The Emergence of Omicron and Its Impact

SUTRA Consortium

SUTRA Model

Key Parameters: Contact Rate β

- Measures how fast pandemic spreads in a region
  - Increases due to people not following safety protocols and more infectious mutants
  - Decreases due to lockdowns, people following safety protocols
- Closely related to Basic Reproduction Number $R_0 \approx 10\beta$

Key Parameters: Detection Factor ϵ

- Measures ratio between detected (tested +ve) and actual cases
  - Decreases when number of asymptomatic patients increase, pandemic reaches inaccessible regions, and testing reduces
  - Increases when testing rate goes up significantly

Key Parameters: Reach ρ

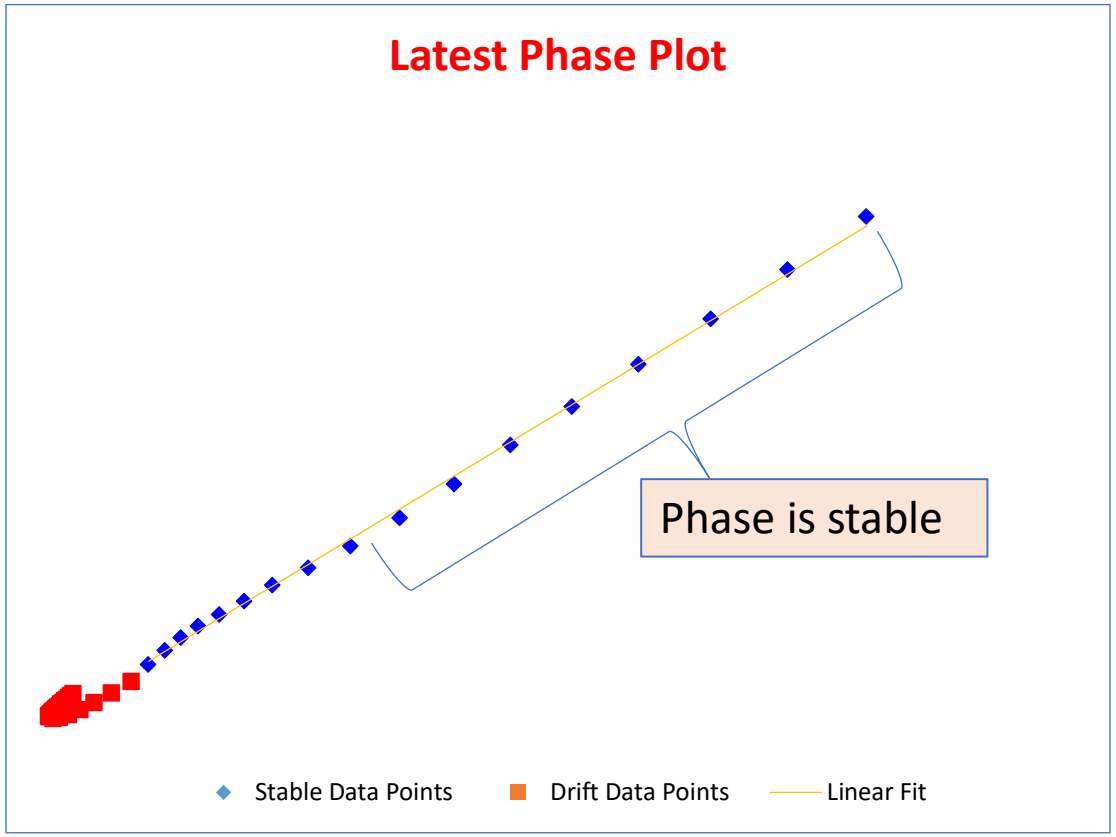
- Measures fraction of population over which the pandemic is active
  - It is very small initially and typically increases with time
  - Increases rapidly when there is a lot of movement across regions, many people come out of isolation
  - Captures loss of immunity and vaccination-induced immunity

Omicron in South Africa

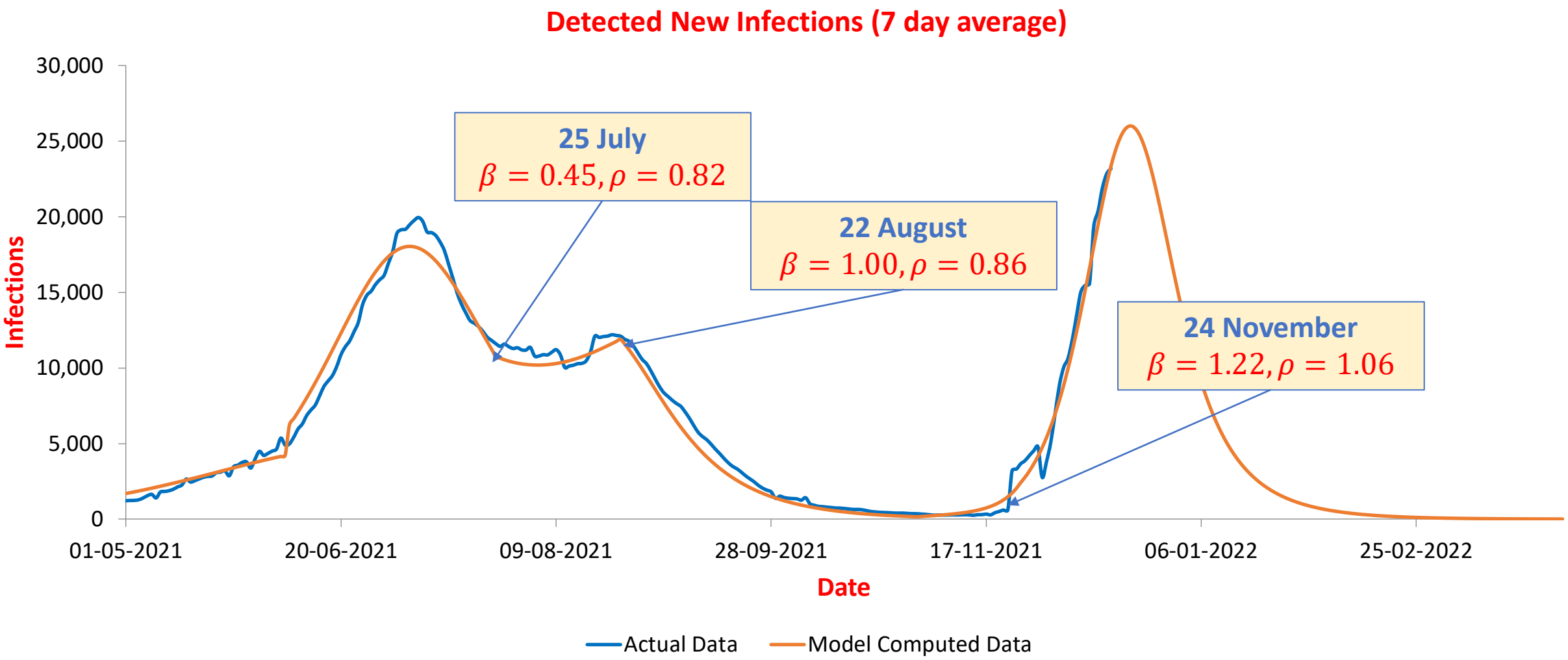
South Africa

Change in Parameter Values

	Phase 9 (Jun-Jul)	Phase 10 (Aug-Oct)	Phase 11 (Nov-)
β	0.45	1.00	1.22
ρ	0.82	0.86	1.06



SUTRA Simulation of South Africa



Observations

- Contact rate β went up by a factor of 2.2 in August
- Numbers continued coming down despite $\beta \approx 1$ due to high immunity
  - Natural immunity in September was $\approx 77\%$
- Rise in November is due to increase in ρ
  - It was $\approx 86\%$ until October and is $\approx 106\%$ from November-end

Emergence of Omicron

- There exist two possible scenarios for Omicron based on our observations:
  1. It started spreading in August causing a 2.2x rise in β
  2. It started spreading in November causing a 20% increase in both β and ρ
- Frist implies that Omicron is much more infectious than Delta
- Second implies that Omicron is bypassing immunity significantly
  - Loss on immunity in x% population results in x% increase in both both β and ρ
- According to biologists, Omicron came into existence in October, which implies second scenario

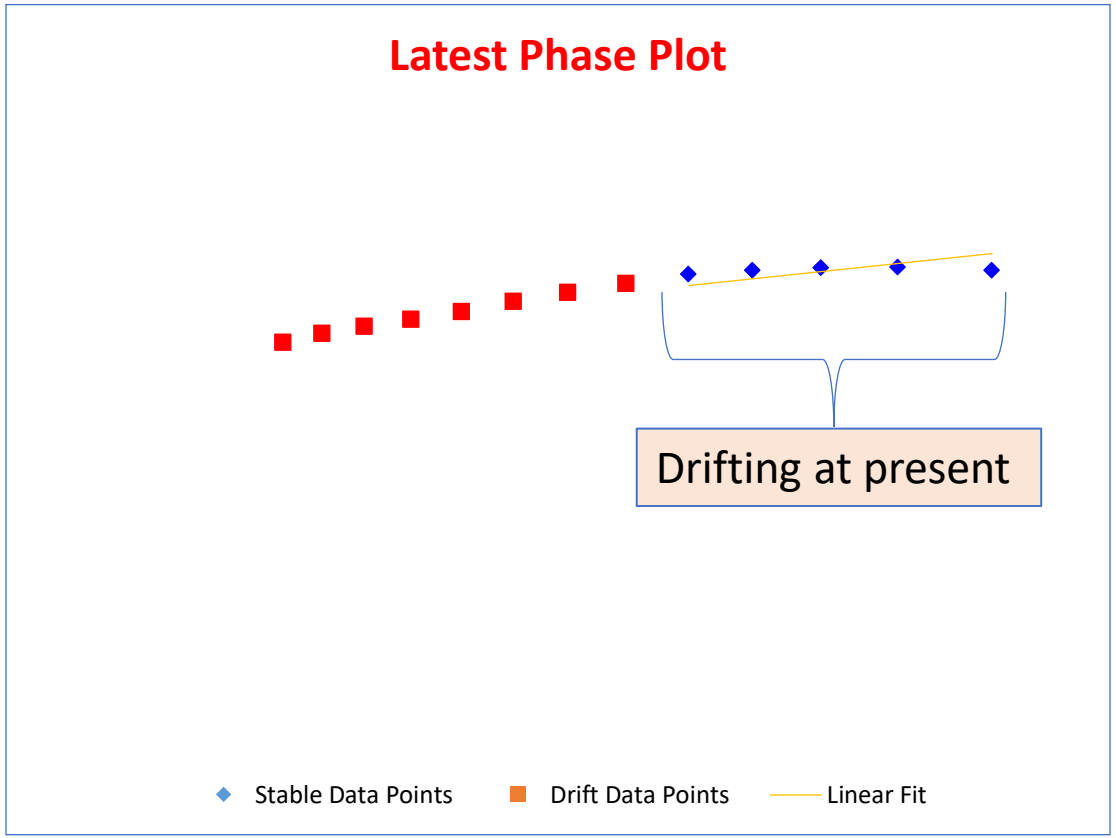
We consider both scenarios

Omicron in UK and Denmark

UK

Change in Parameter Values

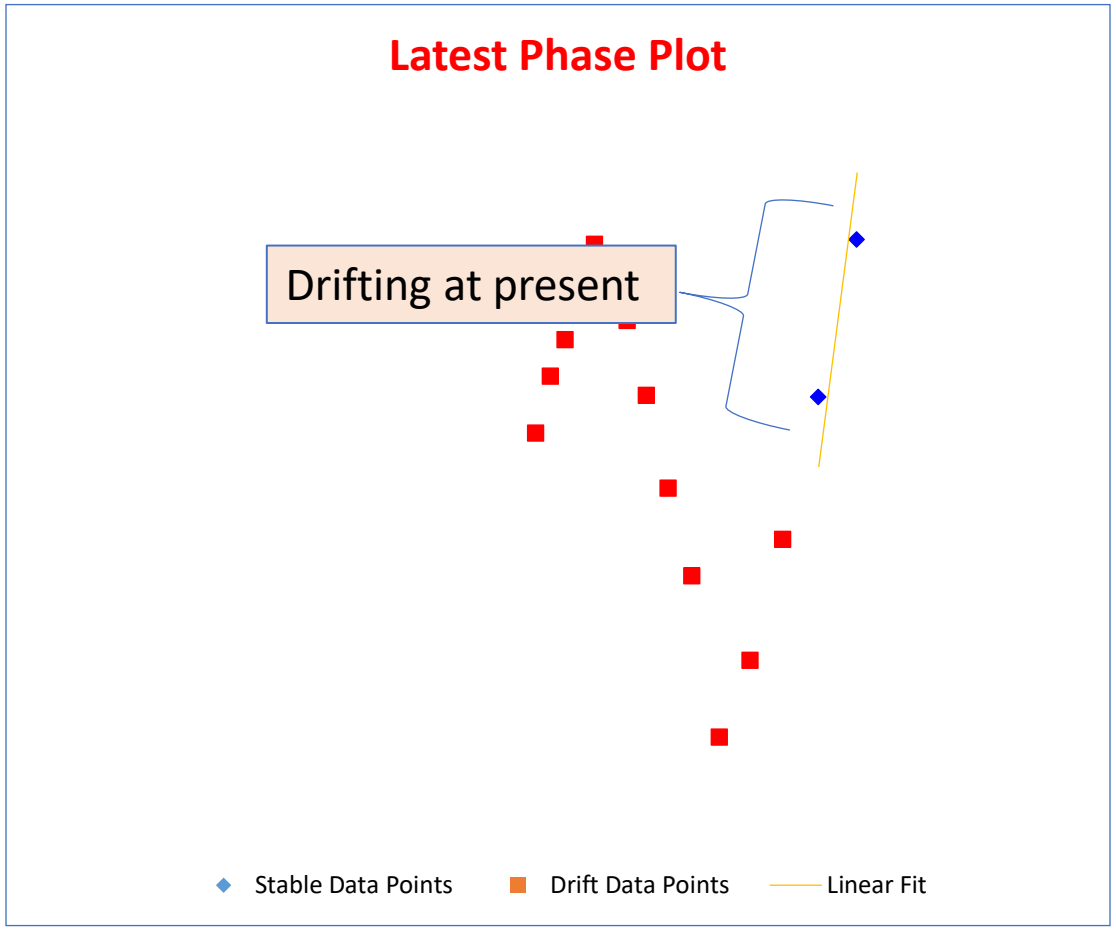
	Phase 13 (Sep-Oct)	Phase 15 (Dec)
β	0.70	0.40
ρ	0.48	0.87



Denmark

Change in Parameter Values

	Phase 12 (Oct-Nov)	Phase 13 (Dec-)
β	0.42	0.33
ρ	0.54	0.80



Observations

- Omicron does not appear to be causing any increase in β
- Instead, reach is rising significantly:
  - In UK, it has gone up by 0.39
  - In Denmark, it is up by 0.26
- Current phase has not stabilized in UK and Denmark, and so parameter values may change

Implications for India

Current Status

$\beta \approx 0.60$

$\rho \approx 0.90$

$\epsilon \approx 1/33$

Natural immunity $\approx 83\%$

High Infectivity Scenario

- β goes up by 2.2x:

$$\beta: 0.60 \rightarrow 1.33$$

- Reach goes up to 100%:

$$\rho: 0.90 \rightarrow 1.00$$

- Detection ratio remains the same:

$$\epsilon = 1/33$$

Immunity Loss Scenario

- Natural immunity is completely bypassed
  - However, on reinfection, people spread infection for quarter period (≈ 2.5 days)
- Equivalently, we may assume that half the people lose natural immunity and, on reinfection, people spread infection for half period (≈ 5 days)

- Vaccination immunity is completely bypassed
  - However, vaccinated people, on getting infected, spread infection for half period (≈ 5 days)

Immunity Loss Scenario

- β goes up by 20%:

$$\beta: 0.60 \rightarrow 0.72$$

- Reach goes up by 20%:

$$\rho: 0.90 \rightarrow 1.10$$

- Detection ratio remains the same:

$$\epsilon = 1/33$$

Future Projection