Pandemic and Panic: Government as the Supplier of Last Resort

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COVID-19

- Since its outbreak in December 2019, COVID-19 has affected **1,603,330** people and caused **95,758** death.

- It has also caused a sharp decline in **financial market with panic** as suggested by the surge in VIX index.

- It has also caused waves of **panic buying** as the virus spread across different regions in
  - Hand Sanitizer
  - Masks
  - Protective gear
  - Toilet papers
  - Food...

On seeing is believing

COVID-19

- It has also caused runs on hospital
  - On January 27, more than *10,000 people visited the fever clinic in Wuhan, only 377 of them needed further treatments* (economic observation daily,经济观察报, 2020, January 28)
  - Cuomo on April 2: ***Hospitals should send unused coronavirus supplies to New York 'stockpile' instead of hoarding them***

COVID-19

- The panic buying and runs on hospital greatly exacerbate the shortage in critical medical supplies, which in turn aggravates the crisis
  - There are numerous reports of shortage of masks, protective gears, and goggles for nurses and doctors
  - Many patients with severe symptoms were left untreated.
  - Presumed Hospital-Related Transmission and Infection are common. Wang et al (2020, The Journal of the American Medical Association) finds that ***57 out of 138*** patients were presumed to have been infected in hospital.

This Note

- Panic buying and runs on hospital is an analogy to bank runs
  - In a bank run, people rush to withdraw their money before no money is left
  - In a panic buying, people rush to buy things before they are sold out
- They are self-fulfilling
  - Standard market forces can not achieve the efficient allocation
  - Government can help as the Supplier of Last Resort
  - **There is a key difference:** governments can not print masks, protective gears, or goggles, doctors or nurses
- China's experiences

A simple two-period model

- Two type of agents
  - the low infection risk group (type L), with measure $\alpha \in (0,1)$
  - the high infection risk group (type H) with measure 1-α
- a medical product, e.g., mask,
  - In period 1, the producer can supply $y_1 \leq m < 1$ units of masks at a marginal cost of ϕ
  - In period 2, the producer can supply $m - y_1$ units of masks at a marginal cost of ϕ
  - The medical product produces momentum utility V for H-type in both periods
  - But only produces momentum utility V with probability θ for L-type when she turns to H-type in period 2.

Assumptions

- Assumption 1: $\theta V > \phi$.
  - This product is so valuable during a pandemic
- Assumption 2: $1 - \alpha + \alpha\theta < m < 1$.
  - This implies that the stock of masks can cover all of the agents with high exposure risks in the first two periods, but it cannot meet the demand if every agent buys masks in period 1.
- Prices are fixed at ϕ in both period.

Normal Equilibrium

- We first consider the normal equilibrium in which only type H (high-risk) agents buy masks in period 1, and type L (low-risk) agents just wait and buy masks in the second period if they become the high-risk type.

- Both types of agents obtain
$$U_H = 2V - \phi \text{ and } U_L = (V - \phi)\theta.$$

- Type-L has no incentive to deviate $-\phi + V\theta < (V - \phi)\theta$

- Total demands in two periods are $1 - \alpha + \alpha\theta < m$

Panic Equilibrium

- In the panic equilibrium, everyone rushes to buy masks in the first period
- Therefore, the expected net utilities for both types of agents are given by

$$\widehat{U}_H = (-\phi + 2V)m \text{ and } \widehat{U}_L = (\theta V - \phi)m.$$

- Both types have no incentive to wait, which yields zero utility
- This is clearly not efficient

Pricing Mechanism

- One natural question is whether the market mechanism, i.e. raising the price, can eliminate the bad equilibrium run.
- We will show that it is more likely to cause opposition.
- We assume that the probability of type-L agents becoming type-H, θ, is increasing in s, i.e. $\theta'(s) > 0$, where s denotes the fraction of high-risk agents who fail to buy the masks in the first period.
- The price is fixed at marginal cost, i.e. $P_1 = \phi$ in period 1 and the price can freely adjust in period 2.

Pricing Mechanism

- We assume that

$$\theta(0)\alpha + 1 - \alpha < m < \theta(1)\alpha + 1 - \alpha.$$

The above condition implies that the maximum production of masks can cover the demand in a normal situation where every type H agent can obtain masks in period 1 (i.e. $s = 0$), but it cannot meet the demand under a panic situation where no type H agents get masks (i.e. $s = 1$).

Normal Equilibrium

- In this equilibrium, no panic run occurs. The prices in two periods are equal to the marginal cost, $P_1 = P_2 = \phi$. The sellers behave competitively and receive zero profit. The net utilities for both types of agents are $U_H = -\phi + 2V$ and $U_L = (V - \phi)\theta(0)$, respectively

- L-type has no incentive to deviate since $(V - \phi)\theta(0) > (V\theta(0) - \phi)$

- Masks are still available: $\theta(0)\alpha + 1 - \alpha < m$

Panic Run and Hoarding

- In this equilibrium $P_2 = V > P_1 = \phi$
- All the sellers now have a strong incentive to hoard all of the masks and wait until the second period to sell them.
- $s = 1$. Therefore, in period 2 the total demand for masks is $\theta(1)\alpha + 1 - \alpha > m$ if $P_2 < V$ and 0 if $P_2 > V$
- Market clearing requires $P_2 = V$
- This is worse than the panic equilibrium with fixed prices

Entry

We now investigate whether entry can eliminate the panic equilibrium

- Assume it takes one period to enter. The new entrants' marginal cost of production ϕ is higher than the incumbent. We assume $V > \varphi > \phi$
- Still two equilibriums. The panic equilibrium still exists now with $P_2 = \varphi$
- All existing producers hoard in period 1.

Policy

- Fixed price: it eliminates the hoarding problem among all existing producers
- Encourage production by subsidizing new entrants to eliminate the panic run of L-type or order State-owned enterprises to produce
- Government can fix price at ϕ and subsidize new entrants $\varphi - \phi$ for each unit they produce in period 2.

China's experiences

- Tax deductions, fee-waiving, rent reductions, and subsidies
- Loan rate cuts, loan rollover, "green channel" for COVID-19 related industries for additional loans
- Social insurance policies, including the delay or deduction of insurance payments
- Window guidance and public promotion of corporations in producing medical products
- Implicit guarantee of purchases for excessive production
- SOEs expanded production capacity dramatically for key materials such as Non Woven Fabric

Production Surge

- On January 24th, China's maximum capacity for Masks including non-surgical masks, surgical masks, KN95 was **20 millions** per day (Ministry of Industry and Information Technology，工信部)

- By February 29th, daily production reached to **116 millions**, which is a more than 5 times increase over a period of a month.

- Through March 1st to April 4th, China exported **3.86 billions masks** at an average price of $0.3 , **37.5 million protective gears** at an average price of $ 3.43, and **16 thousands ventilators** at an average price of $2,767.

Hospital shortage

- On January 23rd, Wuhan started to build its first temporary hospital, the Huoshenshan facility with **1,000 beds**, which was completed on February 2nd.
- On January 25th, Wuhan started to build a second temporary hospital, the Leishenshan facility with **1,600 bed**s, which was completed on February 6th.
- On February 2nd, it started to build **16 mobile hospitals** adding more than 20,000 beds in operation during peak times.
- Through January 24th to March 9th, other provinces in China had sent a total of **426,000 doctors and nurses** to Hubei province. Among them **19,000** were **ICU-related** medical staffs.

Conclusion

- Pandemic is **not a normal time**
- Panic buying and run on hospitals can be **self-fulfilling and exacerbate** the problem
- Government should act fast to facilitate production using **subsidy or direct order.**
- **China did a good job !!!**