

Suitability for Machine Learning and Immunity to the COVID-19 Pandemic?

The 8th South Asia Economic Policy Network Conference

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September 8, 2021

- COVID-19 pandemic has been a health/economic crisis
- Social distancing is the new norm
- Disruption to economic activity

What we do?

- Economic Immunity provided by *Suitability to Machine Learning (SML)*
 - ▶ Resilience of sectors/occupations with high SML
- Event study design around COVID-19 induced lockdown in India
- Use high-frequency payments data for impact evaluation
- Results:
 - ▶ Resilience of sectors with high SML
- Channel:
 - ▶ Business as usual for high SML firms
 - ▶ Better adaptability to remote work

COVID-19 and work from home:

- Dingel and Neiman (2020), Mongey et al. (2020), Bartik et al. (2020), Stratton (2020), Chanona et al. (2020)

Measuring impact of COVID-19:

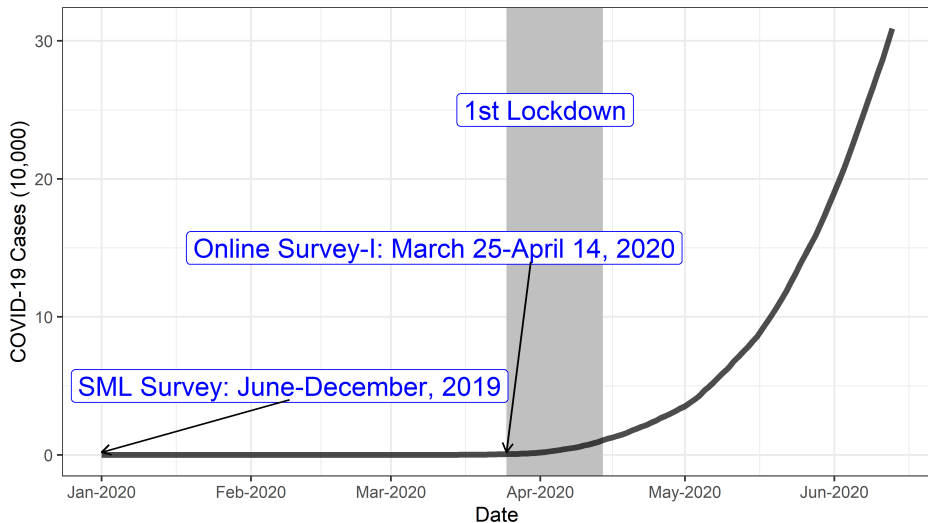
- Carvalho et al. (2020), Chetty et al. (2020), Barrot et al. (2020)

Big Data:

- Eyre et al. (2020), Sutton et al. (2014), Bagrow et al. (2011)

S. No.	Data (1)	Source (2)	Details (3)	Timeline (4)
1	SML Survey	Author	3099 participants	June-December, 2019
2	Firm-level Tweets	Twitter	NIFTY-500 firms	January-April, 2020
3	Payments	UPI (NPCI)	Daily payments data at State \times Sector level	January 2019-April 2020
4	Employment	PLFS-2017	Occupation-wise employment for all sectors	2017
5	Online Survey-I	Author	400+ participants	March-April, 2020
6	Online Survey-II	Naukri.com	Firm Review	March-December, 2020

Timeline



Higher SML \rightarrow Lower disruption

We test it using UPI payments.

UPI Data Description

	Number of Payments ('000)		Value of Payments (INR mn)	
	Pre (1)	Post (2)	Pre (3)	Post (4)
Total Sectors	45	45	45	45
Total States	36	36	36	36
States \times Sector	1456	1378	1456	1378
Mean	7795	6565	4311	3437
Std Dev.	28749	22359	11889	9329
Median	92	33	92	50

In 2020, UPI accounted for 48 percent of the total volume of transactions

Lockdown in India:

- Announced across all geographical areas
- Unanticipated, timing and stringency

Study Design: Use 21 days before and after the lockdown

We estimate the following equation (Mar 4-Apr 14, 2020):

$$r_{s,t}^j = \alpha + \beta_1 \text{Lockdown}_t + \beta_2 \text{SML}^j \times \text{Lockdown}_t + \delta_s^j + \varepsilon_{s,t}^j$$

where:

$r_{s,t}^j$ → residual

s → state

j → sector

t → date

Residual comes from (Jan 1, 2019-Apr 14, 2020):

$$y_{s,t}^j = \delta_{year} + \delta_s^j + \delta_{s,dom}^j + \delta_{s,dow}^j + \delta_{s,w}^j + \delta_{s,m}^j + \delta_{s,y}^j + \nu_{s,t}^j$$

Impact of SML on Payments

Table: Impact of SML on UPI Payments

	Residual (Log # of Payments)			Residual (Log Value of Payments)		
	(1)	(2)	(3)	(4)	(5)	(6)
Lockdown	-0.287*** (0.011)	-1.960*** (0.221)		-0.299*** (0.010)	-2.107*** (0.222)	
SML × Lockdown		0.465*** (0.061)	0.467*** (0.086)		0.502*** (0.061)	0.505*** (0.061)
State × Sector FE	Yes	Yes	Yes	Yes	Yes	Yes
Date FE	No	No	Yes	No	No	Yes
Observations	47,786	47,786	47,786	47,786	47,786	47,786

Network Effect: Impact of SML on Payments

	(1)	(2)	(3)	(4)	(5)
Panel (a): Residual (Log # of Payments)					
SML × Lockdown			0.395*** (0.094)	0.056 (0.089)	-0.016 (0.095)
Input SML × Lockdown	0.861*** (0.218)		0.387 (0.251)		0.505*** (0.255)
Output SML × Lockdown		2.500*** (0.233)		2.430*** (0.254)	2.306*** (0.272)
Panel (b): Residual (Log Value of Payments)					
SML × Lockdown			0.424*** (0.094)	0.119 (0.091)	0.066 (0.096)
Input SML × Lockdown	0.942*** (0.216)		0.433* (0.248)		0.371 (0.259)
Output SML × Lockdown		2.410*** (0.209)		2.261*** (0.231)	2.170*** (0.248)
Observations	47,786	46,274	47,786	46,274	46,274
State-Sector FE	Yes	Yes	Yes	Yes	Yes
Date FE	Yes	Yes	Yes	Yes	Yes

Summary of Results

- Sectors with high SML more resilient in the early phase of lockdown
- Resilience extends to other sectors in the network

How does SML build resilience?

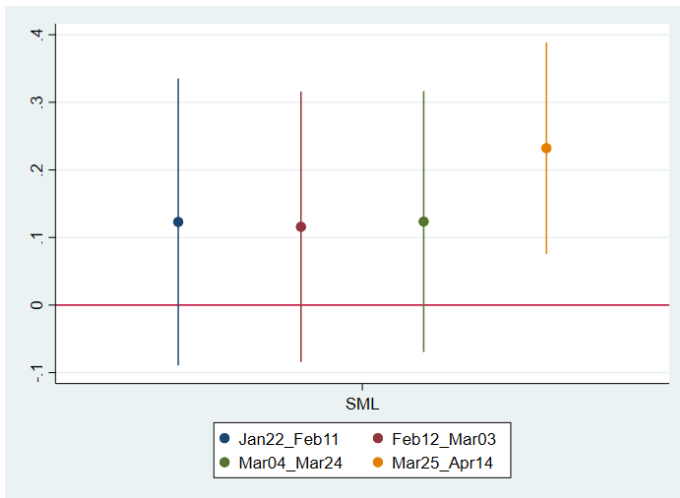
High SML: Greater Adaptability to Remote Work

	Prior WFH Frequency (1)	Reliance on Shared Repository (2)	Reliance on Videoconferencing (3)	Post WFH Fraction (4)
SML	0.687*** (0.171)	0.397** (0.174)	0.317* (0.180)	0.319*** (0.044)
Controls (Firm)	Yes	Yes	Yes	Yes
Controls (Respondent)	Yes	Yes	Yes	
Sector FE				Yes
Observations	375	373	374	2,592
Mean DV	0.466	0.632	0.745	0.380

Both in pre-COVID period as post-COVID WFH outcomes

High SML firms: Business as usual

Figure: SML: Impact on Firm-level Tweet Similarity



- Show resilience engendered by high SML to sectors during COVID-induced lockdown
 - ▶ Event study design around the first lockdown in India
 - ▶ The gains spread through the input-output network
- Firms with high SML display business as usual
- High SML allows easier transition to Work From Home