Economic Impact of the Most Drastic Lockdown During COVID-19 Pandemic Policy

------the Experience of Hubei, China

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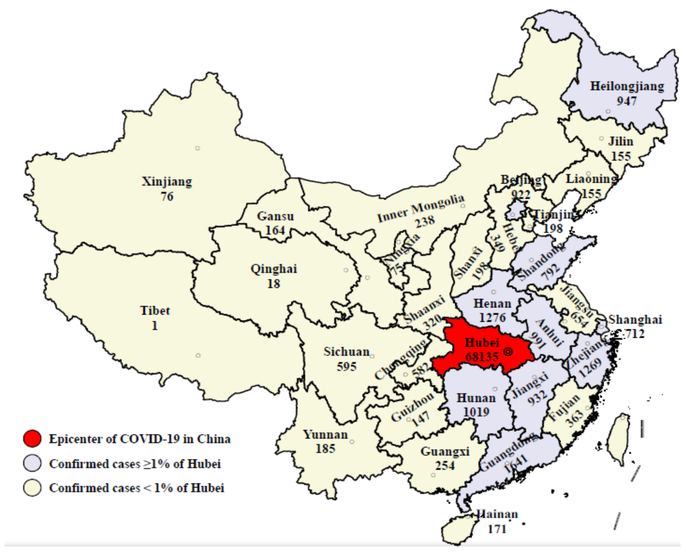
Introduction

- Pandemics have had strong adverse effects on economic prosperity.
- In Dec. 2019, a disease of unknown causes suddenly afflicted Wuhan, a megacity in Hubei province in central China with 60 million inhabitants, & quickly spread to the whole nation.
- Facing the raging COVID-19 epidemic, the Chinese government rolled out perhaps the most agile and aggressive disease containment effort (WHO, 2020).
- We uses the Hsiao, Ching, and Wan (2012) panel approach and Hsiao and Zhou (2019) to assess the evolution of economic consequences of the drastic lockdown policy in the epicenter of COVID-19---the Hubei Province of China.

The lockdown treatment

Severality of the COVID-19 in the epicenter & non-epicenter regions in China



Anti-epidemic measures for epicenter annon-epicenter of COVID-19 in Chin

Table 1 Anti-epidemic time table for epicenter and non-epicenter of COVID-19 in China

Epicenter of COVID-19: Hubei Province	Date	Non-epicenter regions
reported 27 cases of pneumonia of unknown cause; Tips: Wear a face mask when going out	191231	
body temperature monitoring; reduce aggregation	01.13	
Screening for fever patients	01.16	
confirmed that COVID-19 spread between humans	01.19	
"Great Isolation"	01.23	public health emergencies were launched nationwide
346 national medical teams & 42,600 medical staff to Wuhan	01.24	
	01.29	
classified & centralized management "4 types of people"①	02.02	
2 infectious disease hospitals completed in about 10 days ②	02.06	
19 provinces provide support to 16 cities in Hubei	02.10	
	02.14	new confirmed cases decreased for 10 days, all province
	02.18	number of confirmed cases began to decline
newly confirmed cases were less than newly cured cases	02.19	
	02.21	response to major public health emergencies was reduced to level 2（except Jingjinji area）
	02.24	all provincial trunk roads opened (except Wuhan & Beijing)
	02.27	newly confirmed cases decreased to single digits(except Wuhan& Hubei)
newly confirmed reduced to single digits	03.11	
daily increase in confirmed cases remain single digits	03.17	daily increase in the no. of domestic cases remained in single-digit
	03.19	no new confirmed case in China for 7 consecutive days
traffic controls have been lifted except in Wuhan	03.25	
Unlock Wuhan and Hubei	04.08	
the number of hospitalized patients reduced to "0"	04.26	
	04.30	"Jingjinji" public health emergencies reduced to level 2
public health emergencies reduced to level 2	05.02	
Prevent inbound cases and domestic resurgence		

Notes: 1. The "4 types of people" refer to confirmed, suspected, fever, close contacts of confirmed patients.2. The infectious disease hospitals specially built for the treatment of critically ill patients are "Leishenshan" and "Huoshenshan" hospitals.

Methods

Model of untreated outcome y_{it}^0 for $i = 1, \ldots, N,\ t = 1, \ldots, T$

$$y_{it}^0 = b_i' f_t + \alpha_i + u_{it}$$

$\alpha_i =$ province-specific effects
$f_t =$ $K \times 1$ (unobserved) common factors that vary over time
$b_i =$ $K \times 1$ vector of constant loadings that may vary across i
$K =$ number of common factors
$u_{it} =$ ith unit idiosyncratic error with $E(u_{it}) = 0, E(u_{it}u_{js}) = 0$ for $i \neq j$

Methods

The contemporaneous covariance between y_{it} and y_{jt} is given by

$$cov(y_{it}, y_{jt}) = b_i' E(f_t f_t') b_j$$

As long as

$$E(u_{it}|d_{1t}) = 0,\ i = 2, \ldots, N$$

One can write

$$y_{1t}^{0*} = E(y_{1t}^{0*}|\tilde{y}_t) + \eta_{it} = a + c'\tilde{y}_t + \eta_{it},\ t = 1, \ldots, T$$

where $\tilde{y}_t = (y_{2t}, \ldots, y_{Nt})'$, $E(\eta_{1t}|\tilde{y}_t) = 0$. Hsiao et al. (2012) show that minimizing

$$\frac{1}{T_1}(y_1^0 - ea - Yc)' A (y_1^0 - ea - Yc)$$

yields consistent estimates of a and c, where $y_1^0 = (y_{11}, \ldots, y_{1T_1})'$,$A$ is a $T_1 \times T_1$ positive definite matrix. *Define the predictor for counterfactual y_{1t}^0 without the COVID-19 outbreak and the decisive lockdown in Hubei*

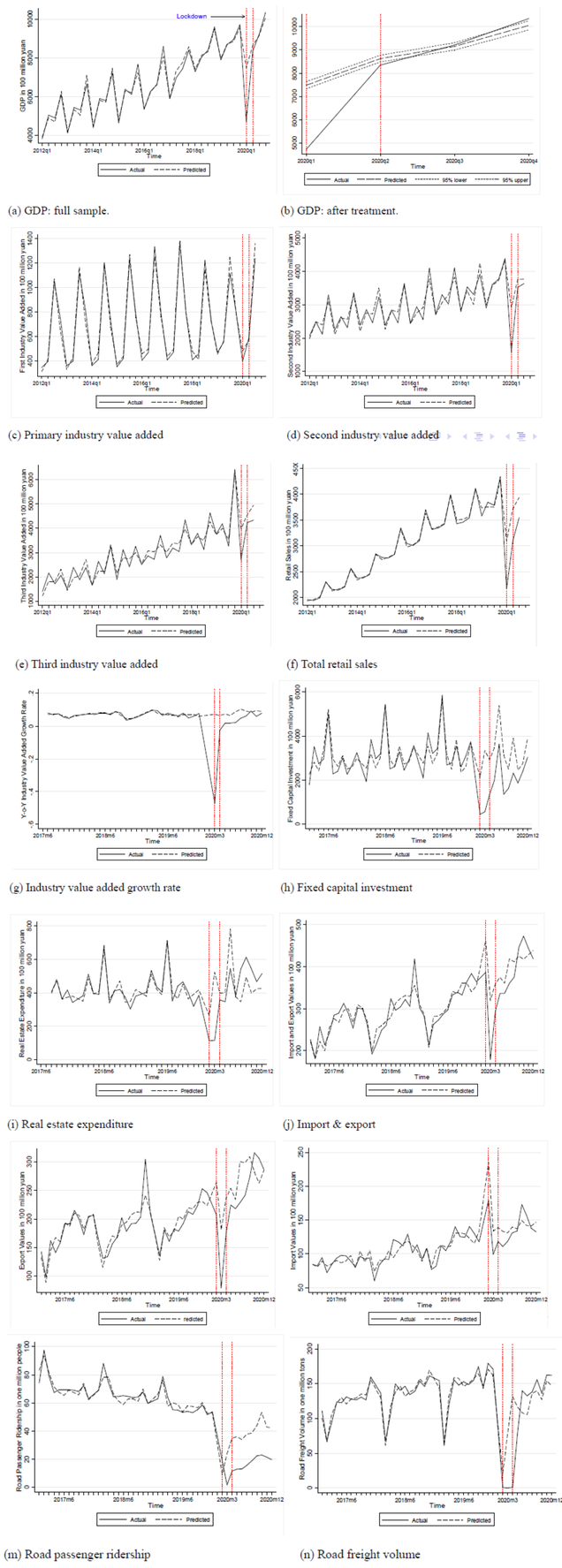
$$\hat{y}_{1t}^{0*} = \hat{a} + \hat{c}'\tilde{y}_t,\ T_1 + 1, \ldots, T$$

Prediction for the drastic COVID-19 lockdown policy treatment effect:

$$\hat{\Delta}_{1t} = y_{1t} - \hat{y}_{1t}^{0*} \quad \text{for } t = T_1 + 1, \ldots, T$$

Results

Treatment effects on GDP, total retail, industry value added growth rate, fixed capital investment, real estate investment, export, import, road passenger ridership, and road freight transport volume



(a) GDP: full sample. (b) GDP: after treatment.
(c) Primary industry value added (d) Second industry value added
(e) Third industry value added (f) Total retail sales
(g) Industry value added growth rate (h) Fixed capital investment
(i) Real estate expenditure (j) Import & export
(m) Road passenger ridership (n) Road freight volume

Summary of the loss/completion relative to counterfactual Hubei—Using AICC

Table 11 Summary of the loss/completion relative to counterfactual Hubei

	Proportion of loss to counterfactual	Proportion of completion to counterfactual		
	Lockdown quarter	Re-opening quarters	First half of 2020	Whole year 2020
GDP	37%	100%	81%	92%
Primary industry value added	17%	94%	94%	92%
Second industry value added	46%	95%	77%	84%
Tertiary industry value added	31%	90%	82%	84%
Industry value added cumulative growth rate	54%	96%	82%	91%
Fixed capital investment	82%	64%	46%	57%
Retail sales	30%	87%	77%	82%
Export and import	28%	96%	82%	92%
Export	36%	92%	77%	88%
Import	25%	96%	81%	92%
Real estate expenditure	71%	106%	63%	94%
Road passenger ridership	92%	44%	38%	45%
Road freight volume	99%	95%	63%	88%

Notes: 1. In the table, we have two types of data: quarterly and monthly. For quarterly data, the lockdown quarter is 2020:q1, re-opening quarters are 2020:q2-2020:q4 for GDP and 2020:q2-2020:q3 for value added of the primary, secondary, tertiary industries, and retail sales respectively. For monthly data (fixed capital investment, export, import, real estate expenditure, road passenger ridership, and road freight volume), the lockdown quarter is 2020:m2-2020:m3; and for industry value added cumulative growth rate, the lockdown quarter is 2020:m3. The re-opening quarters are 2020:m4-2020:m12 for all the variables. The first half of the year refers to policy evaluation period from the lockdown quarter to 2020:m6 or 2020:q2. And the whole year 2000 refers to the whole policy evaluation period from the lockdown quarter to the end of the re-opening quarters for each macroeconomic indicator respectively.

Summary of the loss/completion relative to counterfactual Hubei—Using LASSO

Table 12 Summary of the loss/completion due to LASSO method of selecting the predictor or changes in control units

	Proportion of loss to counterfactual		Proportion of completion to counterfactual			
	Lockdown quarter		First half of 2020		Whole year 2020	
	LASSO	Control group	LASSO	Control group	LASSO	Control group
GDP	35%	36%	81%	82%	92%	91%
Primary industry value added	21%	—	94%	—	92%	—
Second industry value added	47%	—	77%	—	90%	—
Tertiary industry value added	31%	32%	83%	83%	86%	89%
Industry value added cumulative growth rate	54%	54%	82%	82%	92%	91%
Fixed capital investment	80%	80%	44%	47%	56%	56%
Retail sales	29%	31%	78%	76%	77%	81%
Export and import	28%	—	84%	—	94%	—
Export	34%	—	79%	—	88%	—
Import	16%	—	91%	—	97%	—
Real estate expenditure	73%	73%	62%	59%	92%	86%
Road passenger ridership	92%	—	38%	—	45%	—
Road freight volume	99%	—	63%	—	88%	—

Notes: 1. Notes are the same as those in Table 11. 2. As for the robustness checks with respective to changes in control group, we re-estimate the impact of COVID-19 lockdown on variables which select Hubei's neighboring provinces or Eastern coastal provinces with none-zero weights in our baseline analysis. See text for details.

Discussions

Used the HCW and Hsiao and Zhou (2019) panel data program evaluation approach to assess the economic impacts of Hubei Provinces lockdown policy in times of COVID-19 pandemic.

- We find a strict lockdown could result in huge economic loss in times of pandemic but it also showed that as long as the epidemic could be quickly contained, the economic loss was temporary and controllable.
- How did Hubei's economy recover so fast after the COVID-19 epidemic breakout?

1. The "lockdown" is temporary. It has not affected the fundamental structure of the economy;
2. The Chinese government's "lockdown" policy brought the spread of COVID-19 to a halt in three months;
3. The resilience of people in Hubei also played a pivotal role.

Literature Cited

Hsiao, C., Ching, H. S., & Wan, S. K. (2012). A panel data approach for program evaluation--Measuring the benefits of political and economic integration of Hong Kong with mainland China. *Journal of Applied Econometrics*, 27, 705-740.

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