#### LATEX Morkshop

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# Plan for the Workshop

- Introduction.
- Why bother learning LATEX?
- Challenges and downsides.
- Basic structure of a LATEX document and compiling.
- Bibliographies.
- Article-style document: Formatting, figures, tables, bibliographies, equations (accompanying template).

Introduction
Why bother learning LATEX
Challenges
Structure and compiling
Bibliographies

#### Introduction

### What is LATEX?

LATEX is a typesetting language that allows you to produce publication-ready documents.

Give you a jump start into working with LATEX.

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#### Key to learning LATEX

- Good template.
- Basic idea of the structure of LATEX documents.

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- Good template.
- Basic idea of the structure of LATEX documents.
- Google should be your bff.
- Willingness to suffer a bit in the beginning.

# Friendly Warning

If your dissertation is due in 2 weeks,  $\frac{do\ not}{}$  start typesetting it in LATEX now!

Typography Separation of content and presentation ntegration of data from other sources Math typesetting and formal presentatior

# Why bother learning LATEX

• Free, open source.

- Free, open source.
- Beautiful typesetting.

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- Inserting and updating tables/figures from R or Stata.
- Inserting/updating bibliographies.
- Math typesetting and formal presentation (game trees, diagrams).

Typography
Separation of content and presentation
Integration of data from other sources
Math typesetting and formal presentation

# LATEX—The quiz!

The positioning of a specific armed non-state actor along the two dimensions might vary considerably across space and time. For example, certain cartels in Mexico might have a higher capacity and willingness to bend the rules of the game and project control into their areas of influence than others. Therefore, it should be noted that this theoretical approach is action-based and tied to a spatio-temporal unit, as opposed to specific actor identities. It is the nature of the predominant security challenge that a government faces in a specific spatio-temporal unit, rather than the identity of the violent non-state actor, that is thought to influence its welfare spending. Suppose for example, that rebel group q has some territorial control at time t in the subnational area  $i_1$ , but not in area  $i_2$ . Therefore, I expect to see group q conducting guerrilla-style attacks in area  $i_1$  and terrorist-style attacks in area  $i_2$ , both at time t. Consequently, in the next period t+1, we should see higher levels of subnational welfare spending in area  $i_1$  than in area  $i_2$ , even though the governments of both areas face the same opponent a.

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#### INTRODUCTORY STATISTICS LECTURE

#### Segment on Hypothesis Testing

- Segment: three 50 minute class sessions (like IR 211 class).
- Segment after the midterm, i.e. second third of the class, when students are familiar with basic concepts such as sample, population, standard error, t-test, p-values, etc.
- Learning objective:
  - O What is hypothesis testing and why is relevant?
  - o How does it help us to understand statistical relationships?
  - O How is it done (focus on one sample and two sample tests)?
  - O What are some of the fallacies with regard to hypothesis testing?
- I assume that most students are PoliSci or IR majors.
- All mathematical examples for practicing hypothesis tests in class will be presented as
  cases that are either directly relevant to political science or IR, or present interesting
  real-world scenarios.



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  scenarios.



Dependent Variable:  Naval Tonnage Index				
	0.971*** (0.004)	0.970*** (0.004)	0.970*** (0.004)	0.971*** (0.004)
2.247*** (0.077)	0.146*** (0.020)	0.126*** (0.024)	0.120*** (0.024)	0.147*** (0.019)
		-0.002* (0.001)	-0.002** (0.001)	
			1.597*** (0.268)	1.617*** (0.260)
4,226	4,226	4,051	4,051	4,226
0.169	0.955	0.956	0.956	0.956
	2.247*** (0.077)	Na (1) (2) (0.971*** (0.004) (0.077) (0.020) (0.020)	Naval Tonnage In  (1) (2) (3)  0.971*** (0.004) (0.004) (0.004)  2.247*** (0.077) (0.020) (0.024) (0.020) (0.024)  4.002* (0.001)	Naval Tonnage Index   (1) (2) (3) (4)   (2) (3) (4)   (2) (3) (4)   (2) (4)   (2) (4) (4) (4) (4) (4) (4) (4) (4) (4) (4

Figure: Markowitz, J. and C. Fariss: Power, Proximity, and Democracy: Geopolitical Competition in the International System. In *Journal of Peace Research* (Forthcoming).

	Welfare spending			Military spending	
	(1)	(2)	(3)	(4)	(5)
Dummy 25 battle deaths (low)	-0.077 $(0.298)$			0.195*** (0.075)	
Dummy 1000 battle deaths (low)		-0.472 (0.389)			
Insurgency		, ,	$-0.769^*$ $(0.424)$		0.215** (0.105)
ln GDP p.c.	-0.831*** (0.296)	-0.827*** (0.296)	-0.905*** (0.299)	0.684*** (0.217)	0.689*** (0.220)
Democracy dummy	2.191*** (0.375)	2.169*** (0.377)	2.171*** (0.376)	-0.364** $(0.154)$	-0.375** $(0.154)$
GDP Growth	-0.007 $(0.007)$	-0.008 (0.007)	-0.009 (0.007)	0.001 (0.002)	0.0003 (0.002)
N Adjusted R <sup>2</sup>	3,902	3,902	3,902	3,784	3,784

<sup>\*</sup>p<.1; \*\*p<.05; \*\*\*p<.01. Two-way linear fixed effects with heteroskedasticity and serial correlation consistent covariance estimates are computed using the plm function in R.

Figure: Anders, T. The Relationship Between Violent Conflict and Welfare Spending Revisited (unpublished manuscript).



#### WYSIWYG and WYSIWYM

what-you-see-is-what-you-get (WYSIWYG)

Content = presentation. Example: Word.

what-you-see-is-what-you-mean (WYSIWYM)

Content  $\neq$  presentation. Example: LATEX.

#### Example for Separation of Content and Presentation

If your dissertation is due in 2 weeks, do not typesetting it in LATEX now!

```
\begin{center}
If your dissertation is due in 2 weeks,
{\Huge\underline{do not}} start typesetting it in {\LaTeX} now!
\end{center}
```

#### Pros and Cons: Separation of Content and Presentation

#### Pros

- Reproducibility.
- Stability.
- Unambiguous.
- Once set up, no need to worry about formatting. In fact, you <u>should</u> focus on content over form. LATEX will do the rest the form for you. 
   Templates!

#### Cons

- No/few "buttons" to press—need to learn commands.
- Steep learning curve. Can be time intensive.



# Working Directory (WD)

- The WD is a specified path (think folder) on your machine.
- The program will look for and store all data in the WD.
- Unless otherwise specified, LATEX will use the folder where the main .tex file is stored as WD.
- Store all auxiliary data (graphs, tables, etc.) in the WD.

# Adding graphs to LATEX files.

```
\begin{figure}[h!]
\begin{center}
\includegraphics[width = 2in]{latex_comic.jpg}
\caption{Source \url{http://bit.ly/25VwZaG}.}
\label{comic_fig}
\end{center}
\end{figure}
```

#### Integration of tables is one of the main perks!

- R packages such as stargazer or xtable will output beautifully formatted (regression) tables as a .tex file.
- estout package for Stata.
- Save the .tex file directly to you WD, then import the file into your LATEX document.

# $\setminus \mathtt{input}\{\}$ command

The following table (stargazer output) is imported by the following line:

\input{tab\_simple.tex}

Disclaimer: In reality, to import the table into the beamer class,  $\boldsymbol{I}$  use a wrapper:

\resizebox{\linewidth}{!}{\input{tab\_simple.tex}}.

### This is what the stargazer looks like

```
% Table created by stargazer v.5.1 by Marek Hlavac, Harvard University. E-mail: hlavac at fas.harvard.edu
% Date and time: Wed. Apr 13, 2016 - 12:31:07
\begin{tabular}{@{\extracolsep{5pt}}lcccc}
\\[-1.8ex]\hline
\hline \\[-1.8ex]
& \multicolumn{4\fc\f\textit{Dependent variable:}}\\
\cline{2-5}
\V-1.8exl & \multicolumn(3\fc\finternet\) & life\ exp \\
W-1.8exl & (1) & (2) & (3) & (4)\\
Vhline W-1.8ex1
polity & 0.255$\(\frac{4***}\$\ & 0.084$\(\frac{4***}\$\ & \\
 & (0.023) & (0.020) & & \/
 8 8 8 8 N
pop & & 0.000 & & \\
 & & (0.000) & & \\
 & & & & \\
gdppc & & 0.001$\frac{***}$ & & 0.0005$\frac{***}$ \\
 & & (0.00002) & & (0.00001) \\
 & & & & \\
life\_exp & & & 1.101$\footnote{***}$ & \\
 & & & (0.031) & \\
 8888\
Constant & 15.002$\(\frac{***}\$ & 5.955$\(\frac{***}\$ & $-$60.212$\(\frac{***}\$ & 62.576$\(\frac{***}\$ \)\\
 & (0.401) & (0.408) & (2.098) & (0.160) \\
 8888\
Vhline W-1.8ex1
Observations & 3,126 & 3,003 & 3,376 & 4,111 \\
R$\\2\$ & 0.039 & 0.384 & 0.276 & 0.334 \\
Adjusted R$\(\frac{1}{2}\$ & 0.038 & 0.383 & 0.276 & 0.334 \\
Residual Std. Error & 22.391 (df = 3124) & 17.953 (df = 2999) & 18.534 (df = 3374) & 8.625 (df = 4109) \\
F Statistic & 125.913$\frac{***}\$ (df = 1; 3124) & 622.987$\frac{***}\$ (df = 3; 2999) & 1,285.932$\frac{***}\$ (df = 1; 3374) & 2,063.299$\frac{***}\$ (df = 1; 4109) \\
Vhline
Vhline \( \( \( \) -1.8ex \)
\textit{Note:} & \multicolumn{4}{r}{$^*}$p$<$0.1; $^**}$p$<$0.05; $^***}$p$<$0.01} \\
\end{tabular}
```

### stargazer output with LATEX typesetting

	Dependent variable:				
	internet			life_exp	
	(1)	(2)	(3)	(4)	
polity	0.255*** (0.023)	0.084*** (0.020)			
рор		0.000 (0.000)			
gdppc		0.001*** (0.00002)		0.0005*** (0.00001)	
life_exp			1.101*** (0.031)		
Constant	15.002*** (0.401)	5.955*** (0.408)	-60.212*** (2.098)	62.576*** (0.160)	
Observations R <sup>2</sup>	3,126 0.039	3,003 0.384	3,376 0.276	4,111 0.334	
Adjusted R <sup>2</sup> Residual Std. Error F Statistic	0.038 22.391 (df = 3124) 125.913*** (df = 1; 3124)	0.383 17.953 (df = 2999) 622.987*** (df = 3; 2999)	0.276 18.534 (df = 3374) 1,285.932*** (df = 1; 3374)	0.334 8.625 (df = 4109) 2,063.299*** (df = 1; 4109)	

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

#### Fancier stargazer output

	Dependent variable:				
	Internet Users			Life Expectancy	
	(1)	(2)	(3)	(4)	
Polity Score	0.2553***	0.0842***			
	(0.0228)	(0.0202)			
Population	, ,	0.0000			
•		(0.0000)			
GDP p.c.		0.0010***		0.0005***	
·		(0.00002)		(0.00001)	
Life Expectancy		, ,	1.1005***	, ,	
			(0.0307)		
Constant	15.0024***	5.9550***	-60.2123***	62.5757***	
	(0.4005)	(0.4082)	(2.0975)	(0.1602)	
Observations	3,126	3,003	3,376	4,111	
$R^2$	0.0387	0.3839	0.2760	0.3343	
Adjusted R <sup>2</sup>	0.0384	0.3833	0.2757	0.3341	
Residual Std. Error	22.3914 (df = 3124)	17.9527 (df = 2999)	18.5340 (df = 3374)	8.6253 (df = 4109)	

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01

<ロ > ← □

### Professional typesetting of math symbols

```
\begin{equation*} \begin{equation*} \frac{\partial EU_{ns_p}}{\partial s}&=A(v)f\gamma-S'(s)\leq0\\ \frac{\partial^2 EU_{ns_p}}{\partial s^2}&=-S''(s)<0 \end{split} \end{equation*}  \frac{\partial EU_{ns_p}}{\partial s} = A(v)f\gamma - S'(s) \leq 0   \frac{\partial^2 EU_{ns_p}}{\partial s^2} = -S''(s) < 0
```

#### Professional typesetting of regression equations

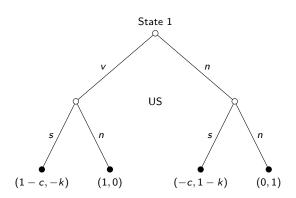
```
\label{eq:local_equation*} $$ \operatorname{equation*} $$ \operatorname{conflict}_{i,t-1} + \operatorname{c_i}_{i,t-1} + \beta_1 + \operatorname{c_i}_{i,t-1} + \beta_2 + \beta_2 + \beta_3 + \beta_3 + \beta_3 + \beta_4 + \beta_4
```

#### Professional math typesetting

Basic list of math symbols in LATEX

http://web.ift.uib.no/Teori/KURS/WRK/TeX/symALL.html

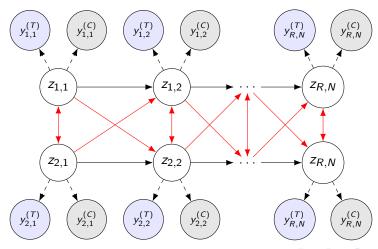
# Game trees with tikz package



## Game trees with tikz package

```
\usetikzlibrarv{calc}
 \tikzset{
    solid node/.style={circle,draw,inner sep=1.5,fill=black},
    hollow node/.style={circle,draw,inner sep=1.5}
7
\begin{tikzpicture}[scale=1.2,font=\scriptsize]
    \tikzstvle{level 1}=[level distance=15mm.sibling distance=35mm]
    \tikzstvle{level 2}=[level distance=15mm.sibling distance=15mm]
  \node(0)[hollow node,label=above:{State 1}]{}
    child{node(1)[hollow node]{}
      child{node[solid node,label=below:{$(1-c,-k)$}]{} edge from parent node[left]{$s$}}
      child{node[solid node,label=below:{$(1,0)$}]{} edge from parent node[right]{$n$}}
     edge from parent node[left,xshift=-3]{$v$}
    child(node(2)[hollow node]{}
      child{node[solid node,label=below:{$(-c,1-k)$}]{} edge from parent node[left]{$s$}}
      child{node[solid node.label=below:{$(0.1)$}]{} edge from parent node[right]{$n$}}
      edge from parent node[right.xshift=3]{$n$}
};
  \node at ($(1)!.5!(2)$) {US}:
\end{tikzpicture}
```

### Diagrams with tikz package



## Diagrams with tikz package

```
\tikzstyle{hv}=[circle,draw]
\tikzstvle{ovt}=[hv.fill=blue!10]
\tikzstyle{ovc}=[hv,fill=black!10]
\tikzstyle{a}=[-{Latex[length=2mm,width=1.5mm]}]
\tikzstvle{ao}=[a.dashed]
\tikzstyle{across}=[a,red]
\tikzstyle{d}=[above]
\tikzstvle{both}=[{Latex[length=2mm.width=1.5mm]}-{Latex[length=2mm.width=1.5mm]}.red]
\begin{tikzpicture}[every node/.style={scale=1}]
      \node (z11) at (-3,2) [hv] \{(z_{1,1})\};
     \node (z12) at (0,2) [hv] \{(z_{1,2})\};
      \node (z1n) at (4.2) \lceil hv \rceil \cdot \{ (z \cdot \{R,N\} \setminus) \}:
      \node (v11t) at (-3.75,3.5) [ovt] {\left(y^{(T)}_{1,1}\right)};
     \node (v11c) at (-2.25,3.5) [ovc] {\colored{ (v^{(C)}_{1,1})}};
      \node (v12t) at (-0.75.3.5) [ovt] {\left(v^{(T)} : 1.2\right)}:
      \node (y12c) at (0.75,3.5) [ovc] {\columnwidth} (y^{(C)}_{1,2});
      \node (v1nt) at (3.25,3.5) [ovt] {\scriptsize\(\(\nabla^{(T)}_{R,N}\)\);
      \node (v1nc) at (4.75.3.5) [ovc] \{\coloredge{v1nc} \coloredge{v2nc} \coloredge{v2nc} \coloredge{v3nc} \c
      \node (z1dots) at (2.2) {\ldots}:
      \draw[a] (z11) -- (z12);
      \draw[a] (z12) -- (z1dots):
      \draw[a] (z1dots) -- (z1n):
      \draw[ao] (z11) -- (v11t);
      \draw[ao] (z11) -- (v11c);
      \draw[ao] (z12) -- (v12t):
\end{tikzpicture}
```

Steep Learning Curve Collaboration and journal submissio Miscellaneous

# **Challenges**

# Steep Learning Curve

### The key to learning LATEX

- Learning by doing
- Trial and error
- Google
- PATIENCE

## Co-Authoring

Reproducibility is one of the main advantages of LATEX. But co-authoring can be tricky with a basic LATEX distribution.

#### Challenges toward collaboration

- Co-authors that don't know LATEX.
- Special packages, fonts, etc.
- Limited tracking of changes.
- Limited commenting abilities (except % or ).

### Tools for collaboration

Online platform https://www.overleaf.com

Limited free version, many templates.

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#### Online platform https://www.overleaf.com

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#### todonotes package

Adds margin and in-text comments. Example:

\todo[author = Therese]{Needs to be done.}

Therese: Needs to be done.

### Journal submission

- Some journals will not accept LATEX files for final manuscript submission.
- There are software tools for converting LATEX to Word, but it is a pain.
- Especially frustrating for: Tables, bibliographies, equations. Hence, all the reasons why you would want to use LATEX in the first place.

## Other Challenges

- Limited spell-checking options. Depends on editor.
- Debugging is part of the process.
  - Check for typos.
  - Read error message of compiler.
  - Google error message.
  - Trial and error.
- Special characters, for example:
  - \'a → á
  - $\bullet$  \"a  $\longrightarrow$   $\ddot{a}$

## Some misconceptions

#### No word counts

Many compilers don't have a build in function, but there is external programs (e.g. http://app.uio.no/ifi/texcount/) and ShareLaTeX also has a word count option.

#### Tables in LATEX suck

Programming tables from scratch is no fun! But, there are tools such as the stargazer and estout packages, plug-ins for Excel, and online tools (http://www.tablesgenerator.com).

# Structure and compiling

### Basic Structure

#### **Preamble**

Document type, basic settings, packages. Not printed.

#### Title section

Title, date, author information.

#### Main Body

Document content including title wrapped by

\being{document} ... \end{document}.

### Preamble

documentclass[1pt,letterpaper.oneside](article) %Change basic font size and paper size here.

\( \text{\text{usepackage}}(setspace, graphics, fullpage, fancyindr, amssymb, amsmath, epstig, natbib, array, multirow, hyperref, tabulars, iscape booktabs, sidecan, subfic, londable, enumitiem)

#### \hypersetup{ bookmarks

urlcolor=blue,

```
bookmarks=false.
                      % show bookmarks bar?
unicode=false
                    % non-Latin characters in Acrobat?s bookmarks
pdftoolbar=true.
                    % show Acrobat?s toolbar?
                   % show Acrobat?s menu?
pdfmenubar=true.
pdffitwindow=false, % window fit to page when opened
pdfstartview=(FitH), % fits the width of the page to the window
pdftitle=0. % title
pdfauthor=(). % author
pdfsubject={Subject}, % subject of the document
pdfcreator={Creator}, % creator of the document
pdfproducer=(Producer), % producer of the document
pdfkeywords={keywords}, % list of keywords
pdfnewwindow=true. % links in new window
colorlinks=true.
                  % false: boxed links: true: colored links
linkcolor=blue
                    % color of internal links
linkbordercolor={0 0 0}, %border color
citebordercolor=(0 0 0).
citecolor=blue.
                  % color of links to bibliography
filecolor=black.
                 % color of file links
```

% color of external links

Most important parameter is documentclass{}

- article
- resume
- beamer
- letter

Packages and hypersetup differ.

## Sample dissertation master document structure

```
[Preamble]
[Title]
\begin{document}
\input{introduction.tex}
\input{chapter1.tex}
. . .
\input{conclusion.tex}
\bibliographystyle{chicago}
\bibliography{mainbib.bib}
\end{document}
```

# Compiling a document

Workflow might differ for each editor. Example TeXShop:

- Running LATEX first time will produce general text.
- Running BibTeX to create bibliography (if necessary).
- Running LATEX second time will product internal links, table of contents, and references.

Some editors like Overleaf will compile everything at once.

## **MTEX** commands and special characters

All LATEX commands start with a \. Example: \begin{}

#### Characters with special meaning

- { and }: Used in functions and for delineation.
- %: Comment (nothing that follows will be printed).
- \$: In-line math.
- &: Alignment character (tables and math).

To use any of these symbols in text, we need to use an escape character. For example, to print % & \$, we need to type:

Using section{}, subsection{}, and subsubsection{},
 ETEX automatically creates a structure that pdf readers will understand.

- Using section{}, subsection{}, and subsubsection{},
   LATEX automatically creates a structure that pdf readers will understand.
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- Create internal links using label{} and ref{}.

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- Size of headings will automatically be chosen by LATEX.
- White space typically does not matter.
- Create internal links using label{} and ref{}.
- Citations can automatically be included as internal links.

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# Bibliographies

### Basic structure

### Bibliographic data base, e.g. sample\_bib.bib.

```
Qarticle{fearonlaitin2003,
Author = {James D. Fearon and David D. Laitin},
Journal = {American Political Science Review},
Number = {1},
Pages = {75-90},
Title = {{Ethnicity, Insurgency, and Civil War}},
Volume = {97},
Year = {2003}}
```

### Basic structure

### Bibliographic data base, e.g. sample\_bib.bib.

```
@article{fearonlaitin2003,
Author = {James D. Fearon and David D. Laitin},
Journal = {American Political Science Review},
Number = {1},
Pages = {75-90},
Title = {{Ethnicity, Insurgency, and Civil War}},
Volume = {97},
Year = {2003}}
```

#### Building bibliography within to .tex document

```
\bibliographystyle{chicago}
\bibliography{sample_bib.bib}
```

### Basic structure

### Bibliographic data base, e.g. sample\_bib.bib.

```
@article{fearonlaitin2003,
Author = {James D. Fearon and David D. Laitin},
Journal = {American Political Science Review},
Number = {1},
Pages = {75-90},
Title = {{Ethnicity, Insurgency, and Civil War}},
Volume = {97},
Year = {2003}}
```

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#### Citations

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- Technical background for LaTEX and TEX programming language.

# Moving on...

Any questions before we move on to part II?

## LATEX Lingo

#### Distribution

Collection of TEX-related software. Examples: MiKTeX, TeX Live.

#### Editor

Creation of documents. Examples: TeXworks, TeXShop.

#### **Format**

Different TEX-based languages. Examples: LATEX, plain TEX.

#### **Packages**

Add ons to basic systems. Examples graphicx, natbib.

