# ECON 3040 – Intro to Econometrics

# Lecture 1 – Course outline, RStudio, "What is Econometrics?"

## Course Description

The principal objective of this course is to provide a basic introduction to econometric theory and its application. Much of the emphasis of the course is on the linear multiple regression model, under standard assumptions. The course begins with a review of probability and statistics, and ordinary least squares (OLS).

## Required Textbook

Godwin, R. T., *Introduction to Econometrics*

## Recommended Textbook

Introduction to Econometrics, 3rd Edition Update, by Stock and Watson.

## Course Website

Course resources (including lecture notes, past exams, assignments, and computer labs) are available on rtgodwin.com/3040

## Evaluation

| | |
|---|---|
| Assignments: | **15%** |
| Midterm 1 (**Oct. 7**): | **20%** |
| Midterm 2 (**Nov. 4**): | **20%** |
| Final Exam: | **45%** |

## Assignments

You will use RStudio and work with data in order to complete your assignments.

## Midterm and final examination

These will be closed book/closed notes. The final examination will cover all of the material presented in the course.

## Grading scale

| | |
|---|---|
| A+ | 93 – 100 |
| A | 87 – 93 |
| B+ | 80 – 87 |
| B | 72 – 80 |
| C+ | 64 – 72 |
| C | 57 – 64 |
| D | 50 – 57 |
| F | 0 – 50 |

- A missed assessment will result in make-up work, or reweighting of your grade.
- Nov. 18 is the last day for Voluntary Withdrawal from courses.

## Academic Integrity

- All assignments and exams must be completed independently.
- Do not engage in “contract” cheating.
- Do not provide your UM Learn login information to anyone else. This is “personation”, a serious form of academic misconduct.

Ignorance is not a defense. Familiarize yourself with section 2.5 of Academic Misconduct Procedures.

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## Tentative Course Topics

- Review of Probability
- Review of Statistics
- Linear Regression with One Regressor
- Hypothesis Tests
- Linear Regression with Multiple Regressors
- Hypothesis Tests in Multiple Regression
- Nonlinear Regression Functions
- Differences in differences
- Instrumental Variables
- Heteroskedasticity

## Student Accessibility Services

Students with disabilities should contact Student Accessibility Services to facilitate the implementation of accommodations, and meet with me to discuss the accommodations recommended by Student Accessibility Services.

## Academic Supports

# Sample Lecture

## What is Econometrics?

- Econometrics is a subset of statistics
- Science of testing economic theories
- Used to estimate causal effects
- Used to forecast or predict (not covered in this course)
- Often characterized by “observational data”

## Causal Effects

Economic models often suggest that one variable causes another. This often has *policy implications*. The economic models, however, do not provide *quantitative magnitudes* of the causal effects.

For example:

- How would a change in the *price* of alcohol or cigarettes effect the *quantity* consumed?
- If *income* increases, how much of the increase will be *consumed*?
- If an additional *fireplace* is added to a house, how much will the *price* of the house increase?
- How does another year of *education* change *earnings*?

## Using data to estimate causal effects

An experiment would be best.

- How would you determine the effect of fertilizer on crop yield?
- How would you use an experiment to determine the above four causal effects (on the previous slide)?
- What is the advantage of experiments?

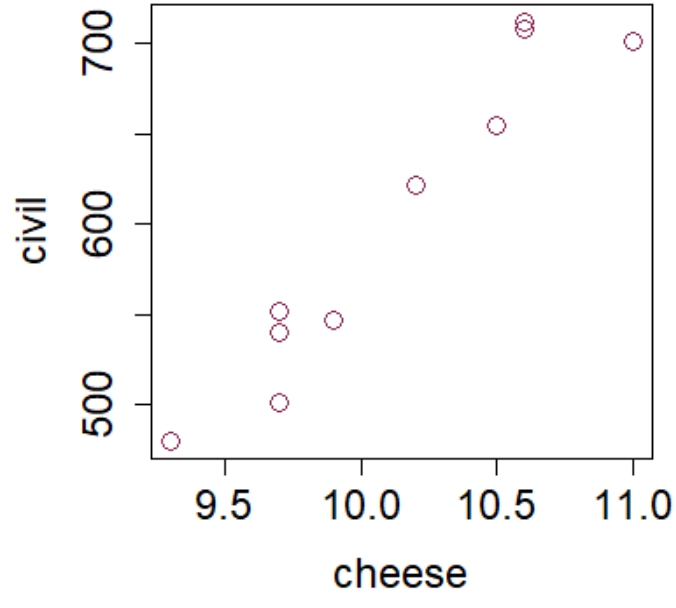
Economic experiments are usually unethical and/or too expensive.

We usually don't have *experimental* data in econometrics – we have *observational* data.

There are issues when dealing with observational data:

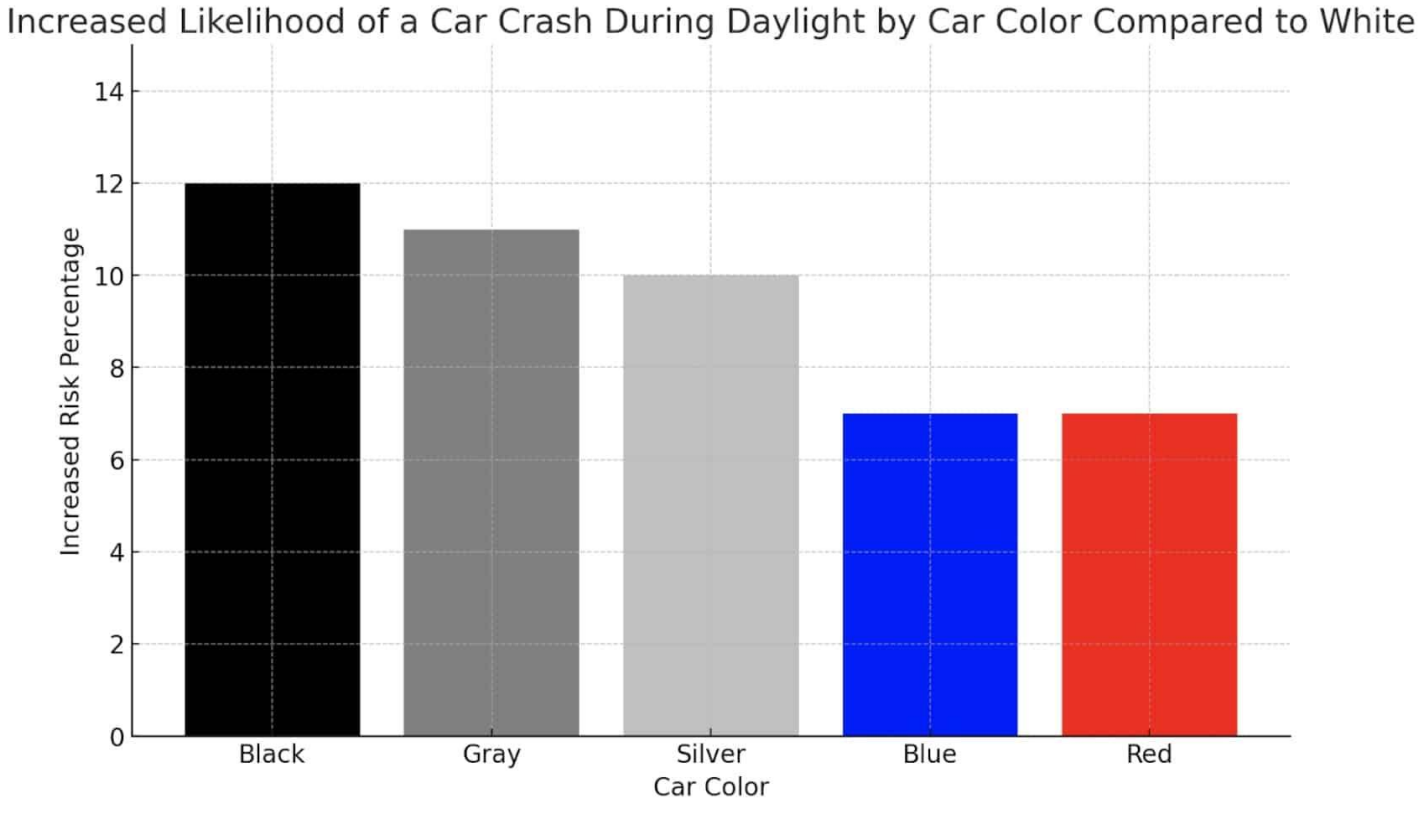
- Correlation vs. causation
- Omitted variables
- Selection bias

*Civil engineering PhDs awarded, and per-capita consumption of cheese, from 2000-2009 in the U.S. (Spurious correlations, Tyler Vigen)*




What is wrong with the above picture?

# What colour car should you drive?




Source: https://www.monash.edu/__data/assets/pdf_file/0007/216475/An-investigation-into-the-relationship-between-vehicle-colour-and-crash-risk.pdf

# Objectives of this course

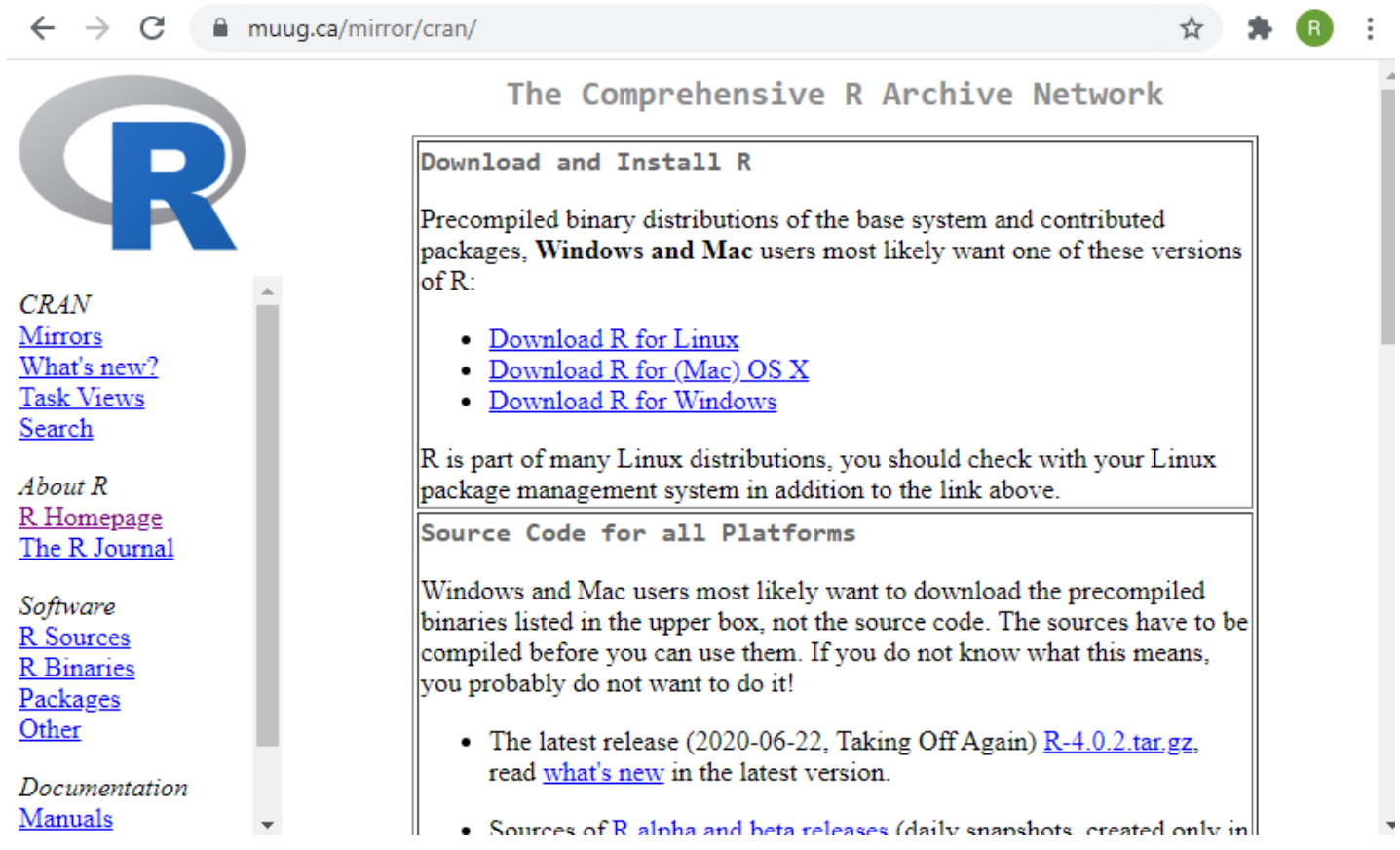
- Learn a method for estimating causal effects (least squares, “LS”)
- Understand some theoretical properties of LS
- Learn about hypothesis testing
- Practice LS using data sets

# R and RStudio

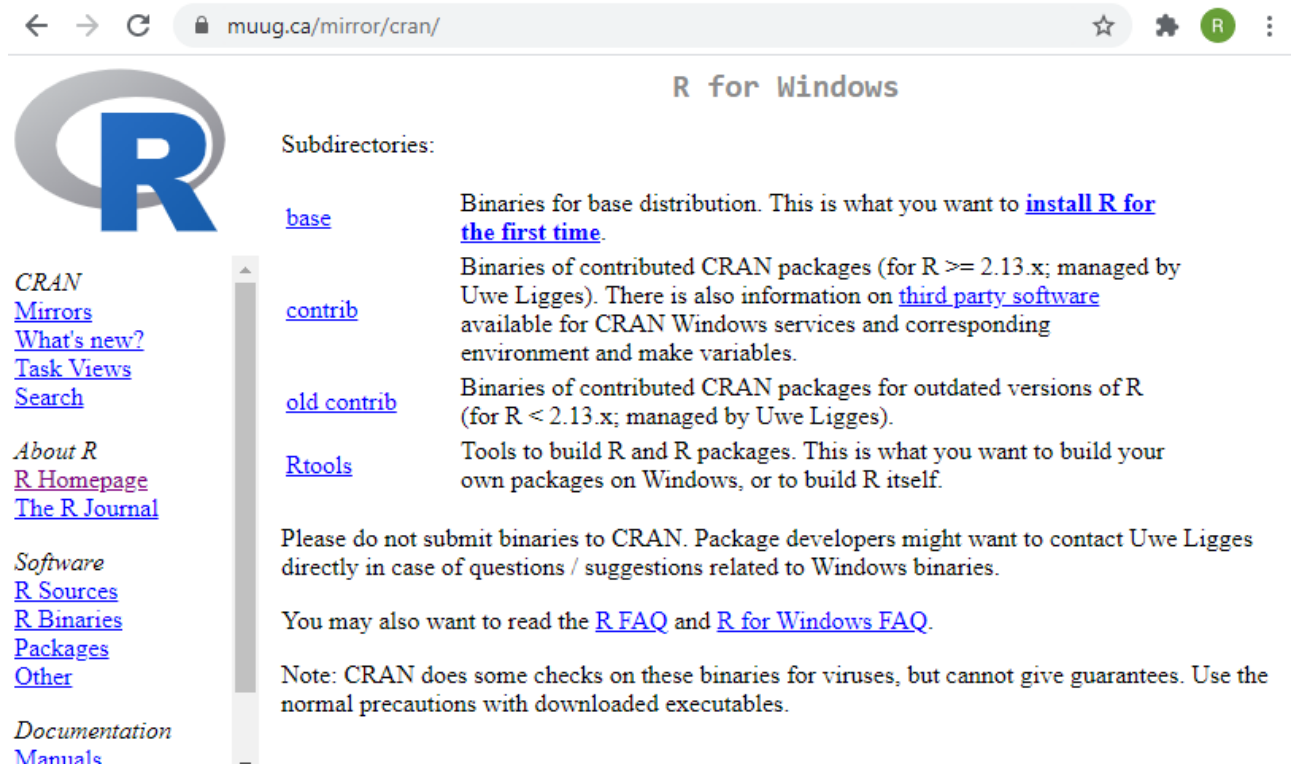
The theory and concepts presented in this course will be illustrated by analysing several data sets. Data analysis will be accomplished through the R Statistical Environment and RStudio. Both are free, and R is fast becoming the best and most widely used statistical software.

## First, install R

- Go to https://muug.ca/mirror/cran/
- Choose Windows or Mac
- Or just search “download R”




- Click “install R for the first time”

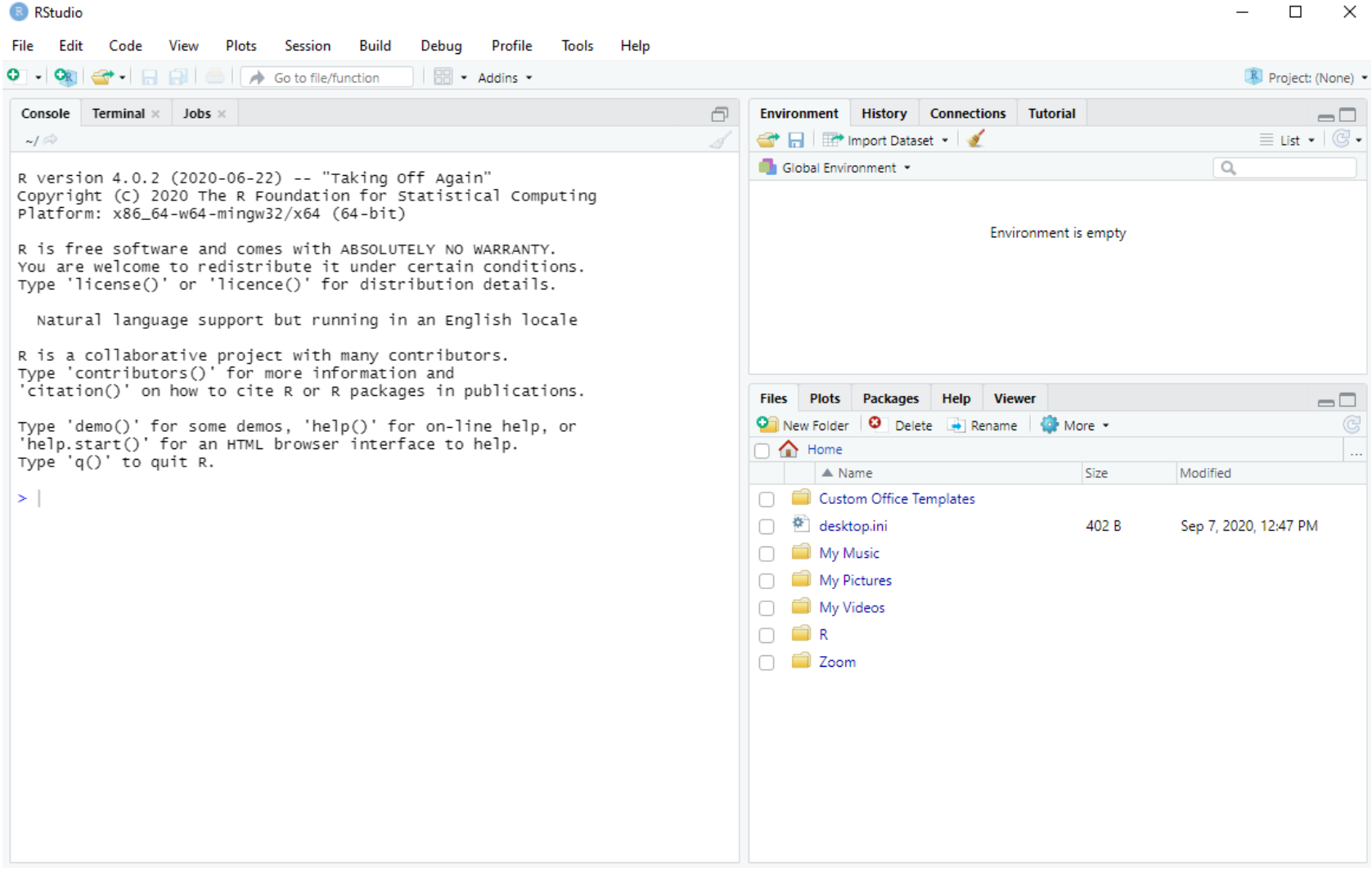



- Click “Download R 4.5.1 for Windows” (or Mac)
- Run the “.exe” file
- Click “Next” a bunch of times
- Don’t download RTools!

## Second, install RStudio

- Go to https://rstudio.com/products/rstudio/download/
- Scroll down until you see the download button “Download RStudio Desktop for Windows (Mac)”. Click it.

- Run the “.exe”
- Keep clicking “next” / “install”
- Find RStudio on your computer and open it. It should look something like this:


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
Console Terminal Jobs
~/
R version 4.0.2 (2020-06-22) -- "Taking Off Again"
Copyright (C) 2020 The R Foundation for Statistical Computing
Platform: x86_64-w64-mingw32/x64 (64-bit)
R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.
Natural language support but running in an English locale
R is a collaborative project with many contributors.
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>
Environment History Connections Tutorial
Import Dataset
List
Global Environment
Environment is empty
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New Folder
Delete
Rename
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