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| **High Discounts and High Unemployment** |

**Paper by Robert E. Hall**

**Replication by Joshua Foxworth**

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| **Introduction**   * The author1 is trying to demonstrate that the discount rate is the main factor determining the unemployment rate instead of changes in productivity * They built a DMP based model which incorporates small productivity changes as well as market tightness, which is an indicator for the discount rate * They use this model to predict the unemployment rate with data2 from 1948-2015 * Because the discount rate is the major factor in the model and it remains predictive, the discount rate is the main driver of unemployment.   **Motivation**   * I wanted to improve my model building abilities and build a deterministic model in R * The paper presents interesting models for the stock market and unemployment, which I wanted to duplicate * The paper’s decision to use a mix of Excel templates and Matlab code presented an interesting challenge in duplication | **Research Question**   * Can the paper’s Excel and MatLab unemployment predictions be fully replicated in R?   **Methods**   * Took data2 provided by the author and the American Economic Review * Placed each month into one of twenty-five state value buckets, which are created based on the ratio of vacancies to unemployment for that month * Calculated the average discount and growth rates for each state using the system of equations from the credible bargaining model and the pracma R package3 * Used these factors to compute the average market tightness value for each state * Used the computed monthly average tightness value to estimate the unemployment rate from 1948-2015 using the DMP model and the 1947 unemployment rate as a starting value * Compared this predicted unemployment to the paper’s predicted unemployment rate |
| * The graph4 has the predicted data (Orange) overlaid with data provided from the original paper2 (Green) * The orange predictions can almost never be seen, indicating that the two graphs are functionally identical * These rates are compared with the actual unemployment rates (Blue) which they are attempting to predict | |
| **Results**   * The mean is 5.577 and the median is 5.500 for both data sets * The variance for the paper’s predictions is 0.9549   while the predicted variance is 0.9537   * The squared difference between the two data sets is 20.49 with a square root of 4.53 * The two data sets are functionally identical   **Discrepancies**   * The Matlab function fsolve is used to calculate the minimum of a set of functions * The R package pracma3 provides an fsolve alternative that is based on the same algorithms * fsolve is implemented differently enough in the pracma3 library to add small differences to the results | **Conclusion**   * Using the provided data2, the paper’s results are replicable * The paper’s conclusion that the discount rate is the largest driver of unemployment seems to be credible   **Further Work**   * Replicate the results using data from original sources instead of the using data provided by the author * Use the replicated model with post 2015 data to attempt out of sample predictions   **Citations**   1. Hall, Robert E. 2017. "High Discounts and High Unemployment." *American Economic Review*   , 107(2): 305-30   1. Hall, Robert E.2017. “High Discounts and High Unemployment: Datasets.” *American*   *Economic Review.* https://doi.org/10.1257/aer.20141297.   1. Hans Werner Borchers (2017). pracma: Practical Numerical Math Functions. R package   version 2.0.4. https://CRAN.R-project.org/package=pracma   1. H. Wickham. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag New York, 2009. |