An econometric analysis of the COVID-19 pandemic on

the Caribbean tourism industry

CSEC 491: Senior Project Report

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# Section I. Introduction

## Background

The COVID-19 pandemic had a profound and long-lasting impact on the economies of the world. One of the industries that was substantially affected by the pandemic is the tourism sector. The number of flights or cruises to tourist destinations plummeted. The introduction of quarantine restrictions aggressively limited incoming visitors and prohibited many recreational activities. A large proportion of jobs in tourism were put on hold and in many cases were terminated. As highlighted by the International Monetary Fund, tourism-dependent regions were most notably and severely impacted by the COVID-19 outbreak and “will likely feel the negative impacts of the crisis for much longer than other economies[[1]](#footnote-1).” One such case study is that of the Caribbean countries, which have a high economic reliance on tourism and thereby have been especially susceptible to the negative financial consequences of the COVID-19 outbreak. Therefore, studying the impact of the COVID-19 pandemic on the Caribbean economy represents an opportunity to analyze the immediate and long-term effects of a health crisis on similar tourism-dependent regions and may help shape predictions about how future pandemic events will affect tourism.

## Project Description

This project seeks to investigate the impact of the COVID-19 pandemic on the tourism industry in the context of the Caribbean region. This senior project is divided into two main parts—an econometric-driven analysis and a software development component—that fulfills the Computer Science and Economics requirements of the CSEC 491 senior thesis course. First, through the investigation of the real-world data, we wish to quantitatively identify the economic effects of the COVID-19 outbreak on the tourist-dependent Caribbean economy. We analyze key economic metrics pertinent to tourism, such as number of visitors, changes in revenue, duration (e.g., overnight; same-day) and mode of travel (e.g., flight; cruise) that we expect to be timely correlated with the onset of the COVID-19 pandemic. Finally, we attempt to estimate the direct impact of COVID-19 cases, deaths and mortality on the Caribbean economy in order to better understand the financial impact of the COVID-19 pandemic on the tourism industry.

Second, using the results from the previous section, we wish to formulate a predictive estimate for future changes in key economic variables associated with COVID-19 cases, leveraging the results found in the first part of this project. The objective is to generalize our findings of the impact of COVID-19 on the tourism-dependent Caribbean economy to other countries that have a similarly heavy reliance on tourism for the growth and generation of tourism volume and revenue. We wish to present this model and other economic insights by building software data visualizations and plots through the use of software programming in order to provide a clear understanding of the impact of a health crisis on the tourism sector.

[TBD: Add list of Caribbean countries]

[TBD: Review introduction]

# Section II. Development Environment

## Project Resources

The following applications and software tools were used for the development and completion of this project:

* JupyterLab: web-based interactive development environment for running Python
* Git: recommended local version control system for keeping track of updating files
* GitHub: web-based version control system used for publishing project
* Visual Studio Code: preferred IDE used for editing and managing the project files

This project was developed on a Unix system and coded primarily in Python 3 (the latest version of Python at the time of this document is recommended) with some programming scripts written in Bash. The following command-line tools were used in the completion of this senior thesis:

* Homebrew: package manager for installing command-line and software utilities
* pip: Python package installers

Additionally, the software and programming libraries that were used for the analysis of this project are as follows:

* Matplotlib: data visualization library for creating plots
* NumPy: mathematical package for data computing
* pandas: data analysis and manipulation library
* statsmodels: statistical modelling and regression module
* linearmodels: complementary library to statsmodels (i.e., fixed-effects regression)
* seaborn: data visualization package based on Matplotlib

[TBD: List any additional resources]

## Software Installation

*Note: This software installation section is written for a Unix-based system, such as MacOS or Linux, in which this project was developed on.*

First, installing Homebrew is recommended for the installation of all necessary software tools; run the following command to install:

|  |
| --- |
| **$ /bin/bash -c "$(curl -fsSL https://raw.githubusercontent.com/Homebrew/install/HEAD/install.sh)"** |

For more information on Homebrew, see [https://brew.sh](https://brew.sh/).

Using Homebrew, install all the necessary software components for this project including Python 3 ([https://www.python.org](https://www.python.org/)), JupyterLab ([https://jupyter.org](https://jupyter.org/)) and the Python package manager:

|  |
| --- |
| **$ brew install python3**  **$ brew install jupyterlab** |

Using Python’s pip package manager, install the latest versions of the remaining Python libraries by running the following set of commands:

|  |
| --- |
| **$ pip install matplotlib**  **$ pip install numpy**  **$ pip install pandas**  **$ pip install statsmodels**  **$ pip install linearmodels**  **$ pip install seaborn** |

## Downloading the Project Files

[TBD: Upload repository to GitHub and link in report]

After cloning the repository from GitHub onto your machine, open the project directory using the software editor of your choice (Virtual Studio Code is recommended).

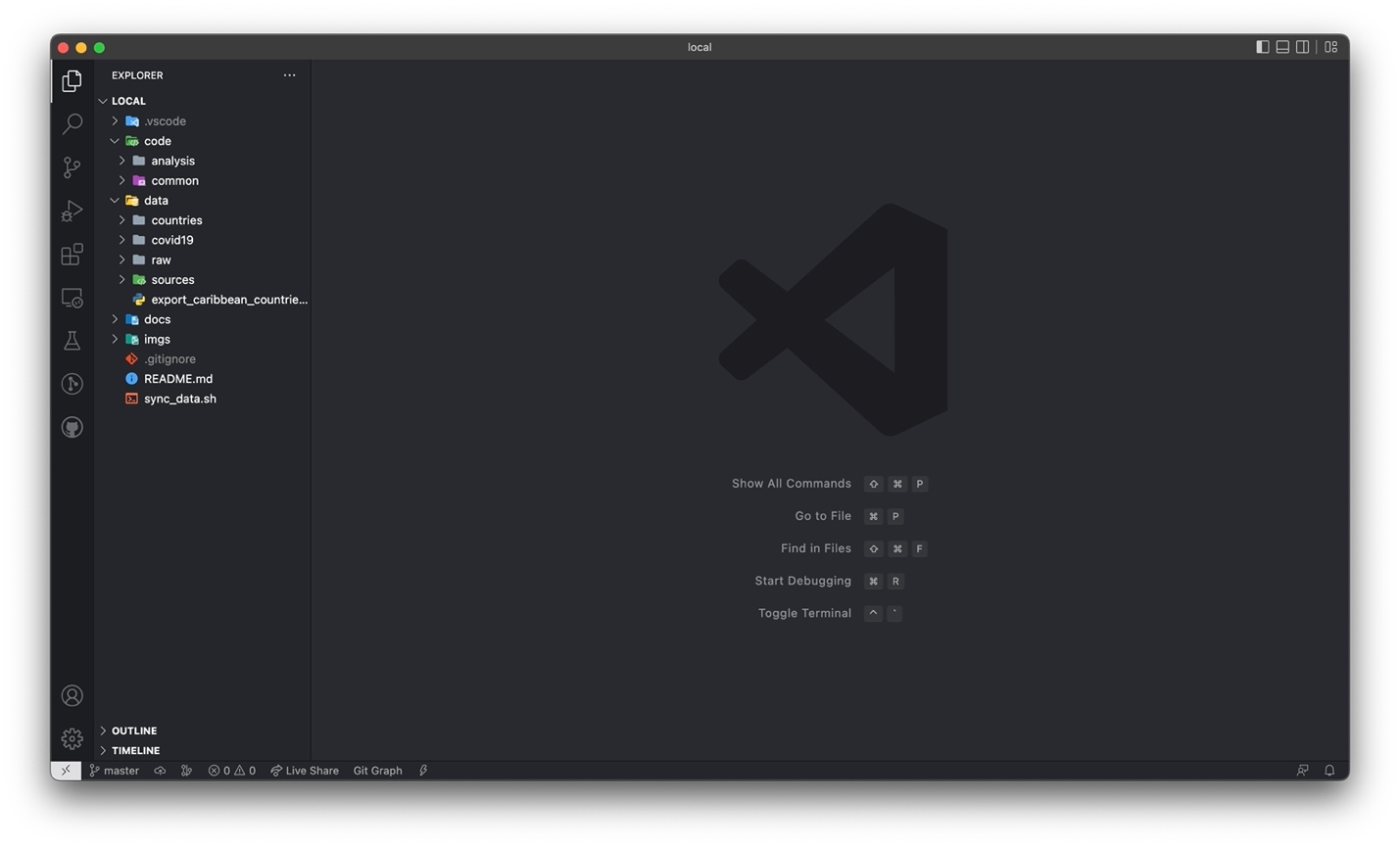


Figure 1: Example of project repository loaded in the Virtual Studio Code IDE

The repository is structured into four main folders with task-specific subdirectories:

* “code”: contains all project code files for data analysis
  + “code/analysis”: has all of the data analysis code of the Caribbean region using Python and JupyterLab, subdivided into folders named for the corresponding Caribbean country
  + “code/common”: includes a Python file with commonly reused code and functions across analyses
* “data”: contains data-specific files, such as scripts for importing and exporting data and subfolders with raw and processed data files
  + “data/countries”: has all per-country data sorted into Excel files with tourism and COVID-19 numbers
  + “data/covid19”: includes all processed COVID-19 data for all Caribbean countries, divided into files storing daily, monthly and yearly rates
  + “data/raw”: contains all raw COVID-19 data for countries around the world extracted from external online repositories
* “docs”: has all documents relating to the development of this senior project, such as the initial senior thesis proposal and final project report
* “imgs”: includes all manually-created and generated images for this project

## Walkthrough of the Repository

We provide a comprehensive walkthrough of the repository and data-generation steps for ease of use by any user who wishes to expand on and use this project as a template.

COVID-19 data

In the “data/raw” directory, there are four CSV files containing raw unformatted information on the number of COVID-19 cases and deaths recorded in the U.S. and countries around the world. These files are downloaded from the Johns Hopkins University’s online GitHub repository on COVID-19 data by the JHU’s Center for Systems Science and Engineering (CSSE), which include cumulative daily COVID-19 rates starting on January 20, 2022.

1. <https://www.imf.org/en/Publications/fandd/issues/2020/12/impact-of-the-pandemic-on-tourism-behsudi> [↑](#footnote-ref-1)