QE I: Quantitative Easing I

Quantitative Tools For Location-Specific Pandemic Projection and Schedules for Phasing Out of Social Distancing

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Social distancing/lock-down and in some countries curfew are a short term measure designed for two primary purposes.

1. Protect the vulnerable.

2. Control the pandemic to a point where the healthcare system can cope.

Now that we understand the pandemic, we must face the reality of phasing out the social distancing. Some percentage of the system will get infected and a percentage of that will need to be hospitalized.

One tool at our disposal is the rate of QE, and fluid feedback from the healthcare providers to policy/decision makers will be instrumental (as the results will show) in implementing a smooth transition to reopening while

<div align="center">**KEEPING THE PANDEMIC WITHIN CONTROLLABLE LEVELS.**</div>

These QE-tools will tell us what simple strategies work, at what rate should the QE be happening and how the pandemic will play out over time. For example certain locations will be doing battle for much longer than other locations.

Comments

Given daily infection counts, the machine learning (fully automated) learns a simple epidemiological model and projects to the future. It should be emphasized that:

1. Things are changing: social distancing; the nature of the testing. The primary testing modality in these results is:

    People self-select for testing when their symptoms alert them to a possible COVID-infection.

    A change to the testing procedure results in a change-point in the dynamics which the system can detect. A similar consideration applies to changes in social distancing protocols.

2. Regions within the USA are very heterogeneous, so a model should be built specific to a given location's data.

The model calibrates to *local* data and automatically and robustly adapts to change-points. For simplicity, we only focus on change-points in the growth-rate. The user inputs:
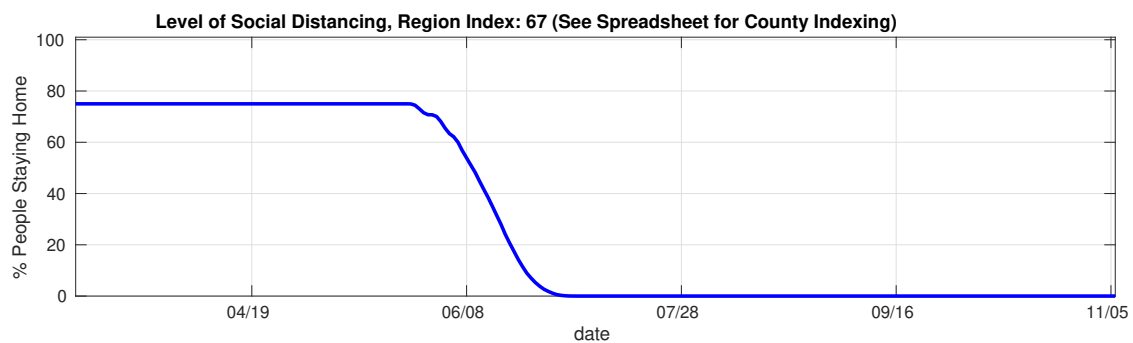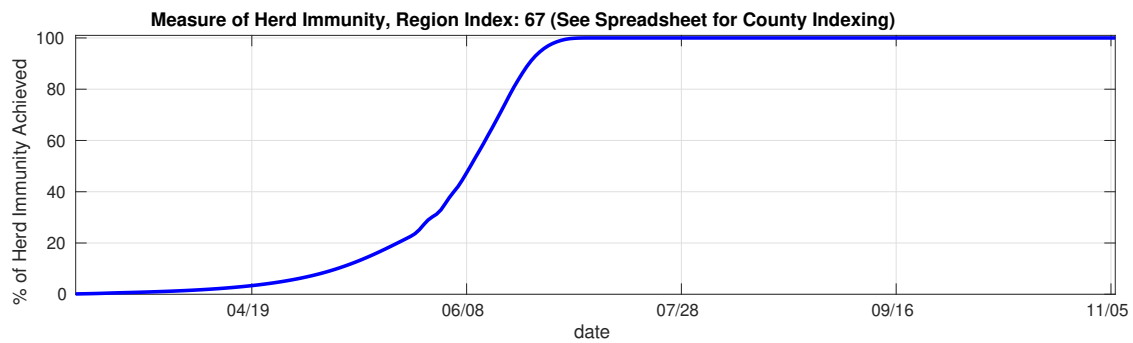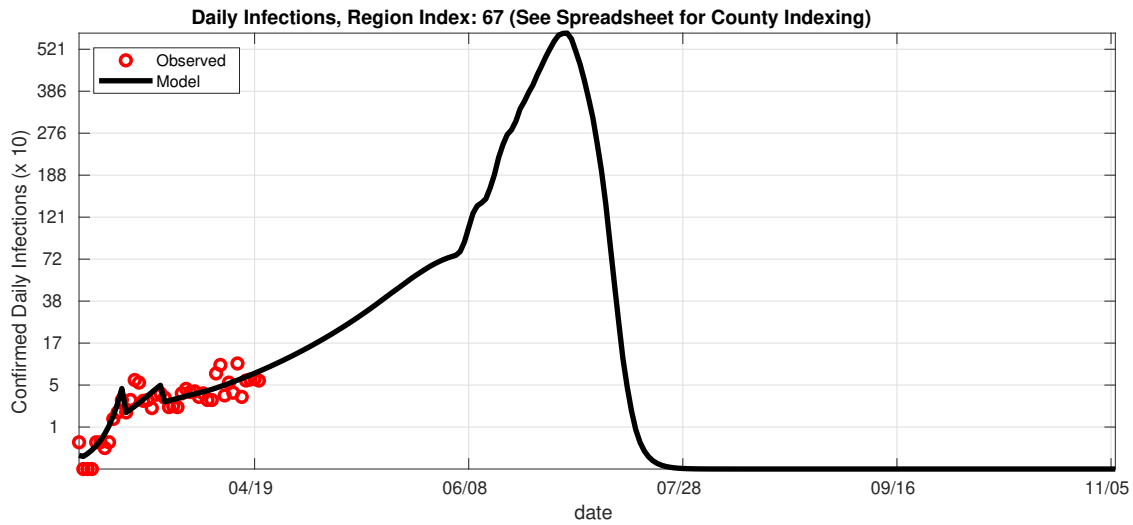
- Daily infection counts for the location of interest (company, county, state, country).

- Current quarantine level (e.g. 75% of population stays at home).

- Maximum number of daily infections the user will tolerate after the peak. For example for a hospital system which has 500 beds, and assuming a patient stays 5 days, the system can tolerate 100 hospitalizations per day. If the number of hospitalizations is approximately 10% of the COVID-positive cases then the region can tolerate 1000 positive cases per day.

- The system delivers simple phasing out strategies for the social distancing to bring the system to herd immunity while not violating the maximum daily infection tolerance.

- Additional modeling/input from the medical front line would be needed to link infection counts to hospital admissions (perhaps broken down by demographic and co-morbidity).

- In what follows, we give a case study of Albany, but such a study can be performed for any region.

- These tools are not decision making tools, but are meant to provide quantitative projections to a decision maker who may combine this information with other considerations.

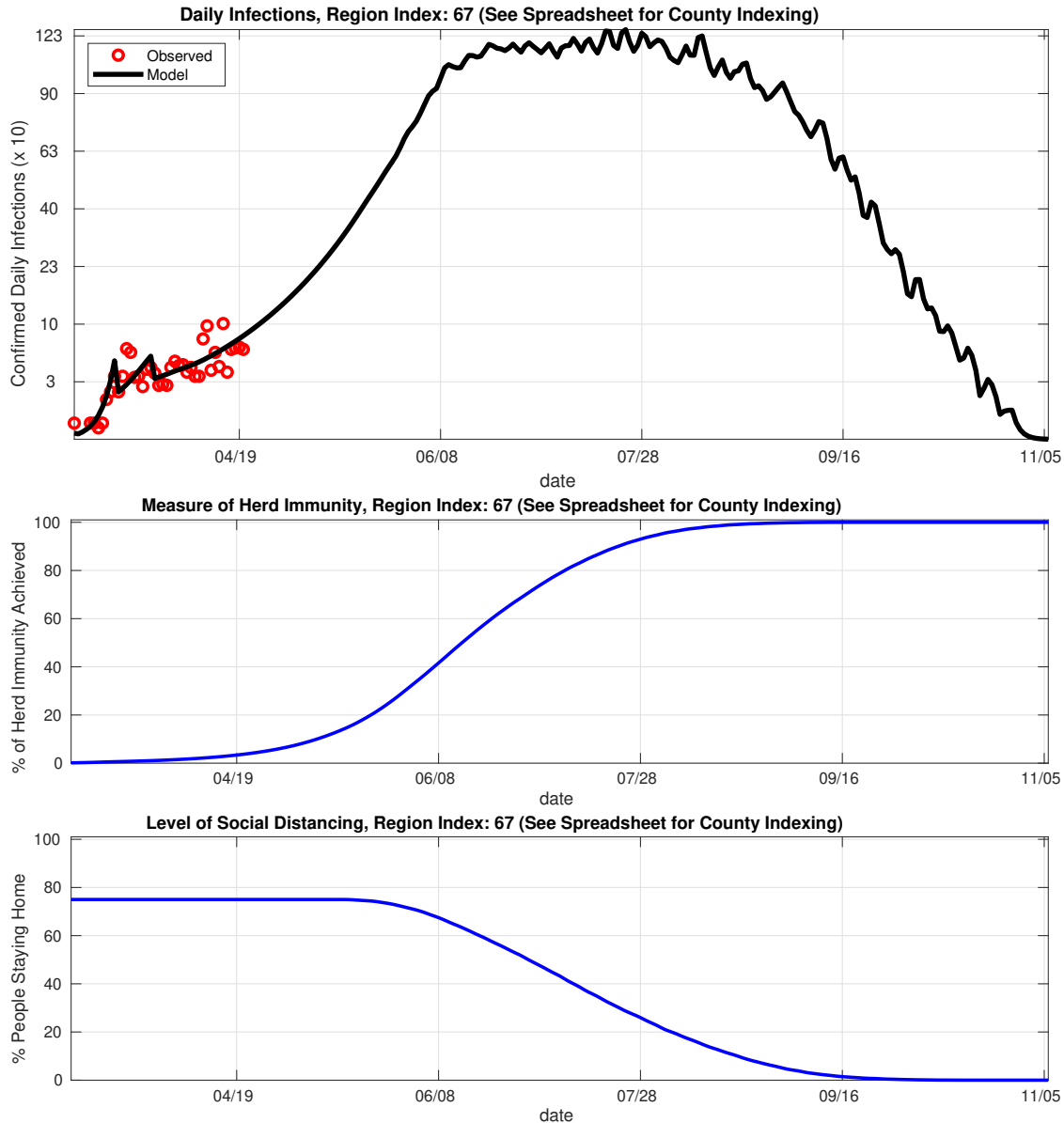# 1 75% People Staying At Home, Peak Around Mid-June 02
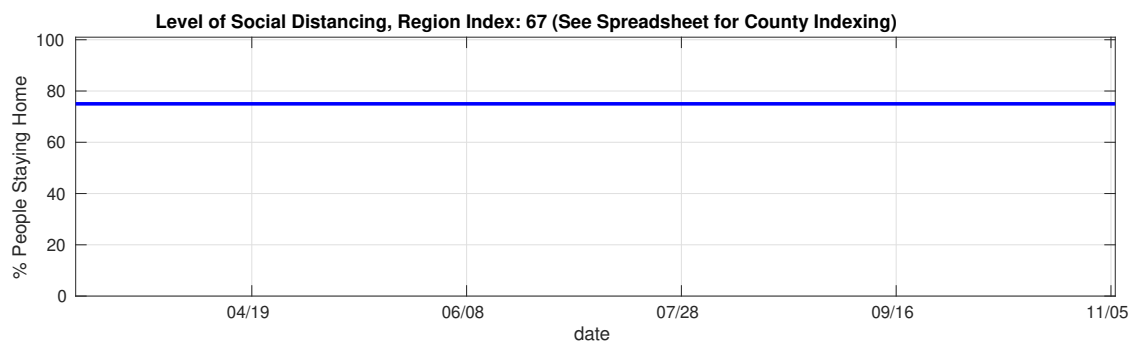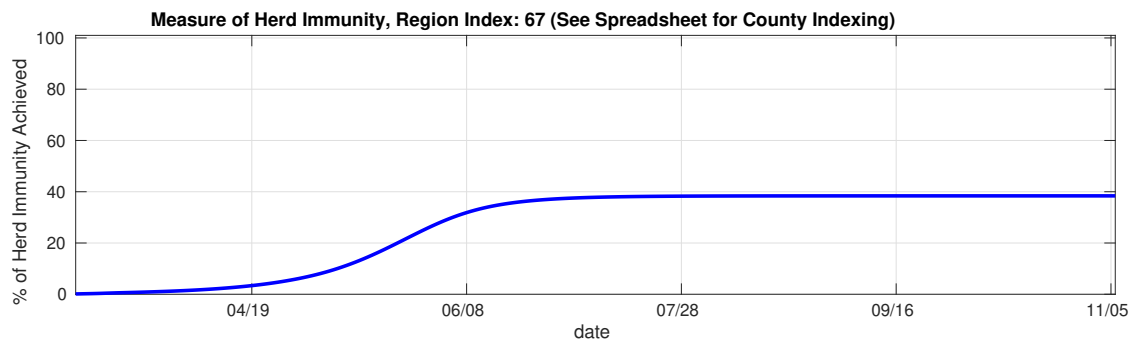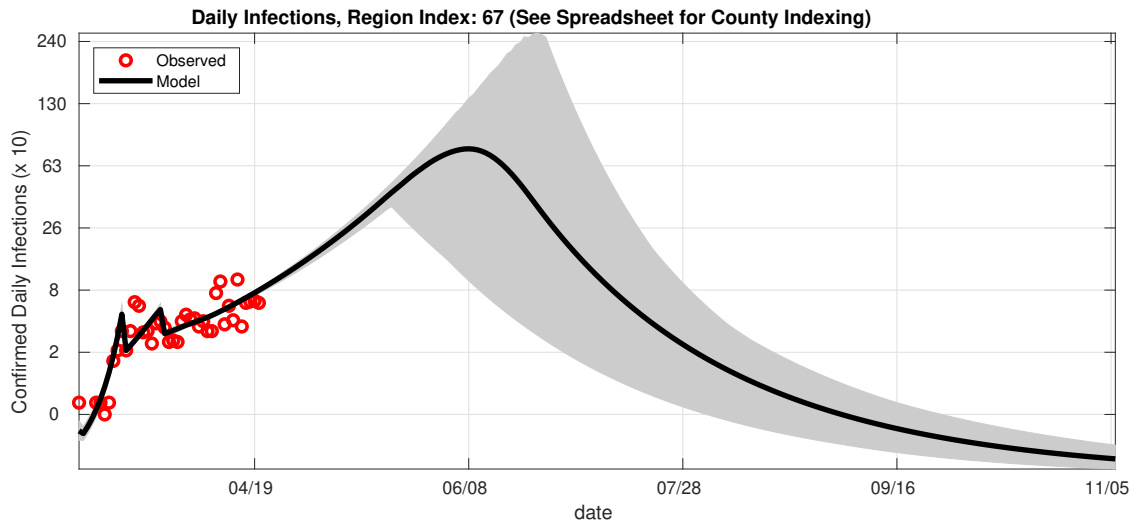
Observe how herd immunity builds only up to a point. Continued social distancing cannot improve this situation. So when one ultimately one reopens, there will be a second wave. To prevent a second wave, one must build up the herd immunity either the hard way by getting infected or with some sort of a mass vaccination campaign, if such were available.

2 75% People Staying At Home Full Reopen After Peak

Daily Infections, Region Index: 67 (See Spreadsheet for County Indexing)

Measure of Herd Immunity, Region Index: 67 (See Spreadsheet for County Indexing)

Level of Social Distancing, Region Index: 67 (See Spreadsheet for County Indexing)

Complete reopening releases the floodgate and a huge surge of infections follow. Herd immunity quickly builds as infections surge well beyond the 1000 capacity as social distancing rapidly drops to 0. This draconian approach could see peak infection rates upwards of 16,000, but the battle is over relatively quickly, by early August.

3   Phased Reopening With 1000 Cap on Daily Infections

Daily Infections, Region Index: 67 (See Spreadsheet for County Indexing)

Measure of Herd Immunity, Region Index: 67 (See Spreadsheet for County Indexing)

Level of Social Distancing, Region Index: 67 (See Spreadsheet for County Indexing)

- Model based phasing out of social distancing. Infection counts are maintained at a steady manageable level as heard immunity builds at which point infection counts rapidly drop to zero, the only possible stable situation.

- The time-period of phasing out of the social distancing that is required to stay at or below around 1000 daily infection count is several months, and the model suggests the Capital District will be free and clear by about early-November.

- Any host of social distancing strategies can be tested. Such a tool can provide phasing in strategies for large companies, cities and counties.

- It is important that the specific strategy and the ensuing dynamics vary significantly from one locale to another, so it is very important to use your local data.

- The model phases out social distancing based on recent infection dynamics. Hence, frontline hospitals must cooperate with the decision makers who adjust the schedule so that the phase-in strategy can quickly adapt to what is transpiring on the hospital floors.

4   The Long Battle Ahead for NYC

Let us compare Albany-QE I, with NYC-QEI.
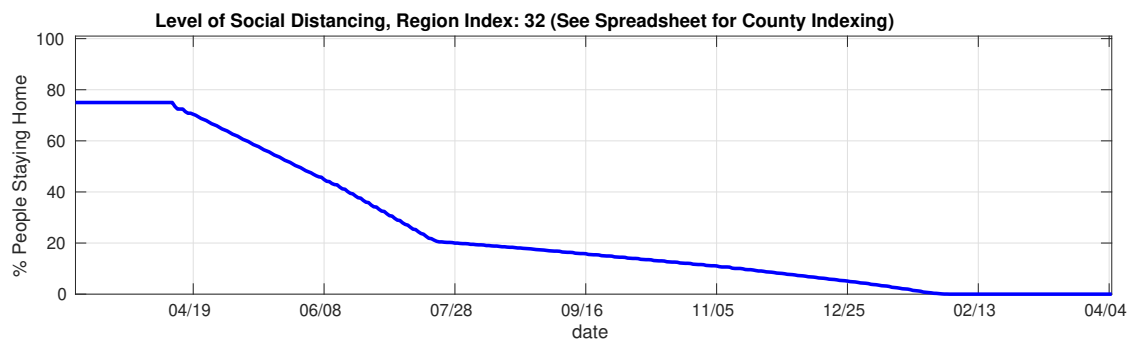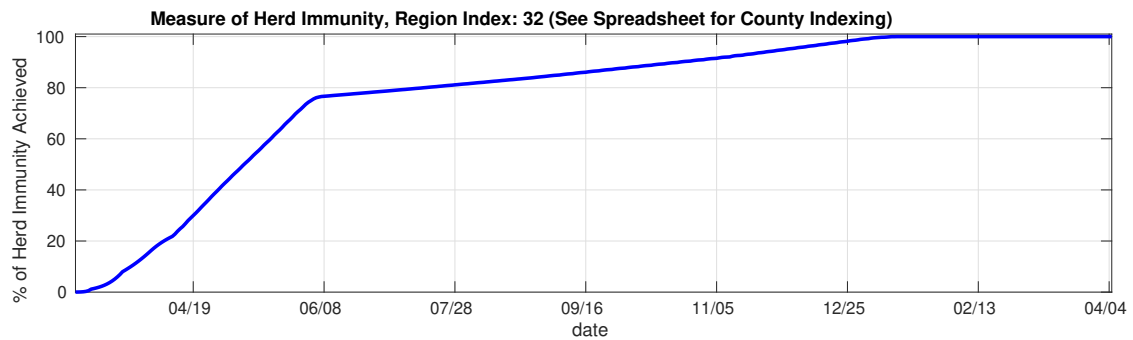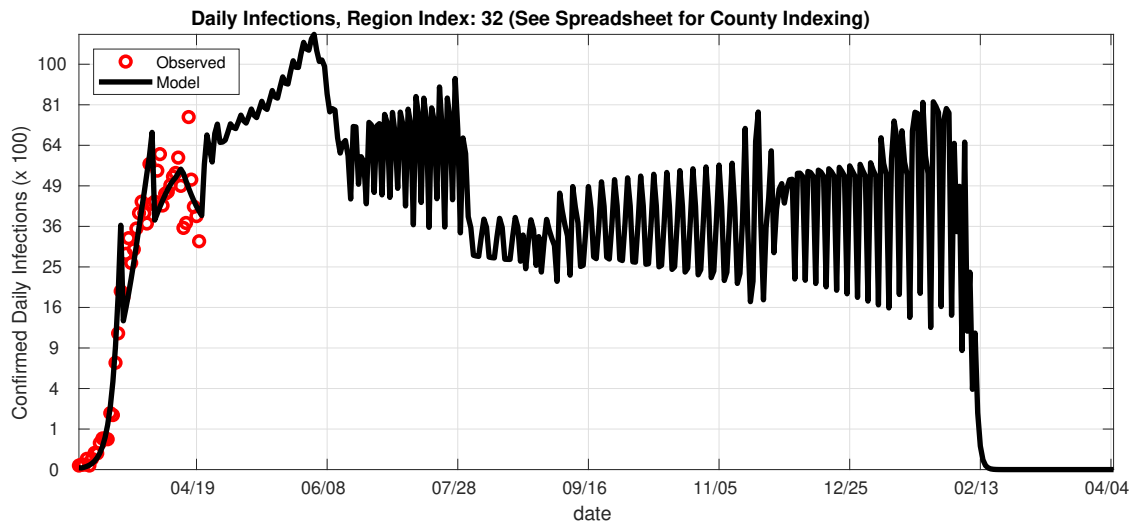
- Note the mini-surges each time a QE-step is taken.

- NYC will be doing battle for a while, perhaps till early 2021.

The bottom line is a certain number of people need immunity to confer immunity on the herd, and what we can control is the rate at which that happens.

5 Buffalo (Erie-Niagara Counties) With A 2000 Daily Infection Cap