

Midterm  
Microeconomics for Public Policy I  
Fall 2020  
October 13, 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_midterm.pdf`. Mine would be `brooks_midterm.pdf`
4. 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](mailto:lfbrooks@gwu.edu). This should be a last resort only.

For marking purposes only

Part A \_\_\_\_\_

Part B \_\_\_\_\_

Part C \_\_\_\_\_

total \_\_\_\_\_

**A. Ripped From the Headlines** (9 points)

Read the article from the *Wall Street Journal* at the end of the exam. You can stop reading after the first picture on the sixth page of the article.

1 (2). Draw a picture of supply and demand in the pine tree market in the US South in the late 1980s, and then add current supply. Discuss the position of the new supply curve relative to the old supply curve.

2 (3). Discuss two reasons for the change in the supply curve.

3 (4). Find the paragraph beginning, "It was worth the trouble to sort the trees carefully."  
Give a supply or demand explanation for these price differences.

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

1. Give two examples of things that could shift demand for movies (movies writ broadly, not just movies in the theatre), and describe which way each example shifts the demand curve.

2. Define the cross-price elasticity of demand. Then consider the cross price elasticity of demand for bananas and apples; say whether its sign is positive or negative for you, and explain why.

3. Suppose that only supply or demand changes in the market for lentils. Further suppose that the equilibrium price declines and the equilibrium quantity increases. Did the supply curve or the demand curve move? Which way?

4. Define a luxury good and give an example of something that is a luxury good for you. Explain why.

5. Suppose that the government is contemplating a new tax, and that design is such that the statutory incidence falls on suppliers. The government is considering two distinct markets in which to levy this tax: Market 1 with relatively elastic demand, and Market 2 with relatively inelastic demand. In which market do consumers bear a greater burden of the tax? Explain the logic behind your conclusion using pictures as needed.

6. Suppose that Joe's demand for ice cream is given by  $Q = 5 - 2P$  and Mary's demand for ice cream is given by  $Q = 10 - 3P$ . What is the maximum willingness to pay for ice cream (the highest price anyone in the market is willing to pay) by either Joe or Mary? Explain how you arrived at your answer.

7. Suppose that you consume only squash and cheddar cheese, and that you prefer cheddar cheese to squash. Draw indifference curves that reflect this (put cheese on the horizontal axis) and explain why they look the way they do.

8. Define the diminishing marginal utility of consumption of a good, and describe it in action for something you consume.



**C. Medium Answer Questions** (51 points, sub-points as noted in questions)

1 (19). Supply, Demand and Zucchini

Demand for zucchini is  $P = 100 - 5Q$  and supply for zucchini is  $P = 20 + 3Q$ . (Zucchini is sold in 10-kilo bags.)

(a, 3) What is the market equilibrium price and quantity of these 10-kilo bags of zucchini?

(b, 4) Define consumer and producer surplus and gives values for them in this market.

(c, 4) Suppose that the government wants to increase the quantity of zucchini its citizens are eating. In response, it adopts a policy where 10-kilo bags of zucchini cannot be sold for more than \$40. Add this policy to your chart (or make a new chart if this is easier) and find the new equilibrium price and quantity.

(d, 4) What are producer and consumer surplus at a price of \$40?

(e, 4) Has the government achieved its objective (see part (c))? Why or why not?

2 (19). Individual Decisionmaking

(a, 3) Suppose that Fiona's income is \$100, and that she purchases only suits (denoted  $U$ ), which cost \$10 and dress shoes (denoted  $S$ ), which cost \$20 per pair. Write the equation for Fiona's budget constraint.

(b, 4) Draw the budget constraint, labeling the axes and intercepts. Put dress shoes on the horizontal axis and suits on the vertical axis.

(c, 4) If she could afford it, might Fiona prefer 4 pairs of dress shoes and 5 suits to any current optimal consumption? Why?

(d, 4) Draw an indifference curve on your picture from (b) (or repeat the picture with this curve) such that Fiona is consuming optimally.

(e, 4) Suppose that Fiona's marginal utility of suits is  $MU_U = 2S$  and her marginal utility of shoes is  $MU_S = 5U$ . If she consumes 4 suits and 3 pairs of shoes, is she consuming optimally? If no, of which good should she increase consumption? Explain why.

3 (13). Income and Substitution Effects

Suppose that the government is deeply interested in non-meat proteins. At the moment, beans and lentils both sell for \$1 per pound, and all consumers have an income of \$1000.

(a, 3) Draw the original budget constraint with lentils on the horizontal axis. Label axes and intercepts. Also draw an indifference curve such that the consumer is consuming optimally. Note the location of optimal consumption.

(b, 3) The government would like to make lentils cheaper relative to beans. To do so, the government subsidizes producers so that all lentils are half-price. Add an additional budget constraint to this figure that shows this new policy, labeling intercepts.

(c, 3) Use the figure to show the income and substitution effects of this price change for lentils and beans. Mark the amounts on the graph; no need to provide exact numbers.

(d, 4) If lentils and beans became less substitutable, how would the substitution effect for lentils change? Give intuition about why.



Name: \_\_\_\_\_

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<https://www.wsj.com/articles/thousands-of-southerners-planted-trees-for-retirement-it-didnt-work-1539095250>

# Thousands of Southerners Planted Trees for Retirement. It Didn't Work.

Too much pine and not enough saw mills spell years of depressed prices for plantations

*By Ryan Dezember*

Oct. 9, 2018 10:27 a.m. ET

STARKVILLE, Miss.—Over the past hundred years, the George family's farm has been sharecropped, grazed by cattle and planted with cotton. By the late 1980s, Clayton George was growing soybeans and struggling to make ends meet.

A new federal program offered farmers money to reforest depleted land. Pine trees appealed to Mr. George. He bought loblolly seedlings and pulled his pickup into a parking lot where hands-for-hire congregated.

"We figured we'd plant trees and come back and harvest it in 30 years and in the meantime go into town to make a living doing something else," he said.

Three decades later the trees are ready to cut, and Mr. George is learning how many other Southerners had the same idea.

A glut of timber has piled up in the Southeast. There are far more ready-to-cut trees than the region's mills can saw or pulp. The surfeit has crushed timber prices in Mississippi, Alabama and several other states.

It has been a big loser for some financial investors, among them the country's largest pension fund. The California Public Employees' Retirement System spent more than \$2 billion on Southern timberland, and harvested trees at depressed prices to pay interest on money borrowed to buy. Calpers sold much of its land this summer at a loss. A spokeswoman for the pension fund declined to comment.

It's also been tough for the individuals and families who own much of the South's forestland, and who had banked on its operating as a college fund or retirement account. The region has more than six million owners of at least 10 wooded acres, say academics and forestry consultants. Many of the owners were counting on forests as a long-term investment that could be replenished and passed on to heirs.

[https://www.wsj.com/articles/thousands-of-southerners-planted-trees-for-retirement-it-didnt-work-1539095250?mod=hp\\_lead\\_pos6](https://www.wsj.com/articles/thousands-of-southerners-planted-trees-for-retirement-it-didnt-work-1539095250?mod=hp_lead_pos6)

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“If you work and you didn’t want to put all your money in the stock market, you’d buy 40 acres and plant trees and they’d be ready to cut by the time your kid went to college,” said Skip Stead, a timber broker in Lincoln, Ala. “It’s like a 401(k).”

The housing crash 10 years ago worsened the developing timber glut by depressing lumber demand and prompting woodland owners to postpone harvests. Mills closed.



Michael Counter grades lumber cut at a PotlatchDeltic saw mill in Arkansas. PHOTO: KAREN E. SEGRAVE FOR THE WALL STREET JOURNAL

Housing has come back in much of the country, pushing prices for finished forest products such as two-by-fours and plywood to historic highs during the spring and summer building season. Prices for logs, as well, have moved up in the U.S.’s other big timber-producing region, the Pacific Northwest, where supply is kept in check by wood-boring beetles and periodic wildfires.

In the South, timber prices haven’t stopped sliding. Adjusted for inflation, the price of Southern pine is down about 45% since 2007, according to Daowei Zhang, an Auburn University professor of forest economics. So-called saw timber, for making lumber, is at a 50-year low, adjusted for inflation.

Corporate owners of far-flung timber tracts can concentrate logging in regional markets where prices are healthier, such as Savannah, Ga., and Charleston, S.C., which have access to ocean shipping. Timber companies that own saw mills, such as PotlatchDeltic Corp. , can buy local logs on the cheap.

Most Southern woodland owners are stuck with whatever the nearest mill is paying.

Hauling logs cross-country chasing better prices isn’t an option. It doesn’t take many tree trunks to fill a truck to its 80,000-pound limit on interstate highways. Loggers, paid for each ton they cut and deliver to the mill, are reluctant to make all-day trips.

Some timber harvests are barely worth the effort after the expense of logging, hauling, taxes and replanting. In some areas, there is hardly any margin for the imperfect pines that are pulped for paper and particleboard.

Waiting for better prices carries its own risks, because after a certain age, trees, like people, become more susceptible to disease. Hurricanes can lay down entire tracts. The Southern pine beetle can alter financial plans in days.

Hernando de Soto searched the South for gold in the 16th century but what he found was mostly trees, a primeval forest of longleaf pine that stretched from what's now southern Virginia to northern Florida and west into Texas.

The British navy gobbled up the colonies' longleaf for its rot-resistant wood and gummy sap, from which turpentine and pitch were made. In the decades following the Civil War, the pine lands were logged nearly to oblivion. Vast swaths of forestland also were cleared to plant tobacco and cotton.



Pine logs move along as a computer decides what size lumber they will become. PHOTO: KAREN E. SEGRAVE FOR THE WALL STREET JOURNAL

In the 1950s, the U.S. Department of Agriculture started dangling forestation incentives to stem erosion and prop up crop prices. At the depths of the 1980s farm crisis, when prices for agricultural commodities plunged, the Reagan administration launched the Conservation Reserve Program. Starting in 1986, it promised farmers annual payments of about \$30 to \$50 for each acre they planted with trees or grasses.

Many seized the offer. By 1994, more than 2.2 million acres of farmland in the South had been converted to pine plantation, much of it in Mississippi, Alabama and Georgia. Other federal forestation programs added about 2.5 million acres more, according to Auburn's Mr. Zhang.

Meanwhile, timber was gaining popularity as an investment idea. People reasoned that trees would grow, and thus gain value, no matter what the stock market did. Investors large and small snapped up forestland that big paper companies put on the market to take advantage of the interest. Researchers reported in 1998 that residual fertilizer in the soil of former farms was helping trees grow faster.

A crush of maturing trees arrived just as U.S. housing markets collapsed in 2007 and 2008, creating a supply imbalance that in some places has never ended. Even with increased demand from the housing recovery, there remain about 25 years' worth of softwood supply in the Southeast, said Brooks Mendell, chief executive of Forisk Consulting, which advises timber investors.

In parts of Mississippi and Alabama, the glut is even worse. "It's unclear we'll ever have timber prices like we did 10 or 20 years ago," Mr. Mendell said.



Logs are piled up to await processing at a PotlatchDeltic mill in Arkansas. PHOTO: KAREN E. SEGRAVE FOR THE WALL STREET JOURNAL

Southern mill owners—who buy logs from landowners and resell them as poles, lumber and pulp—anticipate wide margins for years because their raw material is so cheap. Billions of dollars of new saw mills and mill expansions have been announced by the likes of Georgia-Pacific and Canada's Canfor Corp. Lumber is more practical than logs to haul long distances to stronger markets.

The arbitrage inspired last year's merger of Deltic Timber Corp. and Potlatch Corp. Deltic's three Arkansas mills offered profits amid depressed prices for Potlatch's Southern timber. The combined company quickly added a second shift to a mill in Ola, Ark., and a more efficient kiln for drying wood at another mill.

More mills could help timber prices, but building one of today's modern computerized mills, and finding the skilled labor to run it, is a complex task. "Can they install a mill in a rural town

in Mississippi and be able to go hire a hundred workers who want to work in a saw mill?" asked PotlatchDeltic Chief Executive Michael Covey at an investor conference in New York this summer. "It's going to take a few years for those Southern log prices to tip back up."

In the woods behind a subdivision in suburban Birmingham, Ala., this July, loggers downed all but the most aesthetically pleasing trees on George Lutz's 60 acres. He had plunked down some of his retirement savings to buy the property after the housing crash a decade ago and planned to develop residential lots. He was counting on the timber to recoup much more of his cost.

"If it wasn't my retirement, I probably wouldn't cut," he said.

The 65-year-old enlisted Rick Nelms, an Alabama consultant and procurement forester, to squeeze as much as possible from the harvest. Mr. Nelms is what is known as a timber cruiser, able to move through the woods and size up trees and estimate their value at a glance. He used to procure timber for a big paper company but now drives around Alabama and Mississippi advising an array of dentists, retirees and heirs on land deals and timber sales.



Forestry consultant Rick Nelms oversees a timber harvest on a tract in Alabama. PHOTO: BOB MILLER FOR THE WALL STREET JOURNAL

On Mr. Lutz's property, he watched the operator of a machine called a knuckleboom-crane yank trunks through a "delimber" to shave off the branches.

Mr. Nelms waved to the operator and shouted, "That's a pole."

The man in the crane looked down at the thick log he was about to lay on a pile of trunks destined for a mill that would saw them into lumber. It's bent, he said.

Mr. Nelms assured the operator the log would straighten out on the truck under the weight of the other big logs destined to become utility poles. The crane operator set the trunk aside.





Mr. Nelms examines a log. PHOTO: BOB MILLER FOR THE WALL STREET JOURNAL

It was worth the trouble to sort the trees carefully. A run-of-the-mill power pole could fetch about \$50 a ton at the mill, Mr. Nelms said, and logs big enough for larger transmission poles could be worth as much as \$130 a ton delivered. Saw logs, on the other hand, got only about \$20 a ton.

Nearby, a truck that was headed for a pulp mill 40 miles away pulled two trailers stacked with about 150 tree trunks, each about 40 feet long and too skinny, knotty or crooked to make poles or lumber. Mr. Lutz would pocket just \$3 a ton after expenses, amounting to around \$75 for the whole load, according to Mr. Nelms.



Pine logs arrive at an Arkansas mill. Owners of Southern forests often are stuck with whatever a nearby mill is paying for timber because it isn't feasible to haul logs long distances. PHOTO: KAREN E. SEGRAVE FOR THE WALL STREET JOURNAL

Before the housing crash, he could have expected three to five times that much, but since then, many more trees in Southern forests have grown to maturity.

Mr. Lutz's trees were sorted into seven product types, including saw logs. It was a natural stand, so there was plenty of hardwood, which was a plus. Long a nuisance for plantation growers because they compete with pine for sunlight and nutrients, deciduous trees fetch much better prices these days. A river system that flows to Alabama's Mobile Bay offers a way to ship the hardwood to overseas buyers.

Over toward Mississippi, outside of Reform, Ala., George Ballard harvested 100 acres where a mix of trees had sprouted naturally after an earlier clear-cut. The hardwood here was a blessing, returning \$26 a ton instead of the \$4 to \$12 a ton his pine trees fetched after expenses, depending on what product they were destined to become.

The economics are much worse for 1,000 acres he owns across the road. Mr. Ballard, 62, clear-cut both tracts after he bought them in 1987. Unlike the smaller parcel that he left to grow back naturally, he spent more than \$200,000 planting the larger property with rows of pine. Some lucrative sales had prompted him to go all-in replanting there and on other land he owned.

“I got \$6,000 an acre and we thought, ‘We’ve got to plant everything with pine bushes,’” Mr. Ballard said. “We thought the future was pine trees.”

Pine trees that would have been worth \$45 a ton “on the stump” back then might return \$14 a ton now, he estimates. For income, he leases forestland to hunters. He built a small lake and a cabin, planted some cleared spots with clover to provide food for deer and other wildlife and set up some blinds. Four men from Birmingham pay him \$65,000 a year to drive out on weekends and hunt whitetail deer and turkeys in season.

Mr. George, the Mississippi farmer who planted cropland to trees under a federal conservation program in the 1980s, moved to Memphis and became a cotton exporter. Now, with the pine trees mature and ready to harvest, he has to consider his father’s estate planning and a son in college as he figures out what to do.

Some of his trees have outgrown nearby saw mills and will have to be pulped for lower prices. Whether Mr. George, who is 57, harvests now or holds out for higher prices, he will ultimately have to decide whether he wants to commit to trees again.

“I’m not sure if we’ll replant or let it go to pasture,” Mr. George said. “We’d have to dynamite the stumps, though.”

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