

Final Exam
Microeconomics for Public Policy I
Fall 2020
December 15, 2020

Name: _____

Exam Instructions

1. This exam is open book, open note, open internet.
2. All work you turn in should be your own, and in your own words. You should work by yourself on this exam.
3. Answer all questions.
4. The exam is graded out of 100 points. Points for each section and question are indicated on the exam.
5. Write legibly. Illegible exams cannot be graded.
6. The final page is intentionally left blank for extra work. If you do extra work on this page (or any other non-standard location) that you would like to be counted, note it clearly near the question you are answering.
7. Label all figures as needed.
8. We give liberal partial credit. If a question has multiple parts and you can't answer one, it is in your best interest to answer all the remaining parts to the best of your ability.
9. Make sure you **explain** your answers as needed. When appropriate, you should also explain any assumptions that you make to arrive at your answer. Explanations may yield partial credit.
10. Be concise.

Submission Instructions

1. Submit to your personal google folder
2. Submit **one** pdf for the entire exam
3. Name the pdf `lastname_final.pdf`. Mine would be `brooks_final.pdf`
4. The exam will run till the end of the class session (5:20 or 8:00). You then have a ten minute grace period to turn in your exam (till 5:30 or 8:10)

5. After this, we take off one point for each minute the exam is late
6. If you run into disaster, post pictures of all your exam pages to your personal google drive folder by the deadline and post the pdf as soon as possible after that
7. In the event of google drive failure, submit your exam to lfbrooks@gwu.edu. This is a last resort only.

A. Ripped From the Headlines (9 points, 3 each part)

Read the article from the *Wall Street Journal* at the end of the exam.

1. Use supply and demand language and a graph to show why the price for “recycled catalogs, boxes and newspapers collapsed” two years ago. A complete answer uses your graph to show the situation before and after the price collapse.

2. Name at least two changes to costs for American recycled paper producers that are mentioned in the article. For each one, explain if this cost that changed was a fixed or variable cost.

3. Though the article does not state this explicitly, we can make a prediction about what may happen to the price of recycled paper in China. Use a supply and demand framework with a graph to make a prediction about what will or is happening to paper prices in China. Explain which curve shifts and why.

B. Short Answer Questions (5 points each, 40 points total)

1. Give two examples of things that could shift the supply curve for chocolate, and describe which way each shifts the curve.

2. Explain what public good autopsies produce by referring to (and explaining) the definition of public goods.

3. Does a firm prefer to produce when $MR > MC$, or when $MR < MC$? Why?

4. This year there have been a large number of retail closures and bankruptcies due to covid and attendant restrictions. Give a specific example of a firm closure (full or partial) or bankruptcy and name two costs to the firm due to this: one cost that is sunk and one cost that is not. Explain why using the definition of sunk costs.

5. Name two potential sources of market power, and give an example of each. Please be specific.

6. Give an example of a negative externality that you have exerted on others. Use the definition of externality in your answer.

7. Why might a perfectly competitive firm operate in the short run when it will have negative profits? Explain why, using the conditions under which a firm should operate in the short run.

8. Suppose that a firm operates with marginal product of capital is $MP_K = 5L$, and marginal product of labor is $MP_L = 3K$. The firm faces a wage rate of 3 and a capital rental rate of 2. The firm is currently consuming 2 units of capital, and 3 units of labor. Is the firm optimizing its purchases of capital and labor? If it is not, from which input is it getting more value for the last unit, and which should it purchase more of: capital or labor?

C. Medium Answer Questions (51 points total)

1 ((a)-(e), 3 points, 15 points total) Market Demand

Suppose that there are only two people in the world: Anne and Betsy. Anne's demand is given by $Q = 100 - P$ and Betsy's demand is given by $Q = 50 - \frac{1}{4}P$.

(a) Do these demand curves slope upward or downward? Why?

(b) Draw separate graphs of Anne's and Betsy's individual demand curves. Label all intercepts and axes.

(c) Find an expression for total market demand, assuming that the demand curves are for private goods. Draw the market demand curve in a graph, labeling axes, intercepts and kink points.

(d) Now, suppose that this good Q is a public good. Draw the market demand curve in a graph, labeling axes, intercepts and kink points.

(e) Explain why your pictures for (c) and (d) have different y intercepts. To do so, it may be helpful to explain the intuition for both y intercepts.

2 ((a-c), 3 points; (d & (e), 4 points; 17 points total) Pigouvian Taxes, Externalities, and Tax Incidence

Suppose that the market demand for chocolate is equal to $Q = 200 - (4/3)P$. The private marginal cost of chocolate production is $PMC = (1/4)Q + 50$. Chocolate production uses cocoa beans as an input. Sadly, cocoa bean producers use some terrible spray on the beans that harms chickens. Therefore, the social marginal cost of chocolate production is $SMC = (1/4)Q + 75$.

(a) What is an external marginal cost and is the external marginal cost of chocolate production in this problem?

(b) What is a fixed cost? And what is the fixed cost for chocolate producers?

(c) Suppose that the government levies a Pigouvian tax on \$25 per unit on chocolate producers. What are the equilibrium price and quantity in this case?

(d) Quantify the burden of this tax on consumers and producers of chocolate. Give exact numbers. A picture may be very helpful to figure out the tax burden.

(e) Explain why the larger tax burden you find in (d) falls on the party on which it does.

3 ((a), 3 points; (b)-(e), 4 points; 19 points total). Competition

Answers in this question are sequential. If you don't find the answer to a given sub-question but have some ideas about how to solve the next one, write down as much as is helpful to earn partial credit.

(a) Suppose that the paper industry is competitive and has 100 identical firms, each with marginal cost $MC = (1/4)Q + 40$. What is the industry supply curve? Draw a picture to illustrate the logic of your addition.

(b) Demand for paper is $P = 60 - (3/400)Q$. Find the market equilibrium price and quantity.

(c) Now suppose that there is only one firm and it is a monopolist. This monopolist has the industry supply curve you found in part (a). Demand is unchanged from part (b). What are the new equilibrium price and quantity?

(d) Indicate producer and consumer surplus for this monopoly case in a picture where you label axes, intercepts and key points. (You do not need to calculate specific values.) Without calculating specific values for this or the competitive case, compare the areas you have indicated to those in the case of perfect competition. Explain whether producer and consumer surplus are larger, smaller or indeterminately different between the two cases.

(e) Return back to the world with perfectly competitive firms from part (a). Suppose that each perfectly competitive firm's average variable cost is $AVC = (3/4)Q + 30$, and the firm's marginal cost remains $MC = (1/4)Q + 40$. Would the firm produce in the short run if the market price is 40? if the market price is 45? if it is 50? Explain why. (A picture may be helpful in finding the answer.)

Blank – for extra work

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<https://www.wsj.com/articles/all-those-used-delivery-boxes-are-a-hot-commodity-11605609001>

BUSINESS

All Those Used Delivery Boxes Are a Hot Commodity

Surge in food and package deliveries during the pandemic is recharging U.S. market for recycled paper and cardboard

By [Bob Tita](#) / Photography by Andy Jacobsohn for *The Wall Street Journal*

Nov. 17, 2020 5:30 am ET



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Junk mail and discarded delivery boxes have turned into a hot commodity as the paper industry uses them as a substitute for recycled office paper, which became scarce as people work from home.

That is a sharp turnaround from two years ago, when the market for recycled catalogs, boxes and newspapers collapsed after [China toughened its standards](#) for waste paper imports.

Now, U.S. paper and cardboard mills are figuring out how to turn that trash into new toilet paper, coffee cups, paper towels and cardboard boxes. And they have more material to work with as people [order more food](#) and packages to their homes during the coronavirus.

“Those who are recycling are recycling more,” said Kevin Hudson, vice president of forestry and recycled fiber for paper company [WestRock](#) Co. “You’re definitely seeing more old corrugated cardboard from residential programs since Covid.”



Scrap paper is loaded into a baler at Texas Recycling, which collects paper from commercial and industrial users and sells it to paper mills.

Many U.S. mills long avoided paper from curbside recycling programs. The low quality of paper mixed with glass, cans and household trash made it difficult to turn into new paper and cardboard. Before China tightened its standards, it had been buying two-thirds of such mixed paper collected in the U.S. The export demand kept prices high, discouraging U.S. paper mills from investing in ways to use more of it.

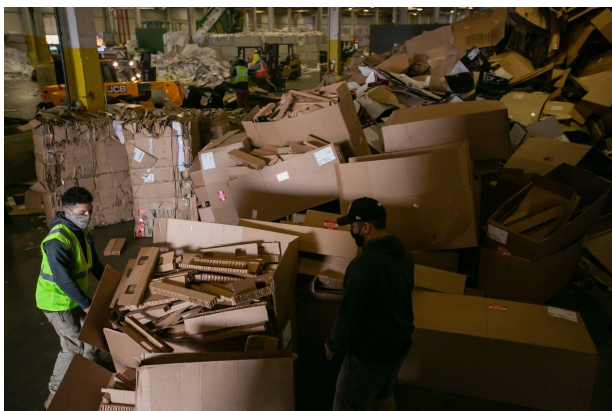
But better screening for contaminants and the rising share of e-commerce delivery boxes in recycling bins have made that mixed paper more attractive, operators say.

Atlanta-based WestRock, which operates 18 plants to sort recycled material of all types, started a public-awareness campaign this summer to encourage consumers to dump some of the three billion pizza boxes produced in the U.S. each year in recycling bins. The grease or cheese residue doesn't preclude them from being turned into recycled pulp, which can be used to make new cardboard, the company said.

Some mills are substituting mixed paper from recycling programs for discarded office paper that has become scarce as most office workers stay home.



Workers unload cardboard deliveries at Texas Recycling, which is looking for more cardboard to make up for a drop in office paper.



“We’re seeing mixed paper match up quite nicely,” said John Mulcahy, vice president of sustainability for Georgia Pacific LLC, which is making toilet paper and paper towels for commercial buildings and hotels with mixed paper.

Georgia Pacific, whose consumer brands include Dixie cups, Brawny paper towels and Quilted Northern toilet paper, invested about \$45 million at mills in Green Bay, Wis., and Muskogee, Okla., in recent years to produce pulp that contains more paper recovered from recycling programs, including coffee cups.

Fine screens were added to pulping equipment at the plants to filter out the polyethylene plastic films inside coffee cups that prevent them from leaking but also make them harder to turn into pulp.



Newspaper and advertising circulars are baled at Texas Recycling before being shipped to a paper mill.

Corrugated cardboard makes up as much as a third of the paper entering recycling plants from homes in big metro areas, up from 5% a few years ago, said Bill Moore, a recycled paper consultant in Georgia.

This surge in cardboard delivery boxes is helping to make mixed paper more valuable. The longer fibers in the cardboard make mixed-paper pulp stronger, allowing mixed paper to be used to make tissue paper and new cardboard for e-commerce boxes and other containers.

Prices for mixed paper have risen from zero at the beginning of the year to about \$30 a ton this month on higher demand from domestic mills, according to data provider Fastmarkets RISI Inc. That is a financial boost for some beleaguered material processors,

trash collectors and cities that have seen revenue from recycling programs plunge in recent years.

The overall collection volume from U.S. residential recycling programs is up at least 7% from last year at this time, thanks in part to the mountain of delivery boxes piling up on doorsteps, according to the Solid Waste Association of North America.

“We’re more than happy to see it. We’ve said this is valuable material,” said Brent Bell, vice president of recycling for Houston-based Waste Management Inc., the nation’s largest trash collector.

Waste Management has opened regional plants in Chicago and Salt Lake City to process recycled materials more efficiently and with fewer contaminants, especially paper and cardboard, which make up the largest share of the items collected. A third plant, in Raleigh, N.C., is scheduled to open by the end of the year.

Recyclers expect prices for mixed paper to keep rising into next year because orders from foreign recyclers and paper mills are increasing. While China won’t accept any U.S. scrap exports after December, China doesn’t recycle enough paper to meet its own paper and cardboard demand, industry analysts say.

As a result, mills in Vietnam, Malaysia and elsewhere are increasing production of pulp and cardboard made from U.S. recycled paper and exporting them to China. And Chinese companies have been buying plants in the U.S. that recycle paper and plastic.

Meantime, American companies are searching for more scrap paper. Dallas-based Texas Recycling Inc., which collects paper from commercial and industrial users and sells it to paper mills, is looking for more cardboard to cover the 40% drop this year in its shredding business for office paper.

“The demand for corrugated is going to pick up,” said co-owner Joel Litman. “More mills are coming on line.”

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All Those Used Delivery Boxes Are a Hot Commodity - WSJ



Baled paper is stacked high at Texas Recycling.

Write to Bob Tita at robert.tita@wsj.com

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