Smooth High-Frequency GDP Indicator with Google Trends

Atin Aboutorabi, Yves Rychener

November 5, 2024

1 Background

The OECD Weekly GDP Tracker [1] developed in response to the need for more timely economic indicators, leverages big data from Google Trends to estimate real-time economic activity. Traditional GDP measurement methods often suffer from significant time lags, delaying crucial information needed for policy and decision-making. The innovative tracker addresses this gap by using the frequency of specific search terms related to economic activities—such as employment, consumption, and business services—to provide weekly estimates of GDP. This real-time approach offers a more immediate and responsive understanding of economic conditions, especially valuable during periods of rapid change like financial crises or economic recoveries. By harnessing the power of big data and advanced modeling techniques, the OECD Weekly GDP Tracker represents a significant step forward in economic monitoring and decision-making.[1]

2 Problem Formulation

While the OECD Weekly GDP Tracker provides valuable real-time economic insights, it suffers from high variability in its weekly estimates, leading to potential volatility that can complicate interpretation and decision-making. This volatility can obscure true economic trends and reduce the tracker's reliability. To address this issue, we propose to enhance the model by introducing an additional term in the objective function that penalizes variability. The optimization problem can then be written as

$$\min_{\theta} \sum_{i=1}^{N} \|y_i - f_\theta(X_i)\|^2 + \lambda V(\theta),$$

where X_i and y_i correspond to the google trend data and GDP at each quarter i. We use the hyperparameter $\lambda > 0$ to tune the regularization strength. For

---

[1]See https://www.oecd.org/economy/weekly-tracker-of-gdp-growth/ for the tracker in action.

example, indexing each week by t and adding a term like $V(\theta) = \sum_t \|f_\theta(X_t) - f_\theta(X_{t+1})\|^2$ can help smooth the estimates by penalizing changes of the estimate between weeks. Students are expected to explore and develop their own solutions to reduce this variability, ultimately improving the stability and reliability of the tracker.

3   Expected Work

The students will undertake the following tasks to enhance the OECD Weekly GDP Tracker:

1. **Replication of Results**: The first step involves replicating the current results produced by the OECD Weekly GDP Tracker. This will provide a solid understanding of the existing model and its performance metrics.

2. **Proposal of Penalty Functions**: Students will explore and propose various penalty functions aimed at reducing the variability in the weekly GDP estimates.

3. **Testing and Validation**: The proposed penalty functions will be implemented and tested against the replicated model. The students will evaluate the performance of each function, focusing on the reduction of volatility and the overall accuracy of the GDP estimates.

4. **Theoretical Justification (Optional)**: While not mandatory, a theoretical justification for the proposed penalty functions—such as a Bayesian perspective or the use of graphical models—will be appreciated. This could provide deeper insights into the rationale behind the chosen methods and their potential advantages.

References

[1] N. Woloszko. Tracking activity in real time with google trends. 2020.