Final project

You have been contracted by the Environmental Protection Agency (EPA) to analyze the possible impact of a tax aimed at correcting the damages from excess carbon emissions resulting from the production and sale of gasoline. The EPA is deciding between several different tax schemes:

1. Impose a single tax to be levied on all gasoline manufacturing plants. This tax would be the same across all states nationwide.
2. Impose a tax that varies with how severe the damage is in each state. The tax would be different across each state.
3. Do nothing.

Your final project has two parts: numbers and communication. The EPA wants to recommend a tax scheme that (1) reduces pollution, (2) causes as little economic distortion as possible, and (3) is both politically viable and socially equitable.

You will need to create and submit the following:

1. Using the data and cost estimates provided to you, calculate the general market equilibrium prices before and after each type of tax. Calculate the economic impacts of the tax, including (1) the size of the deadweight loss, (2) the amount of pollution abatement, (3) the tax burden borne by consumers and producers, and (4) the elasticity of supply.

   Calculate these same details for three individual firms as well. Note that these firms are price takers and face a flat marginal cost (i.e. demand) curve.

   Compile your calculations into a single, easily navigable Excel workbook with as many worksheets as you feel necessary. Ensure that your analysis is fully annotated and that it includes all the graphs and math required to understand how you arrived at your answers (i.e. show your work). This workbook is essentially the technical appendix for your memo. Do not just turn in a disjointed Excel file, though—this workbook should be professional and easily navigable.

2. Write a 2–3-page memo to the EPA section head you've been assigned to report to. Include in this memo your assessment of the economic, distributional, and political factors that should be taken into consideration when making the final decision. Be sure to use the numbers from your analysis as evidence for your recommendation. You *must* make a clear final recommendation of what amount of tax should be levied and where.

   In particular, you should discuss the following topics in your memo:

   - Why a tax increase does not increase the price by that amount (i.e. why a $1 tax does not raise the price by $1)
   - Which consumers, companies, and/or states face the largest burdens and why
   - Who *should* bear the burden of this tax
   - How your recommendation takes equity and fairness into account

You will turn in two files:

1. A PDF of your memo
2. An Excel file with your technical appendix (i.e. your calculations and work described above)

You will be graded based on the rubric posted on the class website. Though there are correct answers for the different market equilibria and the differential effects of taxes across states and firms, *there is no one correct recommendation.* Accordingly, I am not looking for a predetermined recommendation in your memos. Instead, I'm looking for good justification for why you make your recommendation, given your math and other calculations.

Keep in mind these important notes and caveats:

- The prices provided here do not take general cost of living differential into account—they have been adjusted to account for cross-state differences. That is, if you find that demand is higher (and thus price is higher) in Wyoming than in New York, don't be alarmed—New Yorkers have more alternatives to driving than Wyomingites, who are more dependent on cars and thus have a higher willingness to pay.

- Additionally, all numbers have been scaled up for ease analysis. Instead of centering prices around current national averages for gasoline (currently around $2.30/gallon), all these numbers are centered around $10. Don't worry about scaling them down to lower numbers—just pretend you're in a world where gas costs that much.

Some final instructions:

- **Daytime students**: You must turn in your own memo and technical appendix, but you can (and should!) work with others to complete the calculations. You can work in groups of up to five people. When turning in your assignment on Learning Suite, use the notes field to indicate who you worked with.
- **Executive students**: You will turn in a single memo and technical appendix for your team. Choose one person to upload the files to Learning Suite—not every team member needs to submit something.

Demand

A previous team of economists and statisticians ran dozens of representative surveys at national and state levels, asking people if they would be willing to pay for gasoline at randomly selected prices. This team then ran linear regression models to estimate national and state-level demand curves based on the slope and intercept coefficients from these models.

The raw results from the nationally representative survey, as well as state-level surveys in Wyoming and New York, are provided below:

	National	New York	Wyoming
(Intercept)	49.56	29.99	68.68
	(0.35)	(0.12)	(1.08)
Quantity	-0.49	-0.05	-1.36
	(0.01)	(0.00)	(0.04)
N	2245	1367	312
R^2	0.773	0.590	0.782
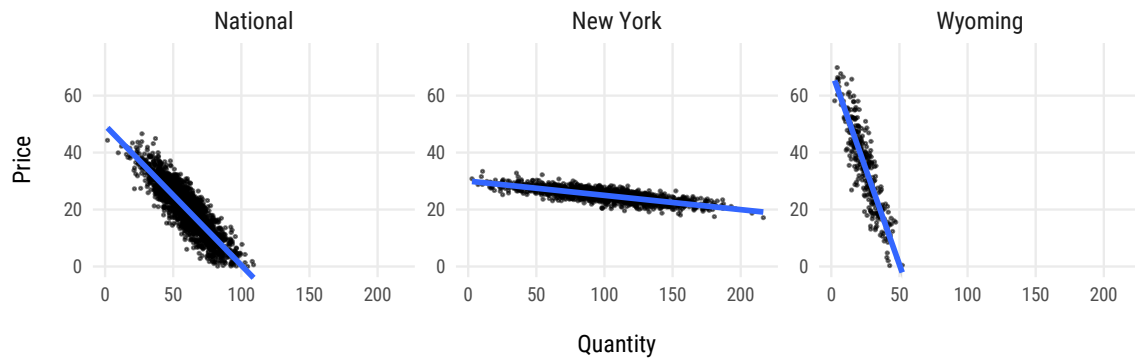
These results can be written in terms of price and quantity, with P measured in dollars and Q measured in gallons of gasoline:

- National aggregate demand:

$$P = -0.49Q + 49.56$$

- New York demand:

$$P = -0.05Q + 29.99$$

- Wyoming demand:

$$P = -1.36Q + 68.68$$

Supply

Based on national surveys of gasoline manufacturing firms, your team estimates that the aggregate industry-wide marginal cost function for gasoline production is:

$$P = 0.2Q + 5$$

The aggregate industry-wide marginal cost functions for firms in New York is:

$$P = 0.8Q - 15$$

...while in Wyoming, it is:

$$P = 0.3Q - 2$$

You are also concerned with the impacts of the proposed taxation scheme on three randomly sampled firms:

Anamizo Energy

Anamizo Energy is a mid-sized gasoline manufacturer based in Pittsburgh, Pennsylvania, with around 8,000 employees located in Pennsylvania, Ohio, North Dakota, and Wyoming. It distributes and sells its oil to all fifty states. Developments in hydraulic fracturing techniques (also known as fracking) allowed the company to grow rapidly between 2005–2010, and the company has been in talks to expand its operations to Alberta, Canada. The company has explored investment into alternative fuels, but has not spent any money on retooling its production process.

Anamizo's chief financial officer has been extremely cooperative with your team and has provided their production cost function:

$$P = 0.6Q - 10$$

Big Apple Gas

Big Apple Gas (or BAG) is one of the largest and oldest gasoline manufacturers in the United States, with refineries and distribution warehouses along the East Coast, throughout the West (including Wyoming), and in dozens of foreign countries. The company employs 16,000 people across the United States and distributes and sells its oil in all fifty states. Foreseeing a future where there will be less demand for gasoline, it has spent the past decade diversifying its portfolio of production activities and has since become a leader in alternative energy research and development. The company relocated its headquarters from Houston, Texas to Manhattan, New York in the 1990s to be closer to investment bankers and increase its access to foreign diplomats. BAG's CEO recently launched a global push for increased corporate social responsibility in oil production.

BAG's actual cost functions are corporate secrets, but according to your best estimates and statistical models, this model is the closest approximation of their production costs:

$$P = 0.125Q + 3$$

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Cecil's Saddle Stop

Cecil's Saddle Stop is a small oil manufacturer and gasoline distributor based in Cheyenne, Wyoming. The company employs 400 people around Wyoming and only has oil extraction locations within the state. Cecil's relies on fracking and traditional standalone oil derricks to extract oil and processes it in three different refineries in Cheyenne, Laramie, and Dubois (near Yellowstone National Park). It distributes and sells its oil at gas stations throughout the Western United States, including Arizona, Colorado, Idaho, Montana, New Mexico, Utah, and Wyoming. Cecil's has dealt with oil for decades and has not considered other sources of revenue, beyond innovations in food offerings in its gas stations.

The firm does not keep detailed records of all its costs, but Cecil himself estimates that their production function looks roughly like this:

$$P = 2.5Q - 55$$

Environmental damage

A team of environmental economists that the EPA contracted with in 2016 estimated the following environmental damages that result from oil extraction and gasoline production:

- Aggregate national average: $1 per gallon
- Average marginal damage in New York: $0.80 per gallon
- Average marginal damage in Wyoming: $1.30 per gallon

Mega hint: these represent shifts in the intercept of the supply/marginal cost functions, *not* shifts in the slope. At a national level, for instance, the social marginal cost should be $P = 0.2Q + (5 + 1)$, or $P = 0.2Q + 6$