APPENDIX A

Matrix Operations with Excel

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A.1 Introduction

Few researchers and professionals know about Excel's capability in matrix operations. Excel wide availability and its intuitive design makes it an appealing platform for experimenting with matrix operations. You may want to know that many built-in Excel matrix functions are also available in Google Sheets. However, my focus in this Appendix A is on Excel. To manipulate small matrices in Excel, the learning curve is almost flat. If you are already a regular user of the statistical software R, then there is no need to worry about Excel because R's capability in matrix operations cannot be matched neither by Excel nor by any other software that I know. However, if you are both an R and Excel user like myself, then you may still find Excel more convenient for doing some quick matrix manipulations. Microsoft 365 in particular makes matrix operations very interactive in the sense that once the formula is keyed in, you can modify a single element of the input matrix before the results are automatically updated.

Excel's documentation uses the term array to designate a matrix or a vector. The term array is mainly used in computer science, whereas matrix is a term that belongs to mathematics. In linear algebra, matrices and vectors are 2 distinct object types, which are represented differently in a coordinate system. In Excel, an array is a set of contiguous cells. Whether the content of these cells represents a vector or a matrix is irrelevant to Excel. But when using Excel for matrix operations, you need to be aware of what the cell content represents. It is because matrix functions, known as array functions in Excel's language, follow the same logic matrix operations are built upon.

In this appendix, I will briefly discuss some useful Excel functions that you may use to replicate some the results presented in this book. Some of the reviewed functions are built in Excel while others were built by me and made available in an Excel template named `pca.xlsm`. This Excel template contains a series of functions, which can be used to perform various matrix operations as well as a complete principal component analysis. The `pca.xlsm` Excel template can be downloaded at the following address:

`https://agreestat.com/books/princomp/pca.xlsm`