Tips + Tricks with LaTeX and Beamer for (Really Young) Economists

Kevin Lai
Federal Reserve Bank of New York

Brendan Moore
Federal Reserve Bank of New York

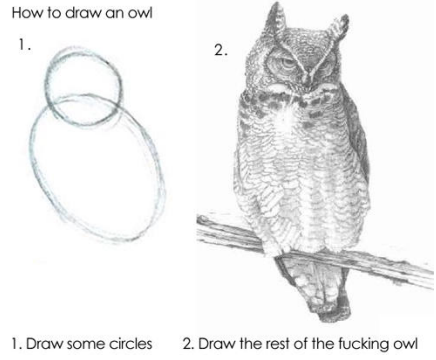
July 24, 2020

What is LaTeX?

- Document preparation and typesetting system used across the sciences & social sciences.
- Developed first as a language typesetter with embedded scripting language, then as a bunch of macros on top of that by Leslie Lamport (LaTeX= Lamport TeX)

Purpose

- To convince RAs to use LaTeX when reporting results to economists.
- Instill good LaTeXpractices in RAs.
- You will be more eager to use LaTeX instead of Word or Powerpoint. (We're assistant economists, not investment bankers or consultants)
- In the future, avoid comments from peers at the New York Fed like "I can't believe he wrote this in Word, he's an AP at Princeton!"



Topics to cover

- Introduction
- PDFs
- Bibliography Management
- Beamer
- Best Practices

Introduction

- Document preparation and typesetting system used across the sciences and social sciences

- Pros:
  - FREE (makes your work seem a lot more professional than it actually is)
  - Updating your wrong figures and results are really easy (just recompile)
  - Formatting and bibliography become a breeze

- Cons:
  - Basic things and syntax errors might take you a whole day
  - Lots of options and packages

Introduction

DESPITE THE CONS, IT IS STILL WORTH IT!

Sample LaTeX Document

```
% Declare document type: e.g. article, book, beamer
\documentstyle{article}[11pt]

% Use some packages
\usepackage{amsmath}
\usepackage{graphicx}

\begin{document}

\title{My Paper}
\author{My Name}
\maketitle
\tableofcontents % if desired

Intro text

\section{Section Name}

\subsection{Subsection Name}

Here is an equation:

\begin{equation}
s_t = T s_{t-1} + R \epsilon_t + C
\end{equation}

Here is some inline math: $s_t$ is a vector of states.
\end{document}
```

PDFs

What are all these other files generated by pdflatex?

- Common file extensions:
  - `.aux`: stores information from compiler run, including cross-references
  - `.bbl`: bibliography file output; produced by BibTeX, used by LaTeX
  - `.log`: detailed account of last compilation
  - `.pdf`: compiled result
  - `.toc`: stores section headers, used to produce table of contents
- These ancillary files (including the PDF) should not be git-tracked. Add the file extensions to your `.gitignore`

PDFs

Where do I start?

- Preamble and Packages
- Body of document
  - How to include graphics
  - How to make tables
  - Appendicies (optional)

PDFs

"Preamble"

```
% Declare document type: e.g. article, book, beamer
\documentstyle{article}[11pt]

% Use some packages
\usepackage{amsmath}
\usepackage{graphicx}

\begin{document}

\title{My Paper}
\author{My Name}
\maketitle
\tableofcontents % if desired

Intro text

\section{Section Name}

\subsection{Subsection Name}

Here is an equation:

\begin{equation}
s_t = T s_{t-1} + R \epsilon_t + C
\end{equation}

Here is some inline math: $s_t$ is a vector of states.
\end{document}
```

PDFs

Useful packages!

- `booktabs`: "publication quality tables"
- `fullpage`: set all margins to 1 inch
- `graphicx`: enhanced support for graphics
- `hyperref`: URL support
- `textgreek`: all the Greek symbols you might want in an equation
- `longtable`: break tables across pages sensibly
- `amsmath, amssym, amsfonts`: almost anything math-related
- `float`: Ensures more natural placement and labeling of figures

PDFs

How to include graphics:

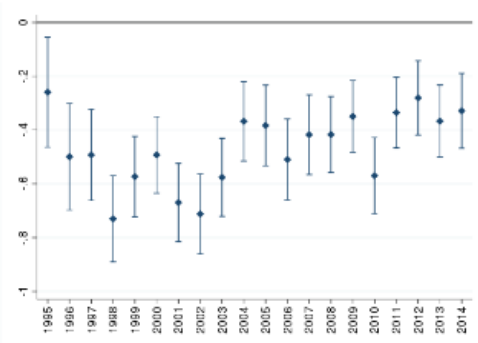
```
\begin{figure}
    \centering
    \caption{$KC \times efd$ across time}
    \label{fig:KC_coefplot}
    \includegraphics[width=0.8\textwidth]{}
    \caption*{Note: This plot shows the cross-sectional coefficients
    of $KC \times efd$ of our baseline result for each year.}
\end{figure}
```

Reference the figure number:

```
Figure \ref{fig:KC_coefplot} is a sample coefficient plot.
```

PDFs

Figure 1: $KC \times efd$ across time



Note: This plot shows the cross-sectional coefficients of $KC \times efd$ of our baseline result for each year.

Figure 1 is a sample coefficient plot.

PDFs

How to create tables:

```
\begin{table}[H]\centering
\caption{PCA of Business Complexity Variables}
\label{tab:pca}
\begin{tabular}{l*{2}{c}}
\hline\hline
&       Comp1&       Comp2\\
\hline
Non-Financial Count Share&        0.45&       -0.16\\
$CountB$              &        0.60&        0.28\\
$CountBHHI$  &       -0.17&        0.94\\
$CountN$              &        0.64&        0.10\\
\hline
\end{tabular}
\end{table}
```

PDFs

Table: PCA of Business Complexity Variables

	Comp1	Comp2
Non-Financial Count Share	0.45	-0.16
CountB	0.60	0.28
CountBHHI	-0.17	0.94
CountN	0.64	0.10

PDFs

How to reset page, section, table, and figure counters for appendix:

```
\renewcommand{\thesection}{\arabic{section}}
\renewcommand{\thetable}{\arabic{table}}
\renewcommand{\thefigure}{\arabic{figure}}
\renewcommand{\theequation}{\arabic{equation}}
\setcounter{table}{0}
\setcounter{figure}{0}
\setcounter{footnote}{0}
\setcounter{section}{0}
\setcounter{page}{0}
\setcounter{equation}{0}
```

Bibliography Management

- Use `natbib` package to automatically update references and sources.
- In your preamble, write:

```
\usepackage[authoryear]{natbib}
\bibliographystyle{ecta} %"ecta": alias for econometrica
```

- Use `ecta` bib style to pretend your working paper is in *Econometrica* (cool look)

Bibliography Management

Bibliography Management

- At the end of your `.tex` file, to include a bibliography:

```
87
88
89  % At the end of the document
90  \bibliographystyle{apalike}  % others include econ, mla, science
91  \bibliography{biblio}   % name of your .bib file
92
93
```

Bibliography Management

- Store references in a separate `.bib` file
- Each reference has its own name that you can choose

```
105
106 @article{song2018firming,
107   title={Firming up inequality},
108   author={Song, Jae and Price, David J and Guvenen, Fatih and Bloom,
      Nicholas and Von Wachter, Till},
109   journal={The Quarterly Journal of Economics},
110   volume={134},
111   number={1},
112   pages={1--50},
113   year={2018},
114   publisher={Oxford University Press}
115 }
116
```

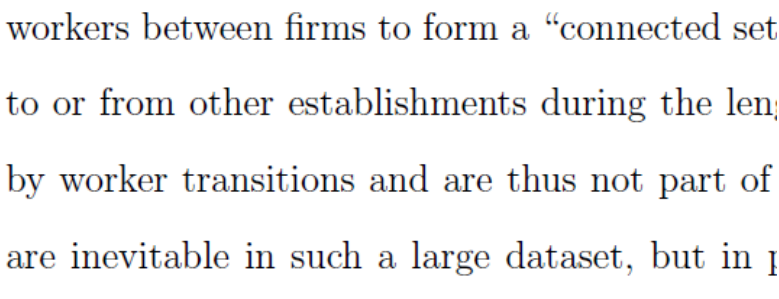
Bibliography Management

- In `.tex` file, can cite the work you list in your `.bib` file for in-text citation

```
to the claim that ``where you work" matters for ``what you
the American context, recent work suggests the role firm pr
the wage structure is more pronounced today than during the
1980s\footnote{\cite{song2018firming} use U.S. Social Secur
employer-employee matched data to argue that two-thirds of
the variance of log earnings between 1978 and 2013 occurred
rise in the dispersion of average earnings between firms.}
setting of JLS's paper. Using matched employer-employee dat
developed the following model for log earnings of person $i
```

Bibliography Management

- In `.tex` file, can reference the work you list in your `.bib` file for in-text citation


workers between firms to form a "connected set

to or from other establishments during the len

by worker transitions and are thus not part of

are inevitable in such a large dataset, but in

[7] Song et al. (2018) use U.S. Social Security employe
in the variance of log earnings between 1978 and 2013
between firms.

Bibliography Management

- At the end of the document, the bibliography includes the full citation

Song, J., D. J. Price, F. Guvenen, N. Bloom, and T. Von Wachter (2018): "Firming up inequality," *The Quarterly Journal of Economics*, 134, 1–50.

Bibliography Management: More about `.bib` files

- Many other entry types besides `article` available, including `book`, `techreport`, and `conference`
- Different field types for each entry type; required fields vary by entry type
- In the `article` entry type, only the author, title, journal and year are required.

Bibliography Management: Other Programs and Packages

- `bibtex` and `biber`: external programs that process bibliography information and interface between your `.bib` and `.tex` files
  - `bibtex`: very stable, widely used
  - `biber`: able to deal with more entry and field types, can handle Unicode characters

- `natbib` and `biblatex`: LaTeX packages that format citations and bibliographies

Beamer

- Beamer is a package used for creating presentations (including this one, which we accidentally almost made in PowerPoint instead)
- ”beamer” is a document class like ”article”
- USE 16:9 SLIDES!

Beamer

Preamble:

```
\documentclass[notes,11pt, aspectratio=169]{beamer}
```

Make sure to include your packages!

Title slide!

```
\title[]{\textcolor{blue}{Tips + Tricks with \LaTeX and Beamer for
(Really Young) Economists}}
 \author[]{}
 \institute[FRBNY]{\small{\begin{tabular}{c c c}
 Kevin Lai &&  Brendan Moore  \\
 Federal Reserve Bank of New York && Federal Reserve Bank of New York \\
 \end{tabular}}}

 \date{\today}
```

Beamer

To create a slide:

```
\begin{frame}
[Insert contents of slides]
\end{frame}
```

Shrinking graphics or tables to fit slides:

```
\resizebox{0.8\linewidth}{!}{
\centering
\includegraphics[]{GRR_emp_ex_USD_bar.png}
}
```

Beamer

16:9 slides will make slides look a lot better on screens.

```
\documentclass[notes,11pt, aspectratio=169]{beamer}
```

For more best practices of beamer slides:
`https://paulgp.github.io/beamer_tips.html`

Best Practices

- Split up text into multiple `.tex` files and include them all in your main `.tex` file using "input" or "include"

```
\section{Introduction} \label{sec:introduction}
\input{introduction.tex}

\section{Empirical Approach} \label{sec:metric}
\input{metric.tex}

\section{Data} \label{sec:data}
\input{data.tex}
```

  - "Input" is preferred because "include" forces a page break, can't be nested witin other includes.
  - You can even do this for your extra packages so you don't see them in your main file

- Use `pdfpages` package to insert existing PDFs

Best Practices

GUIs: press button to compile, view source and compiled document side by side

- LyX
- TeXShop
- TeXWork
- TeXStudio
- ShareLaTeX/Overleaf

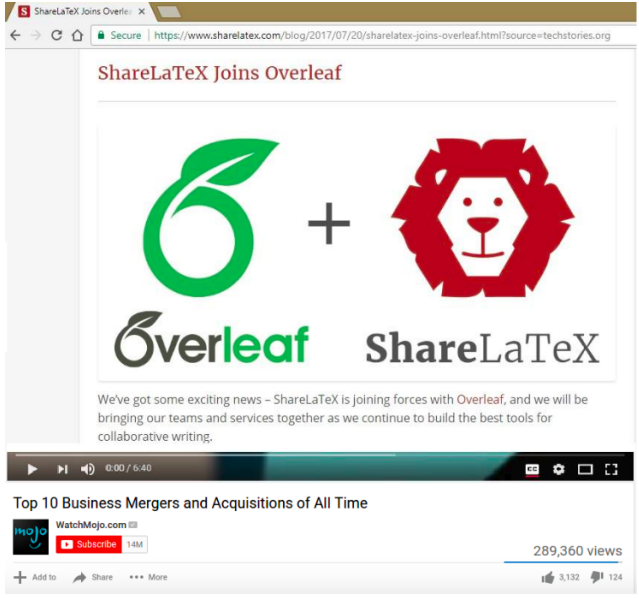
Best Practices

The New York Times

T-Mobile-Sprint Merger Is Approved by Justice Dept., Clearing Major Hurdle

A Sprint store in Manhattan. Under the terms of the deal approved by the Justice Department on Friday, T-Mobile will pay $26 billion to acquire Sprint. Brittainy Newman/The New York Times

Best Practices



Best Practices: Using Commands

Can use commands to reduce boilerplate, write math symbols:

In `plots.tex`:

```
\includegraphics{\plotdir/plot1.pdf} \\
\includegraphics{\plotdir/plot2.pdf} \\
\includegraphics{\plotdir/plot3.pdf}
```

In `main.tex`:

```
\newcommand\plotdir{model1}
\input{plots}

\renewcommand\plotdir{model2}
\input{plots}

\renewcommand\plotdir{model3}
\input{plots}
```

Best Practices: Using Commands

Syntax:

```
\newcommand{name}[num]{definition}
```

- `num` defines the number of arguments; defaults to 0 if omitted
- Don't always need an argument
- Can reference your command referring to name

Example:

```
\newcommand\R{\mathbb{R}}
```

Then

```
$\R$
```

prints $\mathbb{R}$

Best Practices: Using Commands

Useful for typing-intensive math commands

```
\newcommand{\N}{\mathbb{N}}
\newcommand{\Q}{\mathbb{Q}}
\newcommand{\p}{\mathbb{P}}
\newcommand{\R}{\mathbb{R}}
\newcommand{\Z}{\mathbb{Z}}
\newcommand{\E}{\mathbb{E}}
\newcommand{\F}{\mathcal{F}}
\newcommand{\B}{\mathcal{B}}
\newcommand{\G}{\mathcal{G}}
\newcommand{\Om}{\Omega}
\newcommand{\norm}[1]{\left\lVert#1\right\rVert}
\newcommand{\eps}{\epsilon}
\DeclareMathOperator{\Ima}{Im}
\newcommand{\fa}{\; \forall \;}
\newcommand{\df}[1]{\textbf{Def. #1:}}
\newcommand{\pspace}{\left(\Omega,\F,\p\right)}
\newcommand{\abs}[1]{\left| #1 \right|}
\newcommand{\st}{\text{ s.t. }}
\newcommand{\ds}{\displaystyle}
\newcommand{\veps}{\varepsilon}
```