Latex Style Guide for RAs and TAs

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This document is intended as a style guide for RAs and TAs, and for direct how-to of certain Latex tricks.

1 General Comments on Naming

1.1 File Names and Structure

- Always use full words, never ad-hoc abbreviations (unless they are standard. e.g. "balanced growth path" → "bgp" is fine since everyone knows what it is)
- Always lower case, separated by underbars. e.g. `perla_paper_1.pdf`

1.2 Variable and Label Names

- As before, avoid ad-hoc abbreviations and use full words wherever possible. e.g. `prop:graph-beta` as a name instead of `prop:graph-bta`
- All macros, etc. should be in lower case unless it is variation of a lower case macro (e.g. `\large` and `\Large`) or to distinguish distinct small vs. large (e.g. `\theta` and `\Theta` are different). Except in labels, simply concatenate lower case words (e.g. `\includediagram`)
- Prefix labels with standards prefixes followed by a colon. Words can be separated by a dash in labels. For example, reference to a proposition would be `prop:bgp-equilibrium`. Equation prefix is `eq:`, Figures prefix is `fig:`, Tables are `tab:`, Definitions environment are `def:`.

1.3 Flagging Discussions

If you leave something incomplete, are not sure about something, flag it with a `\textbf{TODO: yournotes}` This way, a search for TODO will make it easy to ensure there is nothing left incomplete.

2 Packages, Styles, and Macros

2.1 Preamble

- All of the style files and macros are in the `/libraries/latex` folder from the Git setup . Wherever this folder is located, you will need to have the environment variable `TEXINPUTS` set to point to it so latex can find the file.
- The baseline style for all articles is `etk-article`, `\documentclass[12pt,etk-draft]{etk-article}`
- This includes most of the packages you need, and adds them in the correct order (latex is very fragile for package ordering).
- One of the first things you should do after the `\documentclass...` is call `\pdfmetadata`.
  - This adds in metadata for the pdf file, but also adds in linking between references and ability to have linked urls.
  - It must come before many other packages.
  - The arguments of the macro are: title, author, keywords, and subject. They can all be blank you you wish.
- If a package you need is missing first try adding the `etk-more-packages.sty` before manually adding your own. i.e.
  - `\usepackage{etk-more-packages}`
  - It is crucial to add this package AFTER adding calling the `\pdfmetadata` macro for package ordering.
  - If that doesn't have the package you need, then add it manually

2.2 Bibliography and URLs

- In order to use a bibliography, first add in `\usepackage{etk-bib}`
- Next, wherever you wish to add in the bibliography, use `\bibliography{etk-references}`
- To cite, use use `\citet{LjungqvistSargent2012}`, to get something like Ljungqvist and Sargent (2012)
- Note that all bibliography items are centralized in the `etk-references.bib` file from Git. This will be available to latex through the `BIBINPUTS` environment variable in the setup. There are a lot of bibliography items there, so check for the key before adding it.
- For links: use `\url{http://tex.stackexchange.com/}` to get `http://tex.stackexchange.com/`
- For editing the bibliography file, consider using jabref
  - Regardless, the standardization of the bibtex key name is `[authors3][year]`

  - The easiest way to do this is go to JabRef preferences, choose BibTeX key generator, and put in the Default pattern. Then you can automatically generate keys in jabref with Control-G.
  - When generating the bibtex entry, try to be as thorough as possible by exporting bibtex from the online journal link, `https://ideas.repec.org/`, `https://scholar.google.com`, etc.

2.3 Macros

- Most of the macros collected are in the file `etk-base.sty`
- The whole point of latex is to separate the presentation from the content as much as possible. Therefore, try to use macros whenever possible to simplify the actual content.
- If the macro doesn't exist, then add it at the top of the file. Later, these can be refactored to `etk-base.sty` if appropriate. For example, if you keep finding yourself typing `\mathbb{Q}^{\min}` for $\mathbb{Q}^{\min}$ many times, then create a macro
  - `\Qmin` is created by `\newcommand{\Qmin}[0]{\mathbb{Q}^{\min}}`
- Keep all macro definitions in the preamble whenever possible to allow easier refactoring

3 General Comments

Consistency for Copy/Paste! The most important goal is to ensure consistency for copy/paste when changing notation, etc.

- For example using both `a_z` and `a_{z}` makes it very hard to search for them.
- Another is failing to separate terms. For example, Az represented as `Az` rather than `A z`.
- This is especially important with subscripts. i.e. $x_t P_t$ should be `x_t P_t` rather than `x_tP_t`
- Another is using `\infinity` and `\infty` in the same file. Using one (I prefer `\infinity`) makes it easier to change notation between finite and infinite horizon.

Verbatim and Code listings The verbatim environment is done with `\verb!my verbatim text!`

Sections, etc. Use as many sections, subsections, and paragraphs as possible. Do not put in your own formatting if you can help it.

Equations and Numbering

- Do not use `\begin{eqnarray}`..., use `\begin{align}` or `\begin{falign}` instead.
- Avoid using `$$ a=b $$` and use `\begin{equation}...` instead
- Keep equation numbers as much as possible (i.e. don't use `\begin{equation*}` in general, and don't use `\nonumber` in `align` environment very often). It is always nice to have more equation numbers to refer to.
- Use `\intertext{...}` to embed text lines in the `align` environment, such as

  Text with a footnote[1]

  $$a = b \tag{1}$$

  Adding some text which refers to (1)

  $$c = d \tag{2}$$

- In normal text, you can add footnotes with `\footnote{...}`. However, in an `align` environment, you need to add them with a `\footnotemark` and a `footnotetext` separately, such as

  $$\alpha = \beta^{\epsilon} \tag{3}$$

Fractions

- `\frac{}{}` is adaptive to the type of text it is used within, prefer it. Using it makes copy/paste easier.
- If the size needs to be changed, then use `\tfrac{}{}` sparingly, or `\dfrac{}{}` even more rarely.

Labels

- Don't use `\ref` for referring to labels. Instead use `\cref`. This package will take care of the established style for the references, adding in 'and', etc.
- For example, `\cref{sec:macros,sec:general-comments,eq:ab}` looks like: Sections 2.3 and 3 and (9)
- The only quirk to `\cref` is that you can't put spaces between the different labels. Otherwise, it is pretty clever

[1] The footnotetext go in the order of the from the footnotemark, and must be added after the `align` is complete. Also, see the `\VerbatimFootnotes` macro required in the preamble for verbatim to work in footnotes.

Equation Spacing and Super/subscripts

- Don't use tabs except for indentations of lines and equations
- Try not avoid extraneous spaces in equations, except around equal signs and grouping of terms. For example,
  - Prefer: `a^2 = b_D + a(1 + d)` to: `a ^2 = b_D + a ( 1 + d)`
- For uniary subscript and superscripts, do not use brackets. i.e. prefer `a_b` and `a^2` to `a_{b}` and `a^{2}`. This makes find-replace easier.
- For functions, prefer consistent spacing after commas. i.e. use `f(x, y)`

4 A Few Examples and Preferences

- Matrices, such as $\begin{bmatrix} a & b \end{bmatrix}$ and

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \tag{4}$$

- Derivatives, prefer operator notation where possible
  - i.e., use `\D f(x)` which displays as $\boldsymbol{\partial} f(x)$, instead of things like $\frac{df(x)}{dx}$
  - For partials, use use `\D[x] f(x, y)` which displays as $\boldsymbol{\partial}_x f(x, y)$ instead of $\frac{\partial f(x,y)}{\partial x}$
  - Also reasonable to use the $f'(x)$ notation for univariate derivatives.
- Expectations and conditional expectations use a set of macros
  - $\mathbb{E}\left[f(x)\right]$ or $\mathbb{E}_t\left[f(x)\right]$ or conditional $\mathbb{E}\left[f(x,y) \mid y\right]$ and $\mathbb{E}_t\left[f(x,y) \mid y\right]$
  - Variance and coefficient of variation, $\mathbb{V}\left[f(x)\right]$ and $\mathbb{CV}\left[f(x)\right]$
- Probabilities and conditional probabilities: $\mathbb{P}\left(x = 2\right)$ and $\mathbb{P}\left(x + y = 2 \,|y = 1\right)$
- Real and natural numbers $\mathbb{R}$ and $\mathbb{N}$
- Distribution
  - Normal distribution $\mathrm{N}\left(\mu, \sigma^2\right)$. Also, a reasonable alternative is the common notation $\Phi(\mu, \sigma^2)$ for the cdf and $\phi(\mu, \sigma^2)$ for the pdf.
  - Lognormal distribution $\mathrm{LN}\left(\mu, \sigma^2\right)$
  - Exponential Distribution $\mathrm{Exp}\left(\lambda\right)$
  - Pareto Distribution: $\mathrm{Pareto}\left(x_0, \alpha\right)$
- For integrals, prefer to put to distribution instead of the PDF, where possible.
  - i.e., for cdf $F(x)$ and pdf $f(x)$, prefer $\int g(x)\mathrm{d}F(x)$ to $\int g(x)f(x)\mathrm{d}x$
  - Always use `\diff` instead of just `d` for the differential.

  - For integrating over parameterized distribution, put in the variable of integration before the parameters i.e. $\int g(x) \mathrm{d}\Phi(x; \mu, \sigma^2)$

- Indictator function, Dirac Delta, and Heaviside: $\mathbb{1}\{x = 2\}$, $\boldsymbol{\delta}(x)$, and $\mathbb{H}(x)$.
- Absolute value and norm, $|x + y|$ and $\|x\|$
- Argmin and argmax: $\arg\min_{x \in \mathbb{R}} \{x + y\}$ and $\arg\max_{x \geq 0} \{x + y\}$
- To get limits directly under the equation within a line: $\lim_{x \to 0} f(x)$
- For infinity, use `\infinity` rather than `\infty` (which I never remember and we need consistency for find/replace)
- A good way to format maximization problems

$$\max_{x \geq 0} \left\{ f(x) + \sum_{n=0}^{\infty} \Phi_n(x) \right\} \tag{5}$$

$$\text{s.t. } h(x) = 0 \tag{6}$$

- Dealing with cases in functions

$$f(x) = \begin{cases} x & \text{if } x \leq 0 \\ 2x & \text{otherwise} \end{cases} \tag{7}$$

5 More Examples of Annotation/Layout Structure

- Example with under-braces and over-braces:

$$\underbrace{f(x)}_{\text{stuff}} = \overbrace{G(x)}^{\text{stuff}} + \underbrace{H(x)}_{\substack{\text{multiple lines} \\ \text{of notes}}} \tag{8}$$

- Emphasized entire set of equations, such as the final results after a bunch of algebra

$$\boxed{\begin{aligned} a &= b \\ c &= d \end{aligned}} \tag{9}$$

$$\tag{10}$$

- Boxing only part of an equation for emphasis

$$a = b + \boxed{\frac{d + e}{f^2}} \tag{11}$$

- Easy way to give equation names. But this will cut down on the space available for equations, so consider breaking into a separate `flalign` after the named equations if it gets too compact

$$x_{t+1} = Ax_t \qquad \text{[Evolution]} \tag{12}$$

$$y_t = Gx_y \qquad \text{[Observation]} \tag{13}$$

- Can change highlight color with, `\definecolor{highlightcolor}{rgb}{1,0,0}`
- Emphasized test: **TEXT**, Emphasized math **x** or part of an equation

$$f(x) = a + b\left[\mathbf{c^2} + b\right] \tag{14}$$

- Propositions, such as in Proposition 1, and proofs can be linked:

  Proposition 1 (My Proposition)**.** *Description of the proposition...* $a = a$.

  Proof. give a proof.... □

- Definitions such as Definition 1

  Definition 1 (My Definition)**.** *My definition text...*

6 Infinite Sums and Sets

A few variations on these patterns (with some optional arguments)

- $\sum_{j=0}^{\infty}, \sum_{t=0}^{\infty}, \sum_{t=0}^{T}$
- $\sum_{t=0}^{\infty} \beta^t, \sum_{j=0}^{\infty} \beta^j, \sum_{t=0}^{T} \beta^t$
- $\{A, B\}, \{c_j\}_{j=0}^{\infty}, \{c_t, A_{t+1}\}_{t=0}^{\infty}$
- $\sum_{t=0}^{\infty} \sum_{s^t} \beta^t, \sum_{j=0}^{\infty} \sum_{s^j} \beta^j, \sum_{t=0}^{T} \sum_{s^t} \beta^t$

7 Diagrams and Code

- In general, prefer `.eps` with using `\psfrag` to typeset varaibles with latex
- See Figure 1 for an example.

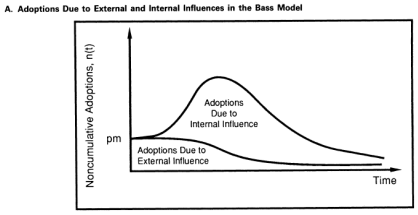

Figure 1: Title of the figure

- Note that the `A` in the picture is replaced with the `\psfrag{A}{$\alpha^2$}` command.
- Use single character replacements where possible (otherwise editing the file in Adobe Illustrator doesn't work)

- Finally, see the `\usepackage{pstool}` at the top of the file. This setup to generate files will only regenerate them when you edit the underlying `.eps` file. So changing the width of the box or the `\psfrag` commands won't immediately display.
  - To regenerate all of the files, you can swap `\usepackage{pstool}` with `\usepackage[crop=preview,process=all,cleanup={.tex,.dvi,.ps,.pdf,.log}]{pstool}` which deletes all files and recreates them.
  - When you are done, switch it back to `\usepackage{pstool}` so you don't have to recompile every time.
- The `\movefigures{./figures/}` at the top of the file will copy all `.eps` files from that folder location over, so you don't have to keep the diagrams in the same location as the `.tex` files. **TODO: The movefigures won't work under os/x yet.**
- To display an line short chunk of computer code, just use verbatim, `A = eig(C)`. For larger sections,**Todo: turn on later**

References

Ljungqvist, L., and T. J. Sargent (2012): *Recursive Macroeconomic Theory, Third Edition*, vol. 1 of *MIT Press Books*. The MIT Press.