South Korea's Steady Decline in Birth Rate is Not Expected to Level Unless Measures are Taken*

Eunkyo Oh

27 April 2022

Abstract

The Republic of Korea's birth rate is decreasing at an alarming pace and it shows no signs of slowing down. In this paper, we examine correlations with variables that depict economical status of the general population, and project future birth rate in upcoming years. From the data at the World Bank, we visualize the data to show that the increase in housing prices and CPI has greatly affected the birth rate, and perform regression analysis to predict that there are no visible signs of birth rate recovering. This outcome implies a rapid decline in population and inevitable stress the younger population will have to withstand in order to support the growing old population.

Keywords: south korea, birth rate, decreasing birth rate, population, aging population, regression studies, world bank

1 Introduction

Republic of Korea's birth rate is at it's all time low and it dipped below 1 birth per women, at 0.84 in 2020 (Fadanelli 2022). It is the second lowest in the world, after Taiwan, while United States and Japan sits at 1.72 and 1.42 respectively. This is a problem since the low birth rate combined with aging population creates a huge burden on its workforce to sustain the nation's tax revenue and health care systems (Nargund 2009). The problem can be traced back to the 1950s where Korea had its baby boom. Following a huge jump in population, the Korean government imposed an anti-naturalistic policy in the 1960s where several contraceptives were abundantly distributed and introduced to the public. Since then, the trend of declining birth rate have been noticed but was regarded as a problem that would stabilize on its own until the 1980s (Kim 2005). However, contrary to the expectation, it continued to dwindle until today. Many scholars point at the following reasons: intense competition in education and employment, low sense of economical security, and higher education along women (Ryall 2021). Although it has never increased since, the government hopefully anticipates that the birth rate will bounce back to 1.0 by 2031 (Lee 2021). In this paper we examine possible economical reasons for it and perform regression models to further predict whether the birthrate will continue to decrease.

With the data obtained from the World Bank, we will perform multiple analyses on the crude birth rate variable. Crude birth rate is reported by number of births per thousand population in each year. I hypothesize that the crude birth rate decreasing has a strong correlation with economical status of the general population. To confirm the hypothesis we will use visualization to demonstrate a clear relationship to the reader. After that we will perform nonlinear regression on the crude birth rate variable to estimate the trend and assess the severity of the issue in the next couple years. The projected results show that the decline in birth rate is far from flattening and will continue to decrease at least for the near future. This is a concerning outcome that needs to be addressed socially.

*Code and data are available at: github.com/oheunkyo/Decreasing-Birth-Rate-of-Korea

Table 1: First ten rows of the Dataset with only necessary columns

	Post-Secondary Enrollment (Female)	Percentage of Female in Workforce	Percentage of Male in Workforce	Ne
1960	NA	27.920	NA	NA
1961	NA	NA	NA	NA
1962	NA	NA	NA	NA
1963	NA	NA	NA	NA
1964	NA	NA	NA	NA
1965	NA	NA	NA	NA
1966	NA	31.42	NA	NA
1967	NA	NA	NA	NA
1968	NA	NA	NA	NA
1969	NA	NA	NA	NA

The remainder of the paper is as follows: Section 2 comments on the data source and performs the analyses the correlation between the variables of focus using plots and tables. Section 3 constructs a nonlinear regression model to predict future birth rates. Section 4 explains the conclusion reached by the data and the model. Following the conclusion there are three discussion points in Section 5. Then the paper concludes by going over weaknesses and ideas for next steps in Section 5.3.

2 Data

The data we are going to analyze is the annual summary of crude birthrate and other relevant economical variables of the country profile of South Korea. We obtain the data from the World Bank open data portal (2020). The dataset consists of all recorded data of the nation in four categories: 'Social,' 'Economic,' 'Environment,' and 'Institutions.' It includes more than 1400 variables and data for each variable starting from the year 1960 to 2020. From the dataset, we focus on the relevant rows in respect to our topic, and remove all unnecessary rows. We modify and clean our data using packages `tidyverse` (Wickham et al. 2019) and `janitor` (Firke 2021) using the and the statistical programming language R (R Core Team 2020).

After obtaining our data, we reduce the number of variables to only contain the necessary columns. In this paper, we will focus on six columns. `Birth rate, crude (per 1,000 people)` is our variable of focus. It displays the yearly crude birthrate per 1000 people. `Labor force participation rate, female (% of female population ages 15+)` shows the percentage of female population over 15 years of age in the labor force. Similarly, `Labor force participation rate, male (% of male population ages 15+)` shows the percentage of female population over 15 years of age in the labor force. `School enrollment, tertiary, female (% gross)` shows the percentage of women enrolled in tertiary education each year. Tertiary education denotes post-secondary education, such as colleges and universities. `School enrollment, tertiary, male (% gross)` denotes the percentage of male population enrolled in tertiary education each year. Lastly, `Adjusted net national income per capita (current US$)` shows the net national income per each individual in current value of U.S. dollars, adjusted for inflation. From the variables over 1400, we pick the six variables to be our focus. Each variable contains numeric values. The dataset has been transposed from the original to put the years as rows and the variables to columns.

Table 1 represents the first ten rows of our dataset. The table was created with `knitr::kable()` (Xie 2021). We are interested in which variables show signs of correlation with the crude birthrate. Some values of the columns are missing before the 1970's. We will analyze with the figures below. Figures in the paper were created with `ggplot2` (Wickham 2016)

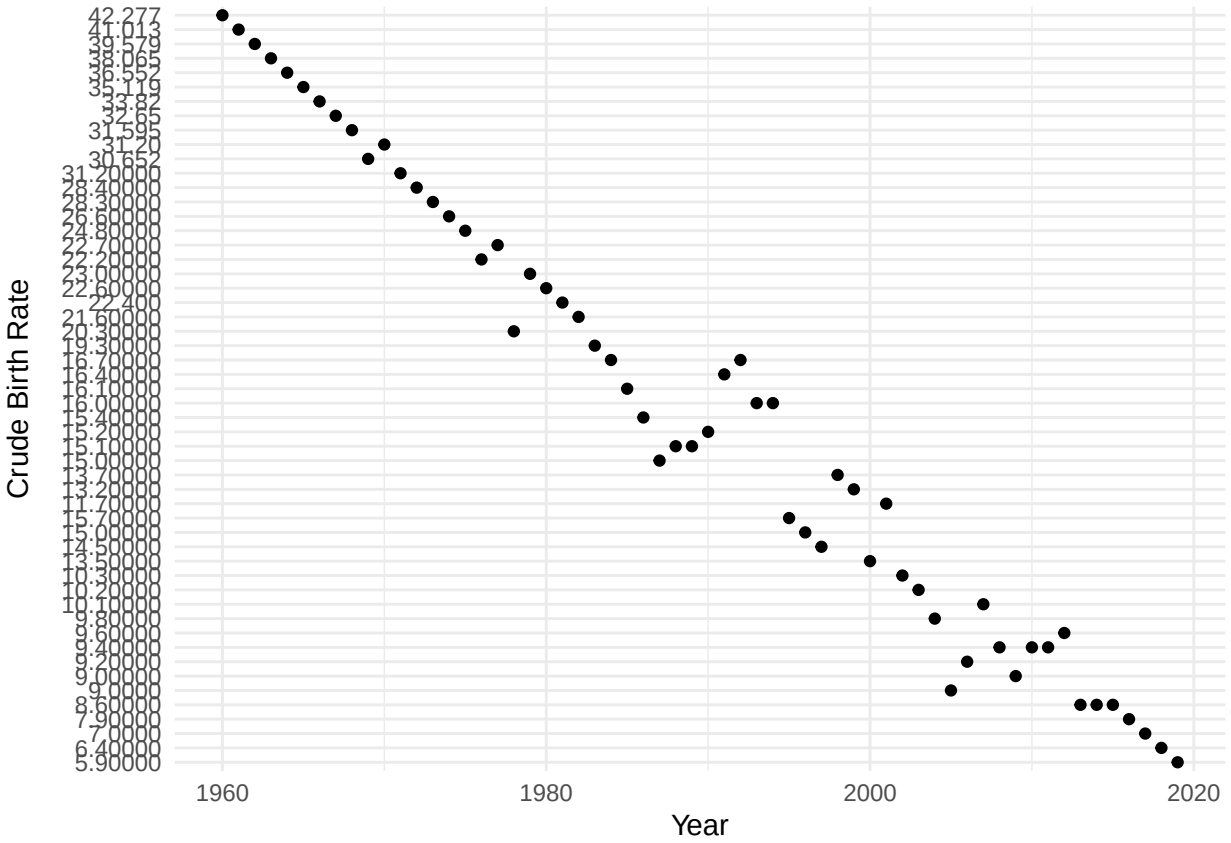


Figure **??** represents the crude birthrate of the South Korean population over the years. It is clearly decreasing in a dramatic way.

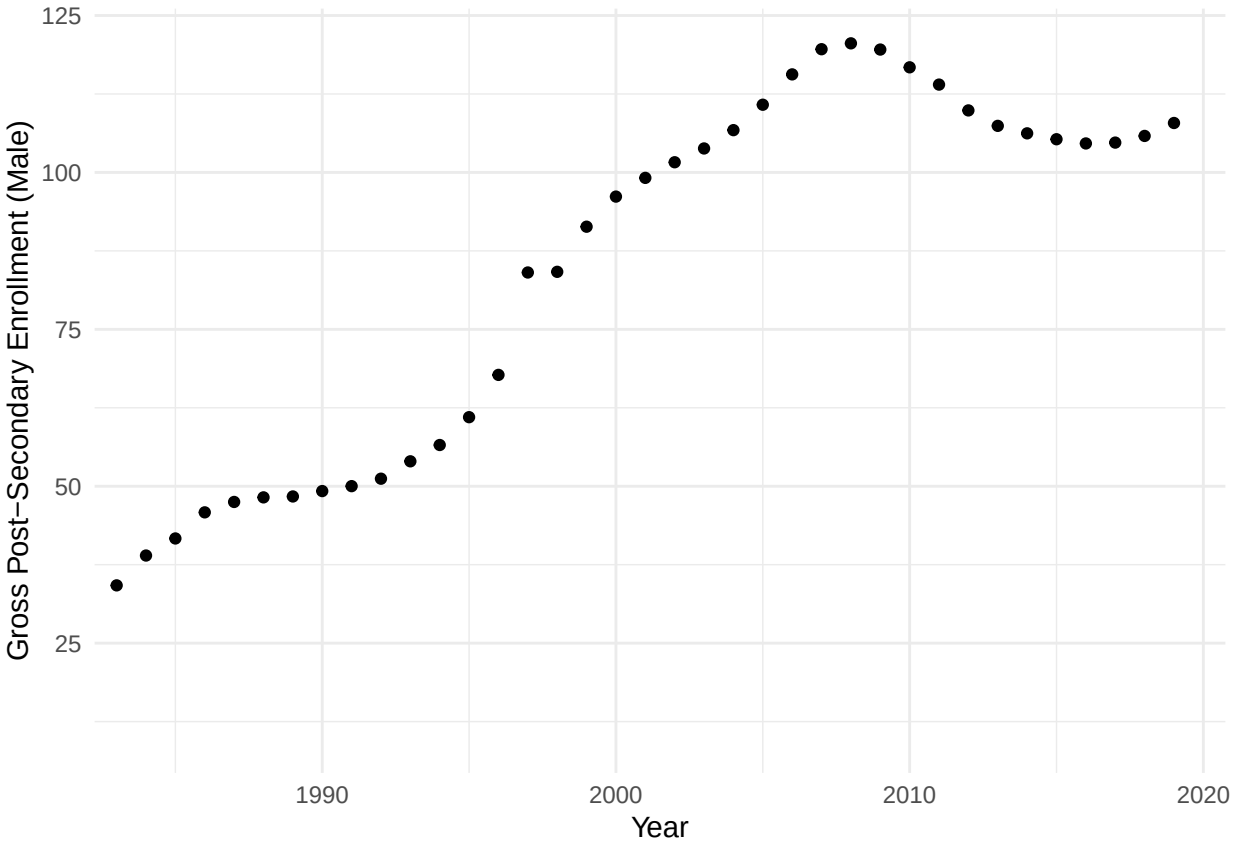


Figure 1: Gross Post-Secondary Enrollment of Males Over the Years

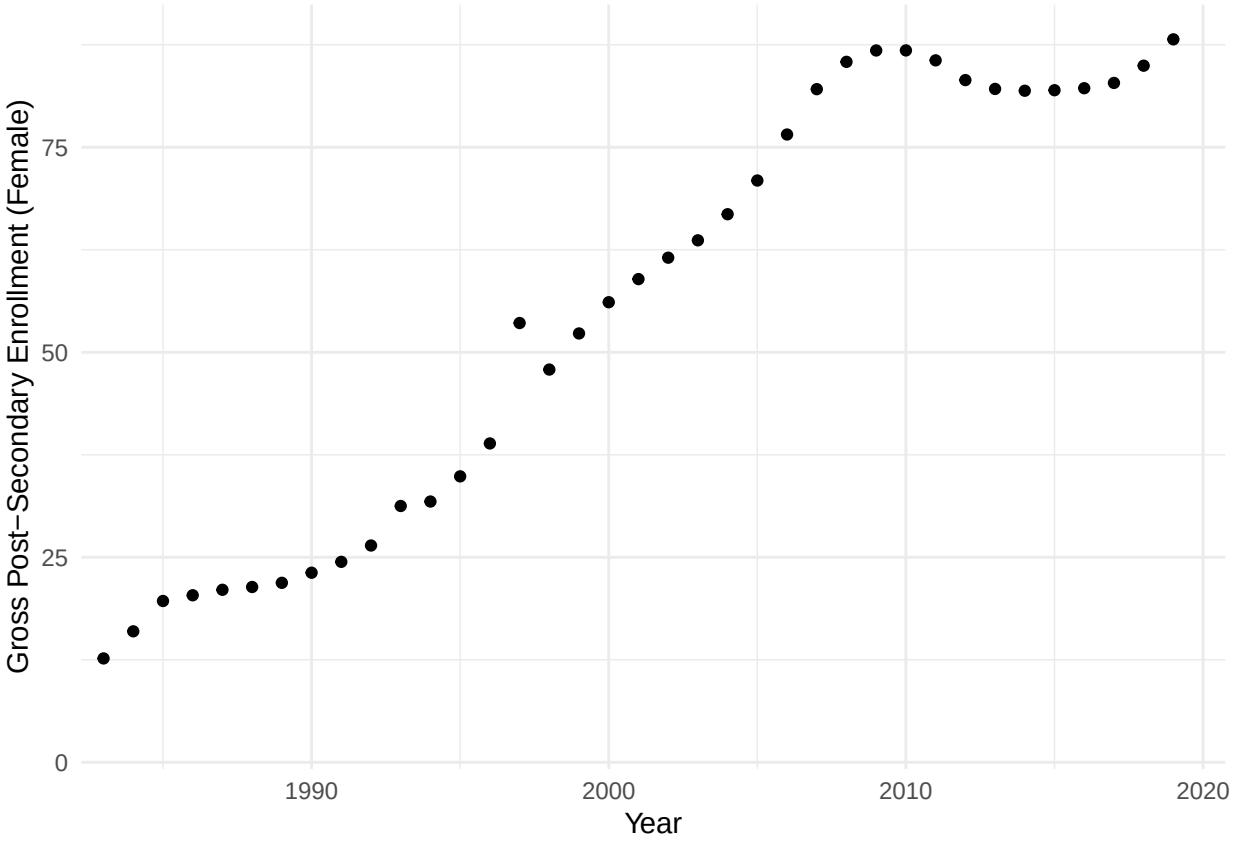
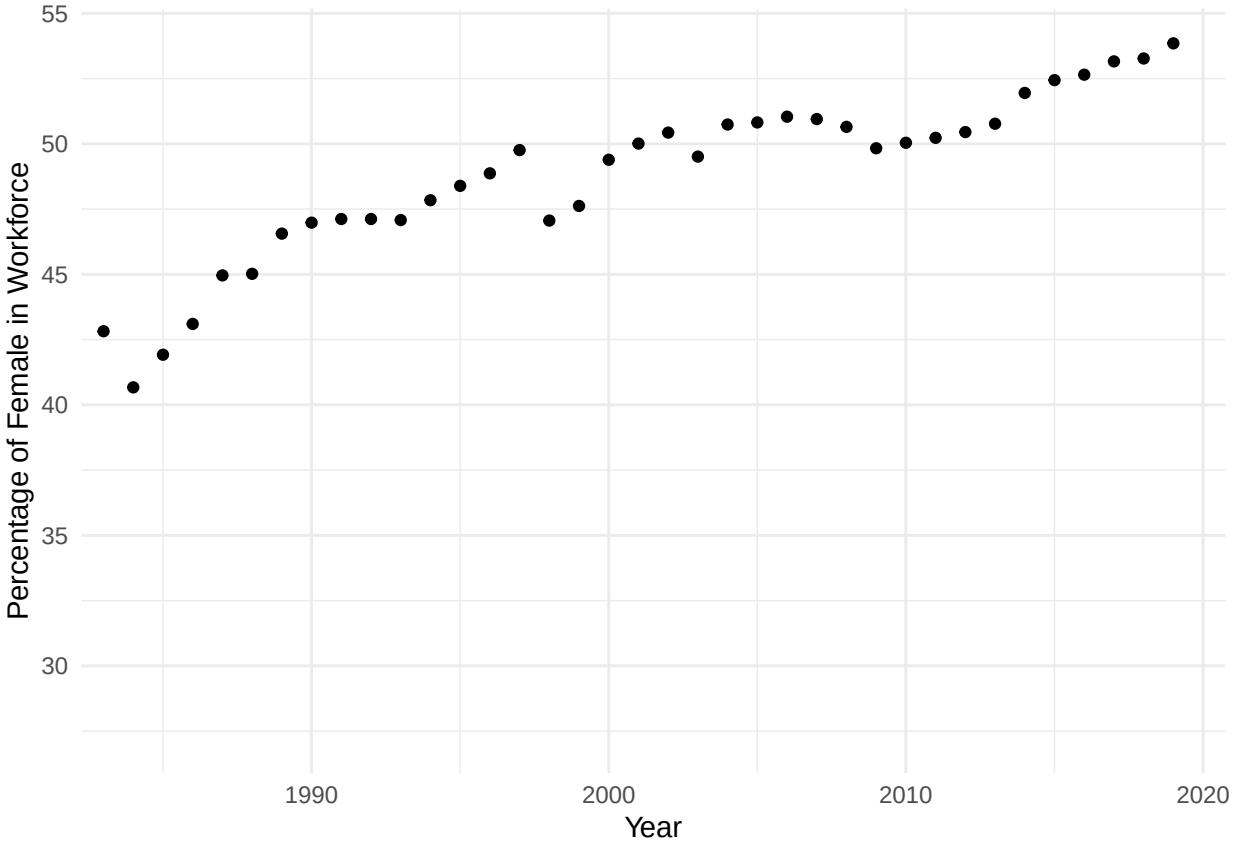


Figure 1 and Figure **??** shows the tertiary enrollment of of male and female. Since it is a gross enrollment value, the value can go over 100 percent.



There are similar trends with the two variables.

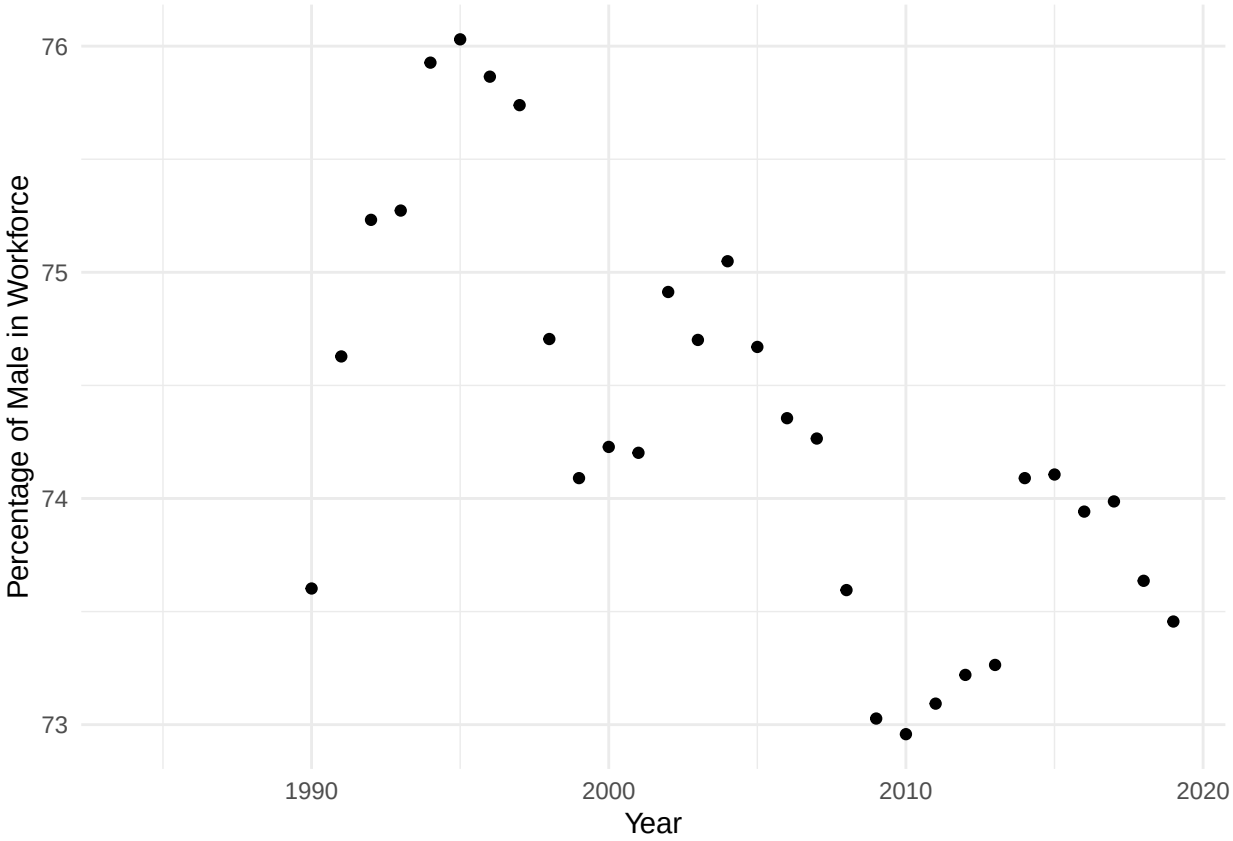


Figure **??** and Figure **??** shows the percentage of population over the age of 15 in the workforce. As you can see the percentage for female is steadily increasing whereas the percentage for male do not show a discernible pattern.

3 Model

We will perform linear regression

validation

4 Results

Results show that there is an inverse relationship of birthrate to tertiary enrollment. There also seems to be a

5 Discussion

5.1 First discussion point

5.2 Second discussion point

5.3 Weaknesses and next steps

Appendix

A Additional details

B Enhancement

References

2020. "Korea, Rep. Data."

Fadanelli, Julia. 2022. "Beyond the Data: South Korea's Birth Rate." *Korea Economic Institute of America*. https://keia.org/the-peninsula/beyond-the-data-south-koreas-birth-rate/.

Firke, Sam. 2021. *Janitor: Simple Tools for Examining and Cleaning Dirty Data*. https://CRAN.R-project.org/package=janitor.

Kim, Doo-Sub. 2005. "Theoretical Explanation of Rapid Fertility Decline in Korea." *The Japanese Journal Population* 3 (1).

Lee, Jiyeun. 2021. "The World's Lowest Fertility Rate Is about to Get Even Lower." *Bloomberg.com*. Bloomberg. https://www.bloomberg.com/news/articles/2021-12-09/world-s-lowest-fertility-rate-to-get-even-lower-korea-reports.

Nargund, G. 2009. "Declining Birth Rate in Developed Countries: A Radical Policy Re-Think Is Required." *Facts, Views &Amp; Vision in ObGyn*. Universa Press. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4255510/.

R Core Team. 2020. *R: A Language and Environment for Statistical Computing*. Vienna, Austria: R Foundation for Statistical Computing. https://www.R-project.org/.

Ryall, Julian. 2021. "What's Behind South Korea's Population Decline?" *DW.COM*. https://www.dw.com/en/whats-behind-south-koreas-population-decline/a-60210895.

Wickham, Hadley. 2016. *Ggplot2: Elegant Graphics for Data Analysis*. Springer-Verlag New York. https://ggplot2.tidyverse.org.

Wickham, Hadley, Mara Averick, Jennifer Bryan, Winston Chang, Lucy D'Agostino McGowan, Romain François, Garrett Grolemund, et al. 2019. "Welcome to the tidyverse." *Journal of Open Source Software* 4 (43): 1686. https://doi.org/10.21105/joss.01686.

Xie, Yihui. 2021. *Knitr: A General-Purpose Package for Dynamic Report Generation in r*. https://yihui.org/knitr/.