

Bayesian Inference for Decision Making under COVID-19: A case study

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Introduction

The worldwide health crisis induced by the the ' *SARS-COV 12* ', globally referred as COVID-19, mutated the classic decision making under uncertainty problem into a substantially more uncertain mess due to the lack of closeness of the 2020 pandemic to previous world plights. Under this particularly uncertain context Bayesian Theory of Inference bestows an adequate framework to incorporate such new precariousness.

In particular, having a reliable ground where to stand becomes critical for policy makers or other high impact decision makers. The following paper presents a simple, yet non trivial, case study of Bayesian Inference to adress the difficulty of predicting the job loss induced by the COVID-19 lockdown measures. We also stress out some of the caveats of the classical aproach from the Fisher and Neyman school of Mathematical statistics and contrast both approaches slanting outturns in the context of desicion making.

Section **I** begins by providing the reader a concrete outlook of the problem and the data at hand to tackle it. Section **II** translates the problem into its concrete mathematical and statistical representation and comments on the frailty of classical solution. Section **III** goes about the same formulation under a simple *by-hand* bayesian alternative while section **IV** proposes a more sophisticated solution and cautions the reader on the first asumptions. Finally section **V** is a brief utterance on the importance of providing a well grounded inference for decision making proceses.

Mexican Social Security Institute and lagged payrrol notices

Estimating labor force decrease the “accepted way”

Having settled some common grounds we can formulate the former situation into statistical language.

Let $N - t$ be the number of workers noticed on time or in advanced by some company to the Social Service Mexican Insitute at some given month t . As mentioned before, it's of interest to predict the amounts of the labor force N_{t+1} for the succesive month at the instances of the health crisis.

Which could be a sufficiently simple formulation of the problem? At first, the notation used and even the timely nature of the phenom may suggest some time series approach. However it's the objective of the authors to present a as simple as posible formulation for the model so. Being that so, though it may look abit naive at first, lets consider the following structural form for the lagged worker numbers at $t + 1$ being:

$$N_{t+1} = N_t \cdot (1 + \theta)$$

Notice that under the prior structural statement, the forecasting of N_{t+1} reduces to estimating θ the *lagged augmentation parameter* between t & $t + 1$.