MODELLING TOBACCO DEMAND: HOW THE ILLICIT CIGARETTE MARKET CONSTRAINS THE LEGAL MARKET

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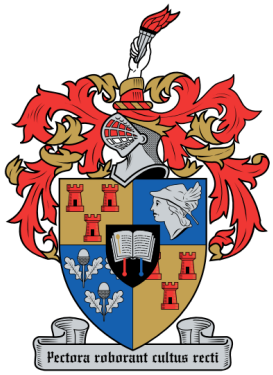
Thesis Draft 1



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Abstract

Abstract to be written here. The abstract should not be too long and should provide the reader with a good understanding what you are writing about. Academic papers are not like novels where you keep the reader in suspense. To be effective in getting others to read your paper, be as open and concise about your findings here as possible. Ideally, upon reading your abstract, the reader should feel he / she must read your paper in entirety.

Keywords: Price elasticity, Tobacco control, Cigarettes, Illicit cigarettes, Excise duties

JEL classification D12, H21, I18, C40

Table of Contents

1. Introduction

References are to be made as follows: Fama & French (1997: 33) and Grinold & Kahn (2000) Such authors could also be referenced in brackets (Grinold & Kahn, 2000) and together Grinold & Kahn (2000). Source the reference code from scholar.google.com by clicking on "cite' ' below article name. Then select BibTeX at the bottom of the Cite window, and proceed to copy and paste this code into your ref.bib file, located in the directory's Tex folder. Open this file in Rstudio for ease of management, else open it in your preferred Tex environment. Add and manage your article details here for simplicity - once saved, it will self-adjust in your paper.

> I suggest renaming the top line after @article, as done in the template ref.bib file, to something more intuitive for you to remember. Do not change the rest of the code. Also, be mindful of the fact that bib references from google scholar may at times be incorrect. Reference Latex forums for correct bibtex notation.

Section 2 describes the data used. Section 3 explains the vecto autoregression method used.

2. Data

Data cleaning

Discussion of data should be thorough with a table of statistics and ideally a figure.

The plots below (2.2) graph the time series for cigarette quantity, legal and illicit real prices and income. All the variables have been logged; and the x-axis shows the year.

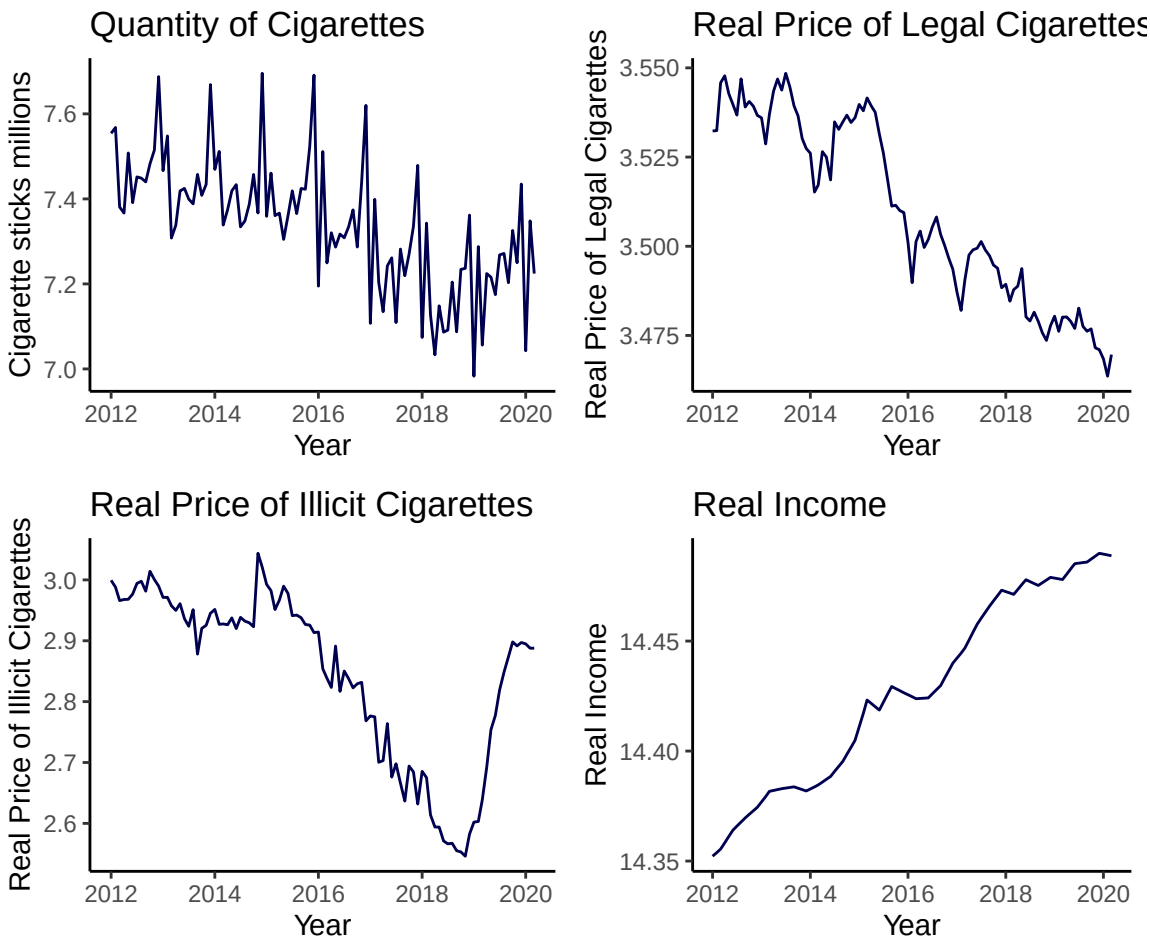

Figure 2.1: Time Series Plot

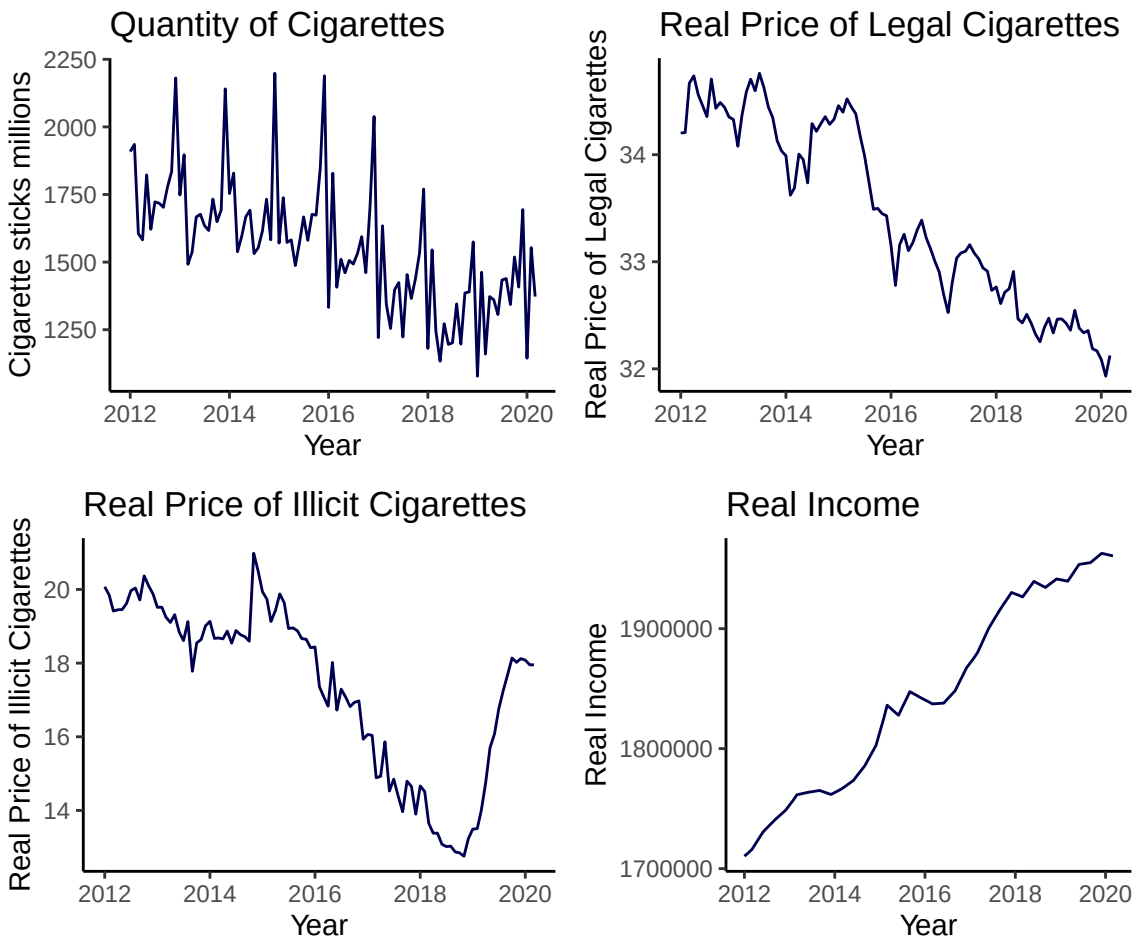

Figure 2.2: Time Series Plot

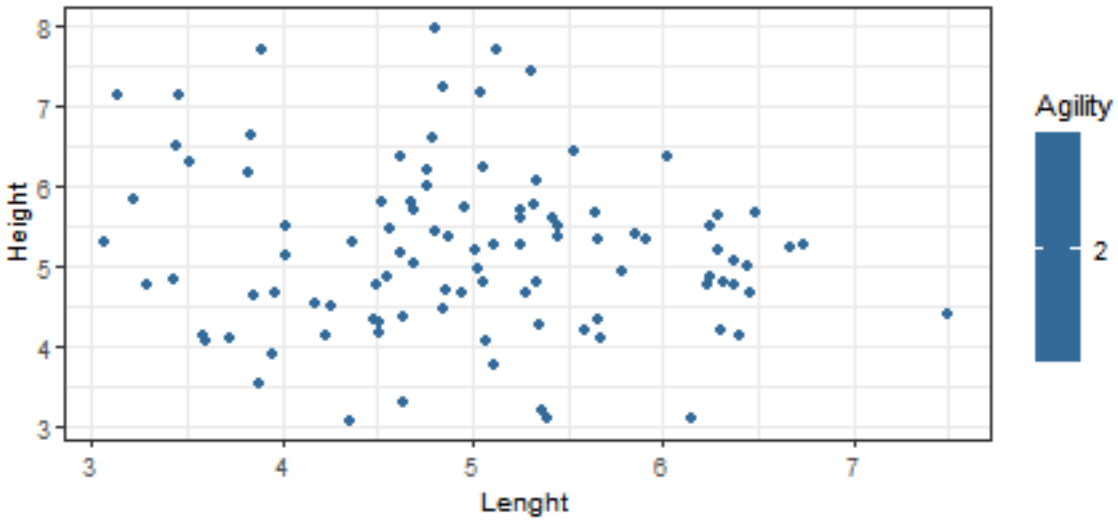

Figure 2.3: Caption Here

Figure 2.8 shows the autocorrelation functions for each of the variables. The persistence is quite high for all of the 4 variables.

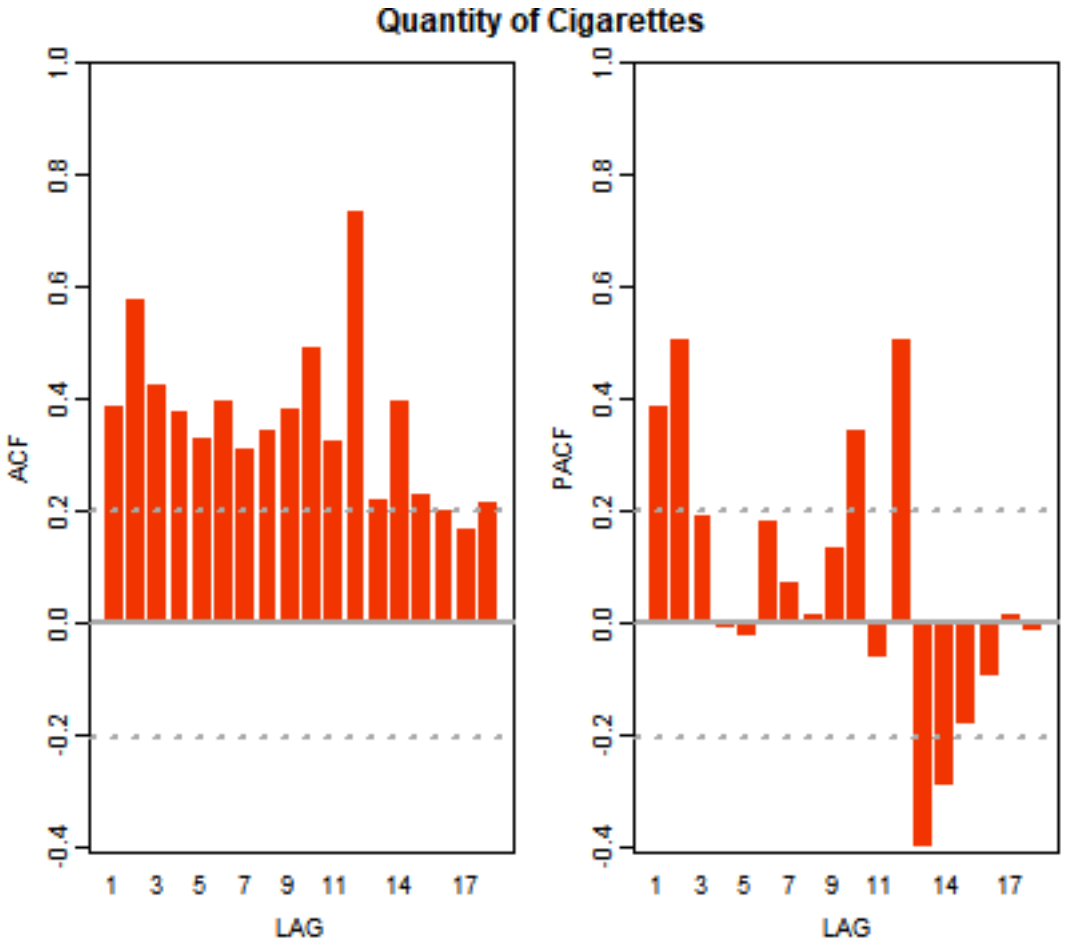

Figure 2.4: Autocorrelation Function Plots

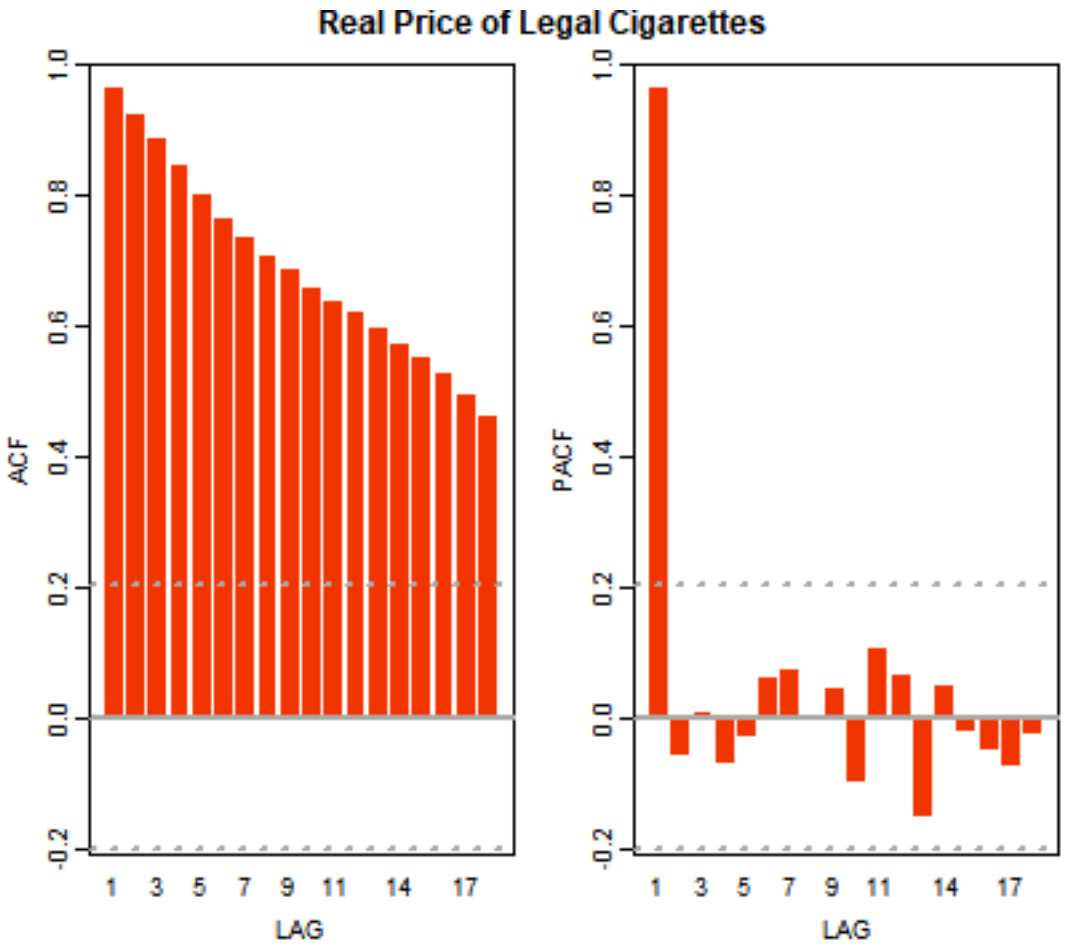

Figure 2.5: Autocorrelation Function Plots

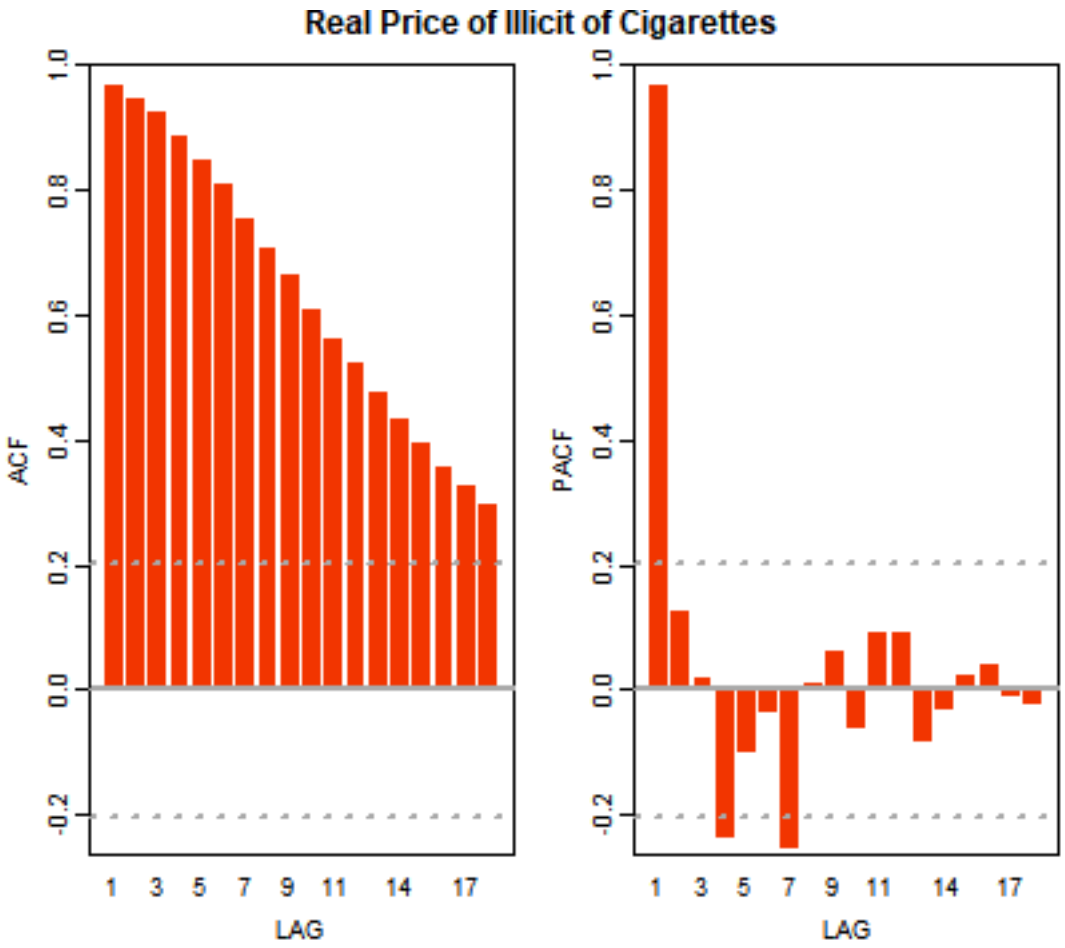

Figure 2.6: Autocorrelation Function Plots

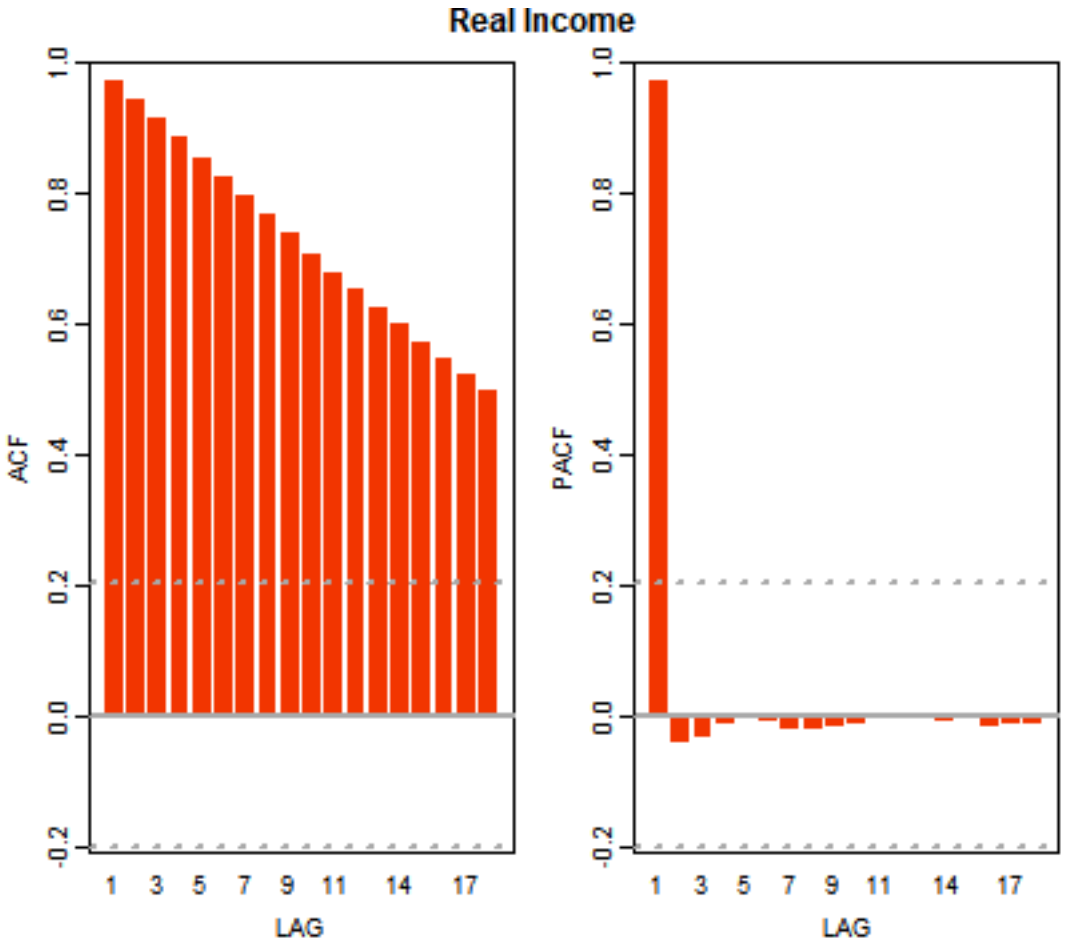

Figure 2.7: Autocorrelation Function Plots

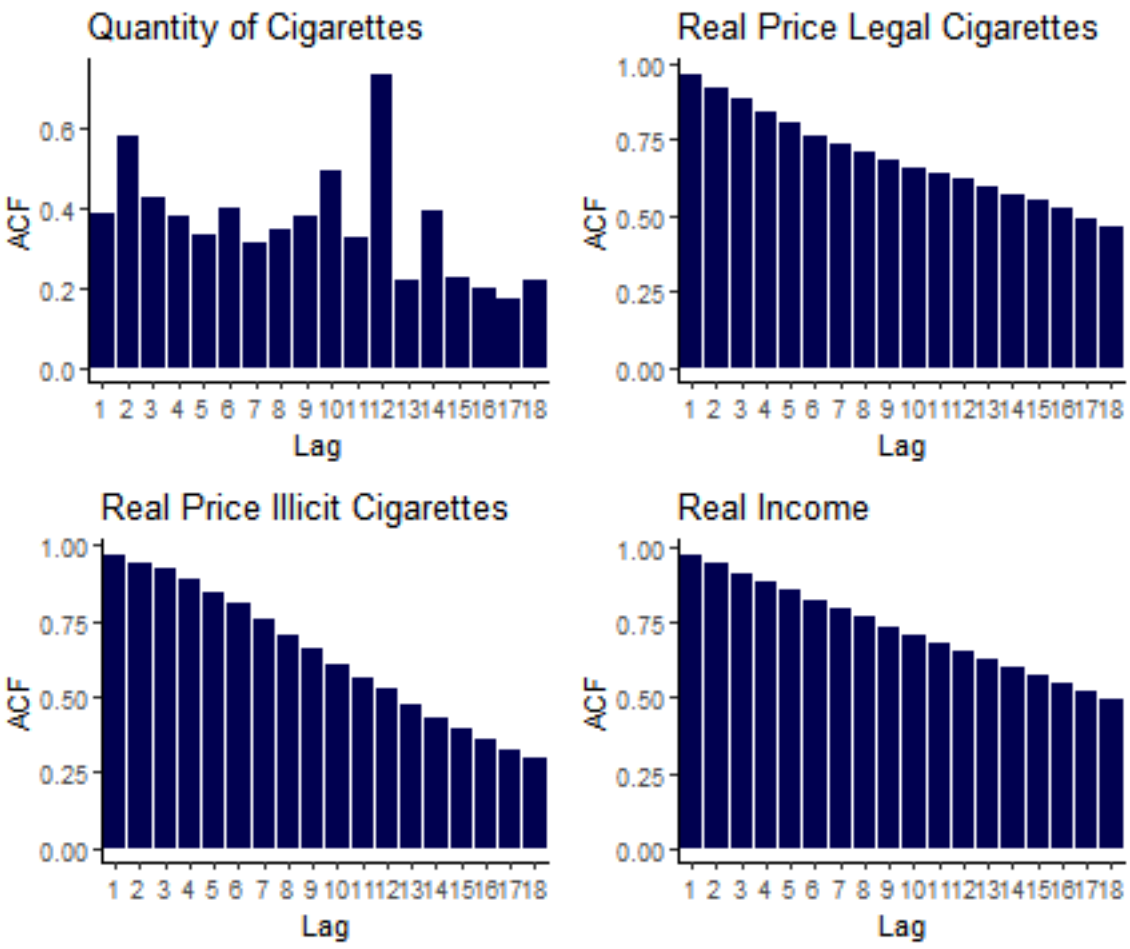

Figure 2.8: Autocorrelation Function Plots

To reference the plot above, add a "\label'' after the caption in the chunk heading, as done above. Then reference the plot as such: As can be seen, Figures 2.2 and 2.3 are excellent, with Figure 2.3 being particularly aesthetically pleasing due to its device setting of Tikz. The nice thing now is that it correctly numbers all your figures (and sections or tables) and will update if it moves. The links are also dynamic.

3. Methodology

3.1. Subsection

Ideally do not overuse subsections. It equates to bad writing.[1]

[1]This is an example of a footnote by the way. Something that should also not be overused.

3.2. Math section

Equations should be written as such:

$$\beta = \sum_{i=1}^{\infty} \frac{\alpha^2}{\sigma_{t-1}^2} \tag{3.1}$$
$$\int_{x=1}^{\infty} x_i = 1$$

If you would like to see the equations as you type in Rmarkdown, use $ symbols instead (see this for yourself by adjusted the equation):

$$\beta = \sum_{i=1}^{\infty} \frac{\alpha^2}{\sigma_{t-1}^2} \int_{x=1}^{\infty} x_i = 1$$

Note again the reference to equation 3.1. Writing nice math requires practice. Note I used a forward slashes to make a space in the equations. I can also align equations using **&**, and set to numbering only the first line. Now I will have to type "begin equation'' which is a native LaTeXcommand. Here follows a more complicated equation:

$$\begin{aligned}
y_t &= c + B(L)y_{t-1} + e_t \\
e_t &= H_t^{1/2} z_t; \quad z_t \sim N(0, I_N) \quad \& \quad H_t = D_t R_t D_t \\
D_t^2 &= \sigma_{1,t}, \ldots, \sigma_{N,t} \\
\sigma_{i,t}^2 &= \gamma_i + \kappa_{i,t} v_{i,t-1}^2 + \eta_i \sigma_{i,t-1}^2, \quad \forall i \\
R_{t,i,j} &= diag({Q_{t,i,j}}^{-1}).Q_{t,i,j}.diag(Q_{t,i,j}^{-1}) \\
Q_{t,i,j} &= (1 - \alpha - \beta)\bar{Q} + \alpha z_t z_t' + \beta Q_{t,i,j}
\end{aligned} \tag{3.2}$$

Note that in 3.2 I have aligned the equations by the equal signs. I also want only one tag, and I create spaces using "quads''.

See if you can figure out how to do complex math using the two examples provided in 3.1 and 3.2.

4. Results

Tables can be included as follows. Use the *xtable* (or kable) package for tables. Table placement = H implies Latex tries to place the table Here, and not on a new page (there are, however, very many ways to skin this cat. Luckily there are many forums online!).

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
1	21.00	6.00	160.00	110.00	3.90	2.62	16.46	0.00	1.00	4.00	4.00
2	21.00	6.00	160.00	110.00	3.90	2.88	17.02	0.00	1.00	4.00	4.00
3	22.80	4.00	108.00	93.00	3.85	2.32	18.61	1.00	1.00	4.00	1.00
4	21.40	6.00	258.00	110.00	3.08	3.21	19.44	1.00	0.00	3.00	1.00
5	18.70	8.00	360.00	175.00	3.15	3.44	17.02	0.00	0.00	3.00	2.00

Table 4.1: Short Table Example

To reference calculations **in text**, *do this:* From table 4.1 we see the average value of mpg is 20.98.

Including tables that span across pages, use the following (note that I add below the table: "continue on the next page' '). This is a neat way of splitting your table across a page.

Use the following default settings to build your own possibly long tables. Note that the following will fit on one page if it can, but cleanly spreads over multiple pages:

Table 4.2: Long Table Example

mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
21.00	6.00	160.00	110.00	3.90	2.62	16.46	0.00	1.00	4.00	4.00
21.00	6.00	160.00	110.00	3.90	2.88	17.02	0.00	1.00	4.00	4.00
22.80	4.00	108.00	93.00	3.85	2.32	18.61	1.00	1.00	4.00	1.00
21.40	6.00	258.00	110.00	3.08	3.21	19.44	1.00	0.00	3.00	1.00
18.70	8.00	360.00	175.00	3.15	3.44	17.02	0.00	0.00	3.00	2.00
18.10	6.00	225.00	105.00	2.76	3.46	20.22	1.00	0.00	3.00	1.00
14.30	8.00	360.00	245.00	3.21	3.57	15.84	0.00	0.00	3.00	4.00
24.40	4.00	146.70	62.00	3.69	3.19	20.00	1.00	0.00	4.00	2.00
22.80	4.00	140.80	95.00	3.92	3.15	22.90	1.00	0.00	4.00	2.00
19.20	6.00	167.60	123.00	3.92	3.44	18.30	1.00	0.00	4.00	4.00
17.80	6.00	167.60	123.00	3.92	3.44	18.90	1.00	0.00	4.00	4.00
16.40	8.00	275.80	180.00	3.07	4.07	17.40	0.00	0.00	3.00	3.00
17.30	8.00	275.80	180.00	3.07	3.73	17.60	0.00	0.00	3.00	3.00
15.20	8.00	275.80	180.00	3.07	3.78	18.00	0.00	0.00	3.00	3.00

Continued on next page

Table 4.2: Long Table Example

	mpg	cyl	disp	hp	drat	wt	qsec	vs	am	gear	carb
	10.40	8.00	472.00	205.00	2.93	5.25	17.98	0.00	0.00	3.00	4.00
	10.40	8.00	460.00	215.00	3.00	5.42	17.82	0.00	0.00	3.00	4.00
	14.70	8.00	440.00	230.00	3.23	5.34	17.42	0.00	0.00	3.00	4.00
	32.40	4.00	78.70	66.00	4.08	2.20	19.47	1.00	1.00	4.00	1.00
	30.40	4.00	75.70	52.00	4.93	1.61	18.52	1.00	1.00	4.00	2.00
	33.90	4.00	71.10	65.00	4.22	1.83	19.90	1.00	1.00	4.00	1.00
	21.50	4.00	120.10	97.00	3.70	2.46	20.01	1.00	0.00	3.00	1.00
	15.50	8.00	318.00	150.00	2.76	3.52	16.87	0.00	0.00	3.00	2.00
	15.20	8.00	304.00	150.00	3.15	3.44	17.30	0.00	0.00	3.00	2.00
	13.30	8.00	350.00	245.00	3.73	3.84	15.41	0.00	0.00	3.00	4.00
	19.20	8.00	400.00	175.00	3.08	3.85	17.05	0.00	0.00	3.00	2.00
	27.30	4.00	79.00	66.00	4.08	1.94	18.90	1.00	1.00	4.00	1.00
	26.00	4.00	120.30	91.00	4.43	2.14	16.70	0.00	1.00	5.00	2.00
	30.40	4.00	95.10	113.00	3.77	1.51	16.90	1.00	1.00	5.00	2.00
	15.80	8.00	351.00	264.00	4.22	3.17	14.50	0.00	1.00	5.00	4.00
	19.70	6.00	145.00	175.00	3.62	2.77	15.50	0.00	1.00	5.00	6.00
	15.00	8.00	301.00	335.00	3.54	3.57	14.60	0.00	1.00	5.00	8.00
	21.40	4.00	121.00	109.00	4.11	2.78	18.60	1.00	1.00	4.00	2.00

4.1. Huxtable

Huxtable is a very nice package for making working with tables between Rmarkdown and Tex easier.

This cost some adjustment to the Tex templates to make it work, but it now works nicely.

See documentation for this package here. A particularly nice addition of this package is for making the printing of regression results a joy (see here). Here follows an example:

Table 4.3: Regression Output

	Reg1	Reg2	Reg3
(Intercept)	-2256.361 ***	5763.668 ***	4045.333 ***
	(13.055)	(740.556)	(286.205)
carat	7756.426 ***		7765.141 ***
	(14.067)		(14.009)
depth		-29.650 *	-102.165 ***
		(11.990)	(4.635)
N	53940	53940	53940
R2	0.849	0.000	0.851

*** p $<$ 0.001; ** p $<$ 0.01; * p $<$ 0.05.

5. Lists

To add lists, simply using the following notation

- This is really simple
  - Just note the spaces here - writing in R you have to sometimes be pedantic about spaces...
- Note that Rmarkdown notation removes the pain of defining LaTeXenvironments!

6. Conclusion

References

10 Fama, E.F. & French, K.R. 1997. Industry costs of equity. *Journal of financial economics*. 43(2):153–193.

Grinold, R.C. & Kahn, R.N. 2000. Active portfolio management.

Appendix

Appendix A

Some appendix information here

Appendix B