region-by-year level.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 2: 2009-2013: subsample of firms that have all the characteristics

	(1) 100Log(Sales)	(2) 100Log(L)	(3) 100Log(K)	(4) 100Log(L Cost)	(5) 100Log(Avg Wage)
N of Storms	-7.819*** (1.949)	-3.519*** (1.000)	-0.860 (3.880)	-0.555 (1.746)	1.418 (1.108)
Rep	2.483 (1.325)	4.059*** (0.649)	11.74*** (2.170)	4.568*** (1.255)	-3.163*** (0.631)
N of Storms $\times$ Rep	1.773** (0.596)	0.956** (0.317)	0.956 (1.172)	-0.910 (0.641)	-0.497 (0.328)
Lag 1	-7.389** (2.856)	-9.971*** (1.396)	-37.40*** (4.078)	-20.58*** (3.187)	6.679*** (1.322)
Lag 1 $\times$ Rep	1.255 (0.771)	2.080*** (0.373)	8.436*** (1.095)	7.835*** (1.118)	-1.149** (0.375)
Lag 2	-1.170 (3.603)	-1.087 (1.322)	-5.990 (4.559)	7.727** (2.887)	0.974 (1.584)
Lag 2 $\times$ Rep	-1.043 (1.085)	-1.193** (0.384)	-4.000** (1.322)	-5.180*** (1.049)	0.234 (0.440)
Lag 3	-6.855** (2.265)	-2.578* (1.036)	-20.33*** (3.558)	-4.082* (1.800)	-0.118 (1.131)
Lag 3 $\times$ Rep	0.161 (0.825)	-0.185 (0.349)	1.901 (1.150)	-0.359 (0.732)	0.360 (0.363)
Lag 4	-9.190*** (2.033)	-3.201*** (0.911)	-20.86*** (3.025)	-7.753*** (1.532)	0.593 (0.788)
Lag 4 $\times$ Rep	2.211*** (0.606)	0.214 (0.271)	2.339* (1.006)	3.437*** (0.570)	0.489 (0.256)
Lag 5	-6.012*** (1.680)	-6.137*** (0.881)	-47.81*** (4.903)	-2.513 (1.592)	1.949* (0.922)
Lag 5 $\times$ Rep	0.747 (0.569)	0.967** (0.302)	11.04*** (1.679)	0.921 (0.628)	0.388 (0.313)
N	864287	864287	864287	864287	864287
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.821	0.863	0.674	0.731	0.584

Standard errors in parentheses

Plant and year fixed effects are included in each specification. All variables are real values.

Errors are clustered on both plant-level and region-by-year level.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 3: 2009-2013: subsample of firms that have all the characteristics

	(1) 100Log(Mat)	(2) 100Log(VA)	(3) 100Log(VA/L)
N of Storms	-6.627** (2.015)	-19.98*** (3.452)	-16.46*** (3.543)
Rep	0.950 (1.365)	5.084* (2.262)	1.025 (2.279)
N of Storms $\times$ Rep	1.644** (0.631)	5.773*** (1.216)	4.817*** (1.257)
Lag 1	-7.393* (3.066)	32.20*** (5.311)	42.17*** (5.627)
Lag 1 $\times$ Rep	1.631 (0.842)	-13.82*** (1.732)	-15.90*** (1.862)
Lag 2	0.532 (3.533)	-15.40** (4.830)	-14.31** (4.882)
Lag 2 $\times$ Rep	-1.093 (1.081)	4.206* (1.697)	5.400** (1.767)
Lag 3	-4.605* (2.306)	-15.11*** (3.347)	-12.53*** (3.215)
Lag 3 $\times$ Rep	-0.335 (0.854)	4.996*** (1.377)	5.181*** (1.347)
Lag 4	-9.505*** (2.076)	6.121* (2.964)	9.322** (2.849)
Lag 4 $\times$ Rep	2.471*** (0.642)	-3.689*** (1.116)	-3.903*** (1.080)
Lag 5	-6.768*** (1.722)	-5.667 (3.050)	0.470 (3.057)
Lag 5 $\times$ Rep	1.349* (0.572)	0.475 (1.165)	-0.492 (1.160)
N	864287	864287	864287
Plant FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adjusted R-squared	0.807	0.714	0.507

Standard errors in parentheses

Plant and year fixed effects are included in each specification. All variables are real values.

Errors are clustered on both plant-level and region-by-year level.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 4: 2007-2013 (dropping VA and Materials since they are not reported in 2007-2008)

	(1) 100Log(Sales)	(2) 100Log(L)	(3) 100Log(K)	(4) 100Log(L Cost)	(5) 100Log(Avg Wag
Max Speed (m/s)	-0.0265 (0.158)	-0.106 (0.0563)	-0.427* (0.197)	0.0279 (0.0885)	0.147** (0.0524)
Rep	-1.919 (2.002)	-1.217 (0.880)	7.243* (2.875)	-1.413 (1.474)	-1.418* (0.668)
Max Speed (m/s) $\times$ Rep	-0.00411 (0.0562)	0.0277 (0.0199)	0.177** (0.0658)	-0.00503 (0.0329)	-0.0410* (0.0177)
Lag 1	1.111*** (0.145)	0.176** (0.0655)	-1.172*** (0.200)	-0.0304 (0.101)	0.0948 (0.0495)
Lag 1 $\times$ Rep	-0.255*** (0.0356)	-0.00773 (0.0151)	0.316*** (0.0495)	0.0779** (0.0271)	-0.00901 (0.0126)
Lag 2	1.171*** (0.207)	0.146 (0.0791)	-1.189*** (0.193)	0.0163 (0.109)	0.143** (0.0517)
Lag 2 $\times$ Rep	-0.266*** (0.0537)	-0.00782 (0.0198)	0.179*** (0.0522)	0.0704* (0.0302)	-0.0381** (0.0139)
Lag 3	0.00991 (0.149)	0.0423 (0.0486)	-0.428** (0.154)	-0.0613 (0.0761)	-0.00765 (0.0400)
Lag 3 $\times$ Rep	0.0771 (0.0459)	0.0216 (0.0149)	-0.0266 (0.0485)	0.0537* (0.0240)	-0.00709 (0.0113)
Lag 4	0.0115 (0.131)	0.176*** (0.0533)	-0.315* (0.149)	-0.105 (0.0745)	-0.0768 (0.0395)
Lag 4 $\times$ Rep	0.0936* (0.0368)	-0.0188 (0.0142)	-0.0958* (0.0431)	0.0895*** (0.0228)	0.0363** (0.0118)
Lag 5	0.160 (0.115)	0.00569 (0.0454)	-2.181*** (0.234)	0.261*** (0.0778)	0.0104 (0.0426)
Lag 5 $\times$ Rep	0.0995** (0.0325)	0.0270* (0.0131)	0.534*** (0.0691)	-0.0778** (0.0238)	0.0370** (0.0121)
N	1363767	1363767	1363767	1363767	1363767
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.739	0.832	0.653	0.702	0.574

Standard errors in parentheses

Plant and year fixed effects are included in each specification. All variables are real values.

Errors are clustered on both plant-level and region-by-year level.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 5: 2009-2013: subsample of firms that have all the characteristics

	(1) 100Log(Sales)	(2) 100Log(L)	(3) 100Log(K)	(4) 100Log(L Cost)	(5) 100Log(Avg Wag
Max Speed (m/s)	-0.223* (0.104)	-0.100 (0.0551)	-0.564** (0.203)	-0.330*** (0.0980)	-0.0593 (0.0606)
Rep	1.293 (1.652)	0.270 (0.780)	10.95*** (3.139)	2.352 (1.694)	-1.843** (0.709)
Max Speed (m/s) $\times$ Rep	0.0912** (0.0338)	0.0375* (0.0185)	0.196** (0.0643)	0.0794* (0.0321)	0.0191 (0.0189)
Lag 1	-0.0383 (0.151)	-0.0775 (0.0630)	-1.408*** (0.260)	-0.404** (0.142)	0.208** (0.0672)
Lag 1 $\times$ Rep	-0.00706 (0.0374)	0.0313 (0.0164)	0.345*** (0.0622)	0.0832* (0.0353)	-0.0494** (0.0176)
Lag 2	-0.149 (0.136)	0.0172 (0.0565)	-0.227 (0.260)	-0.266* (0.132)	-0.00737 (0.0704)
Lag 2 $\times$ Rep	0.0401 (0.0335)	-0.00374 (0.0148)	-0.125* (0.0626)	0.0806* (0.0335)	-0.000241 (0.0175)
Lag 3	-0.199* (0.0943)	0.0365 (0.0461)	-0.824*** (0.171)	-0.214** (0.0787)	-0.0424 (0.0416)
Lag 3 $\times$ Rep	-0.0267 (0.0337)	0.00195 (0.0151)	0.0935 (0.0499)	0.0646* (0.0253)	-0.000414 (0.0137)
Lag 4	-0.279** (0.0937)	0.112* (0.0460)	-0.322* (0.164)	-0.251** (0.0812)	-0.0448 (0.0388)
Lag 4 $\times$ Rep	0.0591* (0.0274)	-0.0283* (0.0142)	-0.133** (0.0480)	0.105*** (0.0264)	0.0250 (0.0128)
Lag 5	-0.207* (0.0893)	-0.110** (0.0410)	-2.393*** (0.253)	0.0531 (0.0867)	-0.0158 (0.0473)
Lag 5 $\times$ Rep	0.0271 (0.0266)	0.0405** (0.0124)	0.597*** (0.0728)	-0.0387 (0.0226)	0.0413** (0.0137)
N	864287	864287	864287	864287	864287
Plant FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.820	0.863	0.674	0.731	0.584

Standard errors in parentheses

Plant and year fixed effects are included in each specification. All variables are real values.

Errors are clustered on both plant-level and region-by-year level.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Table 6: 2009-2013: subsample of firms that have all the characteristics

	(1) 100Log(Mat)	(2) 100Log(VA)	(3) 100Log(VA/L)
Max Speed (m/s)	-0.252* (0.109)	-0.226 (0.193)	-0.126 (0.194)
Rep	1.165 (1.754)	-4.491 (2.848)	-4.760 (2.818)
Max Speed (m/s) $\times$ Rep	0.117*** (0.0355)	0.0230 (0.0621)	-0.0145 (0.0625)
Lag 1	-0.174 (0.160)	1.902*** (0.270)	1.980*** (0.263)
Lag 1 $\times$ Rep	0.0251 (0.0396)	-0.397*** (0.0695)	-0.428*** (0.0676)
Lag 2	-0.225 (0.136)	0.923*** (0.248)	0.906*** (0.243)
Lag 2 $\times$ Rep	0.0675* (0.0334)	-0.266*** (0.0658)	-0.263*** (0.0644)
Lag 3	-0.149 (0.100)	-0.0212 (0.153)	-0.0577 (0.148)
Lag 3 $\times$ Rep	-0.0621 (0.0351)	0.0893 (0.0508)	0.0873 (0.0473)
Lag 4	-0.379*** (0.0984)	1.031*** (0.165)	0.919*** (0.162)
Lag 4 $\times$ Rep	0.0678* (0.0285)	-0.209*** (0.0509)	-0.180*** (0.0480)
Lag 5	-0.319*** (0.0932)	0.158 (0.169)	0.267 (0.164)
Lag 5 $\times$ Rep	0.0452 (0.0275)	0.178*** (0.0499)	0.137** (0.0462)
N	864287	864287	864287
Plant FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Adjusted R-squared	0.807	0.714	0.507

Standard errors in parentheses

Plant and year fixed effects are included in each specification. All variables are real values.

Errors are clustered on both plant-level and region-by-year level.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$



## 2. Vietnam: running local projections (Jorda method)

An alternative empirical strategy is to use method by Jorda (2005). If independent variable is not serially autocorrelated, the method is identical to running separate regression for each lag. Below, I present tables for number of storms as a covariate. Since it doesn't have autocorrelation, we receive estimates from the following set of regressions for  $l = 0, \dots, 5$ :

$$100 * \ln(y_{it}) = \beta_l \text{Storm}_{i,t-l} + \alpha_i + \gamma_t + \varepsilon_{it}, \quad (2)$$

where  $y_{it}$  is an outcome of a firm  $i$  in year  $t$ .  $\text{Storm}_{i,t-l}$  is a measure of storm (here number of storms) aggregated at an ADM2 level, lagged 5 times.  $\alpha_i$  is plant/firm fixed effect,  $\gamma_t$  is year fixed effect. We cluster standard errors  $\varepsilon_{it}$  at the plant/firm and region-by-year level. For simple representation, I report estimates from separate regressions in the same column.