

Midterm
Microeconomics for Public Policy I
Fall 2025
October 14, 2025

GWID: _____

Instructions

1. **Write your name on page 14.**
2. Write your GWID on each page. If you don't know your GWID, write your birthdate (or some other made-up number) on **each page**. I request this so that when we scan we don't lose any pages.
3. Answer all questions.
4. Write only on the front of the exam
5. The exam is graded out of 100 points; points are indicated on sections and questions.
6. Write legibly. Illegible exams cannot be graded.
7. 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.
8. Label all figures as needed.
9. 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.
10. 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.
11. Be concise.

For marking purposes only

Part A _____

Part B _____

Part C _____

total _____

A. Ripped From the Headlines (16 points total, 4 points each question)

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

1. Does weather impact the supply of or demand for heating fuels? Explain why.

Weather impacts the demand for heating fuels, and consumers are the users of heating fuels.

2. Explain why the June fire in Texas lowered prices in the US, and discuss for whom they may have increased prices.

The June fire stopped exports of liquified natural gas, meaning that supply was higher in the US than otherwise anticipated. This decreased prices in the US and increased prices wherever this fuel was meant to go – probably Europe.

3. Do higher US fuel inventories make the supply of heating fuels more or less elastic? Explain why.

Higher inventories of fuel make the supply more elastic. suppliers have more fuel to bring to the market in response to price changes.

4. If demand increases, will prices tend to rise more when inventories are high or when inventories are low? Explain your answer.

High, rather than low, inventories, yields elastic supply. When supply is more elastic, suppliers can bring fuel to market when faced with a demand shock. This should lead to lower prices, relative to when inventories are low.

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

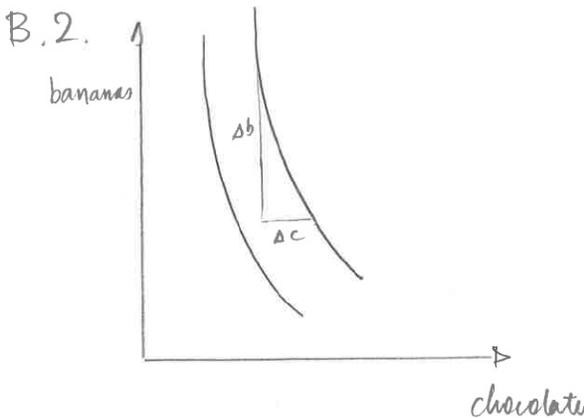
1. Give two specific examples that could shift the supply of apples. For each example, explain which way the supply curve shifts and why.

supply curve shifts are driven by changes in

- suppliers' cost of production
 - technology
 - price of inputs
- number of sellers
- sellers' outside options

2. You are a person who really likes chocolate and somewhat likes bananas. Draw indifference curves for these preferences, putting chocolate on the horizontal axis and bananas on the vertical axis. Explain why your curves look the way you've drawn them.

See picture below. You're willing to give up a lot of bananas for some chocolate, as the curves below describe.



3. Suppose that we write utility as $U = 5X^2Y$. Define utility, explain what this function means, and explain whether X and Y are all complementary.

Utility is overall happiness. This function means that utility comes from consuming goods X and Y , though utility increases more in X than in Y .

We know that there is some complementarity in X and Y because to get any utility from X , you need to consume a little bit of Y – if $Y = 0$, then $U = 0$, regardless of the level of X . The opposite holds as well.

4. Suppose that the equilibrium price of iron ore falls and the equilibrium quantity of iron ore increases. Assume that only supply or demand changed. Which changed? Explain your answer.

There are only four possible pairs of outcomes:

- If S increased \rightarrow prices fall, and Q increases. Possible
- If D increased \rightarrow prices increase, and Q increases. Not possible.
- If S decreased \rightarrow prices increase, and Q decreases. Not possible.
- If D decreased \rightarrow prices fall, and Q decreases. Not possible.

5. The elasticity of supply of chocolate is 0.2. If price increases by 5%, by what percent will chocolate suppliers change production?

The elasticity formula tells us that

$$\begin{aligned} \frac{\% \Delta Q}{\% \Delta P} &= 0.02 \\ \frac{\% \Delta Q}{5} &= 0.02 \\ \% \Delta Q &= 0.02(5) \\ \% \Delta Q &= 0.1 \end{aligned}$$

This implies that a 5 percent increase in price should increase Q by 0.1 percent.

6. Suppose that the government levies a tax of \$0.50 per brick sold. Draw a supply and demand graph such that the post tax equilibrium price is \$0.50 greater than the pre-tax equilibrium price.

Need to show inelastic demand and somewhat elastic supply.

7. If your demand curve is $Q = 600 - 100P$, how many peaches do you want when the price is \$6?

$$\begin{aligned} Q &= 600 - 100P \\ Q &= 600 - 100(6) \\ Q &= 0 \end{aligned}$$

8. Define marginal utility. Give a specific example, for you, that shows how your marginal utility changes as your consumption increases by one unit. Explain why it changes as it does,

and whether this change is consistent with our general assumption about how marginal utility changes as consumption increases.

Marginal utility is the additional utility received by a consumer (you, here) with an additional unit of consumption.

We generally assume that marginal utility decreases as consumption increases

A complete answer also requires an example and an explanation of whether your example is consistent with the general rules.

C. Medium Answer Questions (51 points, points as noted on questions)

1 (28 points, (a) is worth 4 points, (b)-(i) worth 3 points each). Supply, Demand, Quotas and Cookies

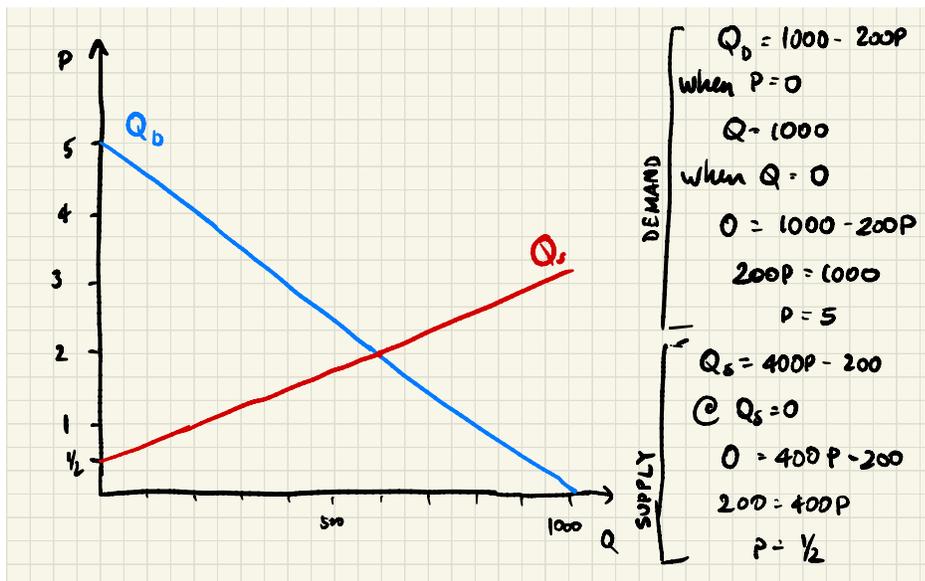
The market for cookies is represented by the following supply and demand conditions: $Q_D = 1,000 - 200P$ and $Q_S = 400P - 200$. The variable P is price per box of cookies and Q measures boxes per day.

Throughout this question, you need to make a graphic. You are welcome to make one graphic, making sure you clearly label all parts as requested.

(a, 4) Solve for the equilibrium price and quantity and illustrate your answer with supply and demand curves. Label your graph axes and intercepts.

$$\begin{aligned} Q_D &= Q_S \\ 1000 - 200P &= 400P - 200 \\ 1200 &= 600P \\ P &= 2 \end{aligned}$$

Solve for quantity in either equation: $Q = 1000 - 200P = 1000 - 200(2) = 600$.



(b) Find consumer and producer surplus at this initial equilibrium and indicate them in the

graph you drew for (a).
Before quota:

$$CS = \frac{1}{2}(5 - 2)(600)$$

$$= 900$$

Before quota:

$$PS = \frac{1}{2}\left(2 - \frac{1}{2}\right)(600)$$

$$= 450$$

(c) Suppose the government places a quota on cookies of 400 boxes per day. Solve for the new equilibrium price and quantity. Illustrate the new supply curve and new equilibrium price and quantity on the graph.

Solve for $Q = 400$ in demand curve.

$$Q_D = 1000 - 200P$$

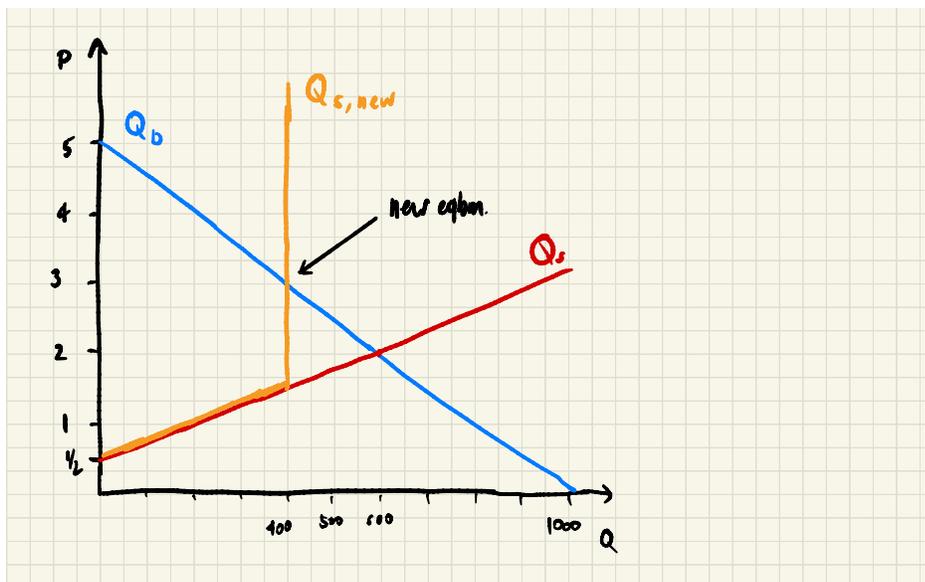
$$400 = 1000 - 200P$$

$$200P = 600$$

$$P = \frac{600}{200}$$

$$P = 3$$

Therefore, the new equilibrium is $Q = 400, P = 3$.



(d) Calculate consumer and producer surplus after the quota. Indicate the location for consumer and producer surplus in your graph above, or in a new graph if your graph above is too crowded.

After quota:

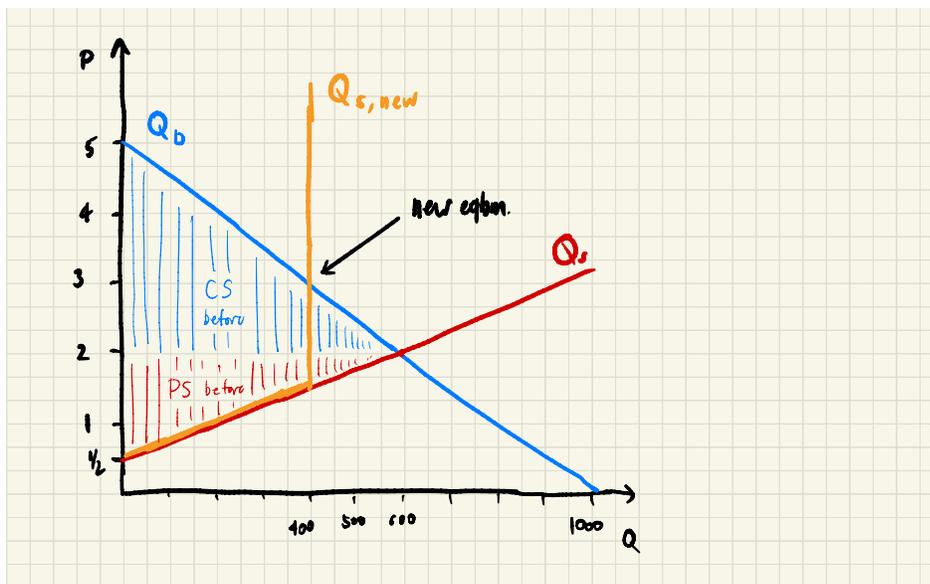
$$\begin{aligned} CS &= \frac{1}{2}(5 - 3)(400) \\ &= 400 \end{aligned}$$

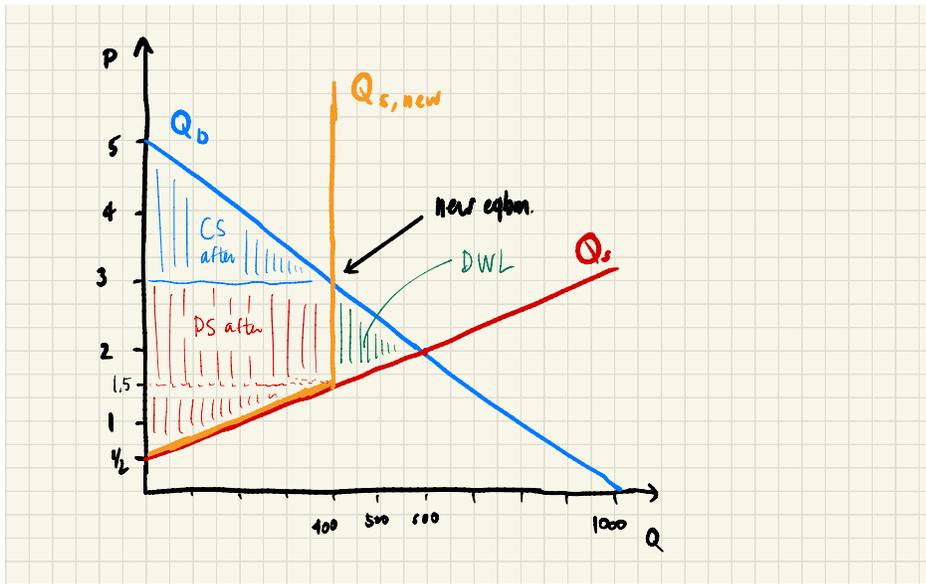
After quota: To figure this out, we need to know what the price on the supply curve when $Q = 400$. To find this, we can write

$$\begin{aligned} Q_s &= 400P = 200 \\ 400 &= 400P - 200 \\ 600 &= 400P \\ P &= \frac{600}{400} \\ P &= 1.5 \end{aligned}$$

Given that, we add up the two areas of producer surplus:

$$\begin{aligned} PS &= (3 - 1.5)(400) + \frac{1}{2}(1.5 - \frac{1}{2})(400) \\ &= 600 + \frac{1}{2}(400) \\ &= 800 \end{aligned}$$





(e) Calculate the deadweight loss from the quota.

$$\begin{aligned}
 DWL &= \frac{1}{2}(3 - 1.5)(600 - 400) \\
 &= \frac{1}{2}(1.5)(200) \\
 &= 150
 \end{aligned}$$

You can check your answer by adding up the before and after and making sure they are the same.

Before: total = $CS + PS = 900 + 450 = 1350$.

After: total = $CS + PS + DWL = 400 + 800 + 150 = 1450$

(f) Define deadweight loss and explain why a policymaker should care about it.

Deadweight loss is welfare lost from the market when policies divert from the market equilibrium. Policymakers should care about it because it measures benefits lost to consumers and producers due to government policy. This is the loss against which policymakers should compare the benefits of the policy.

(g) Suppose that instead of a quota, the government decides to levy a tax of \$2 on each box of cookies. The statutory incidence of this tax falls on the producer. This causes either the supply or the demand curve to change. Write the equation for the new curve below. I

encourage you to draw a graph to help you with this problem.

Original supply curve is $Q = 400P - 200$. To find the new supply curve, re-write so that P is a function of Q .

$$\begin{aligned}Q &= 400P - 200 \\Q + 200 &= 400P \\Q/400 + \frac{200}{400} &= P \\P &= Q/400 + \frac{1}{2}\end{aligned}$$

Remember that the tax shifts the supply curve upward. This means that the y intercept of the supply curve increases by 2. Following this logic, we can write the new supply curve as $P_{\text{after tax}} = P_{\text{before tax}} + 2 = Q/400 + \frac{1}{2} + 2 = Q/400 + \frac{3}{2}$. We can re-write this in terms of Q , which will be helpful for the next part of the problem

$$\begin{aligned}P &= Q/400 + \frac{3}{2} \\P - \frac{3}{2} &= Q/400 \\400P - \frac{3(400)}{2} &= Q \\Q &= 400P - 600\end{aligned}$$

(h) Find the new equilibrium price after the tax.

To find the new equilibrium price, set the original demand equal to the new supply:

$$\begin{aligned}Q_D &= Q_{S,\text{new}} \\1000 = 200P &= 400P - 600 \\1600 &= 600P \\P &= \frac{16}{6} = \frac{8}{3} = 2\frac{2}{3}\end{aligned}$$

(i) Who bears the greater burden of this tax: consumers or producers? Explain how you arrived at this answer.

Consumers see a price increase of $\frac{2}{3}$; this is the consumer burden. Producers enjoy a price increase of $\frac{2}{3}$ and have to pay a tax of \$2. On net, the producer burden is $2 - \frac{2}{3} = 1\frac{1}{3}$. Therefore producers bear the greater burden of this tax.

2 (16 points). Consumer Optimization

Suppose that Seema's budget constraint is $75 = 10Q_X + 4Q_Y$.

(a, 4) Draw the budget constraint, labeling the axes and intercepts. Put Q_X on the horizontal axis and Q_Y on the vertical axis.

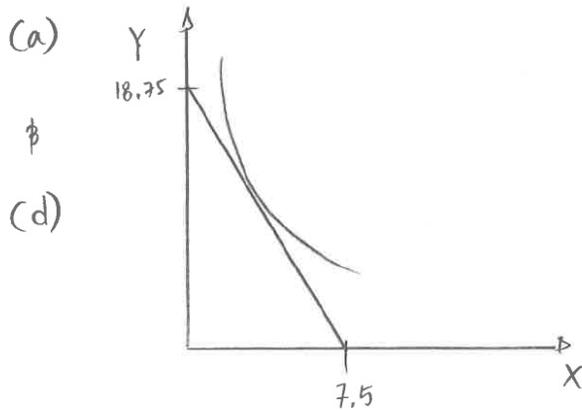
To find the intercepts, consider when $Q_X = 0$ and $Q_Y = 0$.

When $Q_X = 0$,

$$\begin{aligned}75 &= 10Q_X + 4Q_Y \\75 &= 10(0) + 4Q_Y \\4Q_Y &= 75 \\Q_Y &= \frac{75}{4} = 18.75\end{aligned}$$

When $Q_Y = 0$,

$$\begin{aligned}75 &= 10Q_X + 4Q_Y \\75 &= 10Q_X + 4(0) \\10Q_X &= 75 \\Q_X &= \frac{75}{10} = 7.5\end{aligned}$$



(b, 4) What is the slope of this budget constraint?

You can get to this answer in a number of ways. One is to remember that the slope is the ratio of the prices (X/Y) and that the prices are implicit in the budget constraint.

Another is to use the numbers you calculated in the previous step to write that the slope
 $= \frac{18.75}{7.5} = 2.5$.

(c, 4) Can Seema afford 4 units of good X and 10 units of good Y ?

Use the budget constraint to figure this out: $10X + 4Y = 10(4) + 4(10) = 80$.

Seema needs \$80 to afford this combination, but she has only \$75.

(d, 4) Draw an indifference curve on your picture from (a) (or repeat the picture) such that Seema is consuming optimally. What is the MRS at this point?

When the consumer is maximizing utility, $MRS =$ ratio of the prices.

Therefore, at the point indicated, when that point is on an indifference curve that is tangent to the budget constraint, $MRS = 2.5$.

A correct picture shows such a tangency.

Name: _____ Blank – for extra work

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<https://www.wsj.com/articles/higher-heating-bills-poised-to-hit-u-s-households-this-winter-11665805210>

MARKETSCOMMODITIES

Higher Heating Bills Poised to Hit U.S. Households This Winter

More expensive natural gas, heating oil, propane and electricity are colliding with forecasts for slightly colder temperatures



The Energy Information Administration's seasonal outlook has a base case for a 27% increase in home heating oil expenses this winter.

PHOTO: ROBERT F. BUKATY/ASSOCIATED PRESS

By *Ryan Dezember* [Follow](#)

Oct. 16, 2022 5:30 am ET

High fuel prices have been a big driver of inflation, pumping up the cost of summer travel and air conditioning, and federal energy forecasters say that staying warm this winter will be more expensive as well.

Americans should expect bigger home-heating bills compared with last winter, thanks to higher prices for natural gas, heating oil, propane and electricity as well as slightly colder weather, the U.S. Energy Information Administration said in its seasonal outlook.

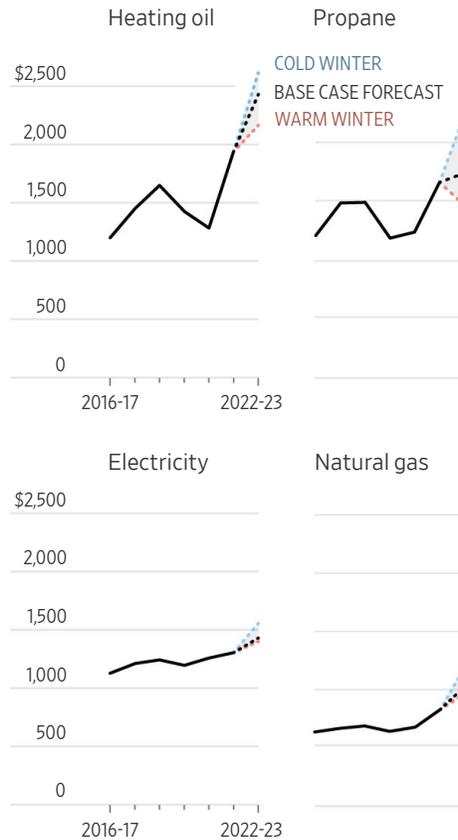
Government energy specialists predict that it will cost \$931 to warm the typical home that is heated with natural gas between this month and March. That is up 28% from a year earlier in nominal terms. If it gets colder than federal weather forecasters expect, heating bills could be

https://www.wsj.com/articles/higher-heating-bills-poised-to-hit-u-s-households-this-winter-11665805210?mod=hp_listb_pos2

1/6

51% more than last year for homes with gas-fueled furnaces and boilers, which is nearly half of U.S. households. A 19% year-over-year jump is anticipated if it is a warm winter.

Historical and forecast average household winter heating expenditures by energy type



Note: Years refer to October through March
 Source: U.S. Energy Information Administration
 Aziz Sunderji/THE WALL STREET JOURNAL

The base case for those who burn heating oil—mainly in the Northeast, where low imports and closed refineries have reduced supply—is for 27% greater expense. Those with propane, popular in rural areas, and electric heat are expected to pay 5% and 10% more, respectively, if temperature forecasts hold.

“Winter energy expenditures for most households are likely to be higher than last winter,” said Joseph DeCarolis, EIA administrator. “Much higher if the weather is very cold.”

A really chilly winter could throw energy markets back into overdrive and turn up the pressure on central bankers, who are fighting what has been the highest inflation in four decades with the steepest interest-rate increases since the early 1980s.

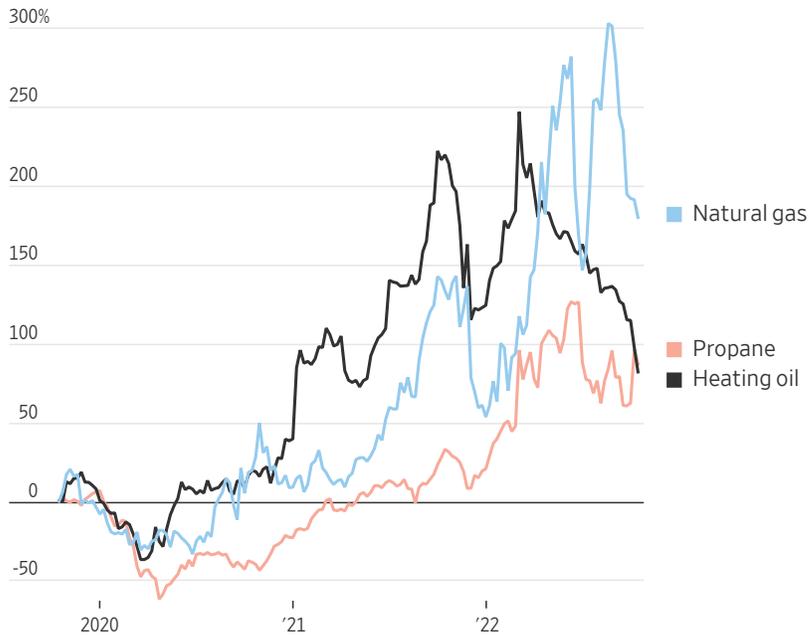
Fuel prices have come down from summer highs as inventories built up from critically low levels.

The declines were reflected in September inflation data, which registered a 19.8% rise in energy costs from a year earlier. That is less than half the year-over-year increase in June and is the slowest gain since March 2021. It is a big reason for the decline in overall inflation from August.

Federal weather officials believe that, on balance, this winter will be colder than last and require more energy to heat homes. Though milder temperatures are expected in the Southwest and along the Atlantic Coast, the National Oceanic and Atmospheric Administration forecasts colder weather in the frigid parts of the country, where the most heating fuel is consumed.

As recently as August, the outlook for winter-fuel prices looked a lot worse for consumers. Natural-gas futures hit shale-era highs above \$10 per million British thermal units, and the amount of gas in storage was more than 12% below normal levels. Sky-high coal prices kept gas consumption among U.S. power plants at all-time highs, while Russia's invasion of Ukraine created insatiable demand in Europe for overseas shipments of liquefied natural gas, or LNG.

Futures price performance, weekly



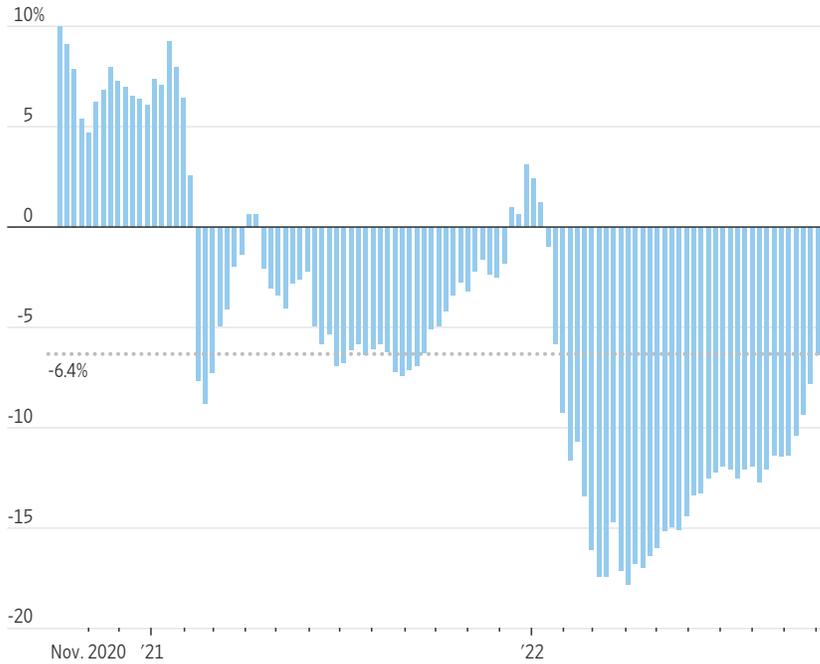
Source: FactSet

Natural-gas prices have declined by about a third since then. They would have likely lingered in double digits had a big LNG shipping terminal in Texas not shut down following a June fire, said Rusty Braziel, chief executive of the consulting firm RBN Energy LLC.

Freeport LNG’s outage has reduced U.S. export capacity by nearly one-sixth.

“Instead of going on a ship, these volumes went into inventories, effectively giving the market a reprieve,” Mr. Braziel said. “As painful an event as it has been for the folks at Freeport and its customers, it actually helped the U.S. dodge a bullet this summer.”

Weekly U.S. natural-gas inventories versus rolling five-year average



Source: Energy Information Administration

Between the gas that otherwise would have been shipped abroad and domestic production that has lately notched daily records, the volumes pumped into U.S. storage facilities over the past month have been the biggest four-week build of the shale era, EIA data show.

Injections of gas into underground caves by traders hoping to sell the fuel for higher prices this winter have halved the deficit to normal inventories that pushed up prices in August.

Analysts and traders say inventories are still low enough that there could be price surges during very cold weather, especially once Freeport resumes operations. The company has said it is aiming to restart next month.

Natural-gas futures ended Friday at \$6.453 per million British thermal units, declining for the eighth consecutive week but still 19% higher than a year earlier.

“While we think gas prices are close to fair value, do not write off volatility this winter,” said RBC Capital Markets analyst Christopher Louney.

Write to Ryan Dezember at ryan.dezember@wsj.com