

An introduction to demand functions, supply functions and competitive market equilibrium

rough draft notes, September 15, 2011

The intent of these notes is to compliment the demand, supply, and equilibrium sections in Chapter Three of Krugman and Wells.

1 Demand for Vail ski days

So, you need to draw a graph on a sheet of paper you can share with those around you.

I want you to do the following and then make sure you did it correctly by asking the people around you if it looks reasonable to them.

Assume you have a season ski pass to Vail (with free parking), new ski equipment, and a new SUV (you won it all in a raffle for breast-cancer research). You attend college near your home (live in same town you attend college). First guesstimate how many days you will ski Vail this winter assuming you live in Boulder (100 miles to Vail). Then for Fort Collins (150 miles), Summit Country (25 miles) and Vail (zero miles).

Plot on a graph (ski days at Vail on the vertical axis and miles to Vail on the horizontal axis) your guesstimates, and connect the points. Put your name of the graph, or an alias

Does your line slope up? down? or is it flat? Is it vertical.

Describe your line in words

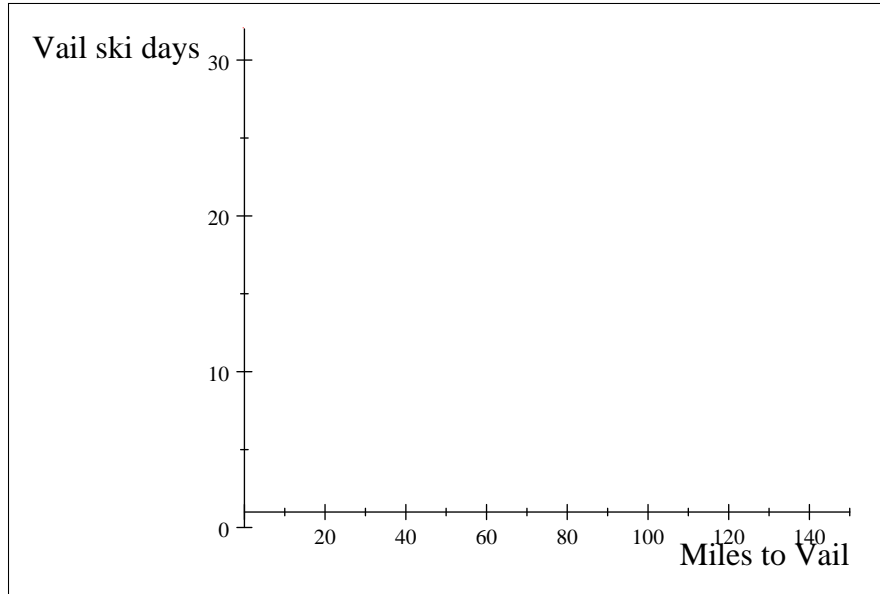
Describe, in words, what the graph tells an observer about you.

How does the graphs of those around you differ from your graph. Are their graphs reasonable? (collect some of the graphs.)

My guesstimates are

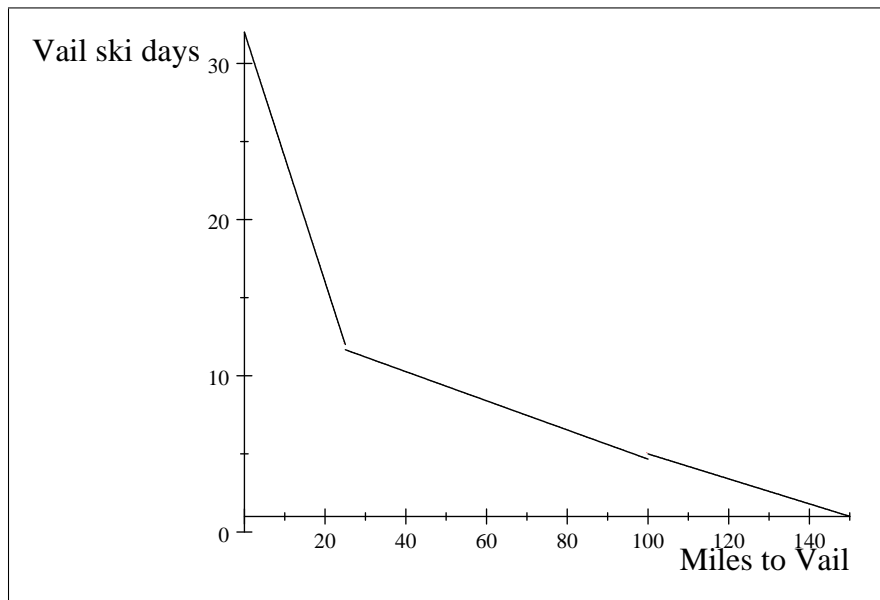
	Vail	Summit County	Boulder	Fit Collins
Number of Vail ski days	32	12	5	1
miles to Vail	0	25	100	150

Plotting these numbers:



Days Edward will ski Vail as a function of where he lives

Now let's connect the dots with straight lines. Note that the straight lines might get it wrong.

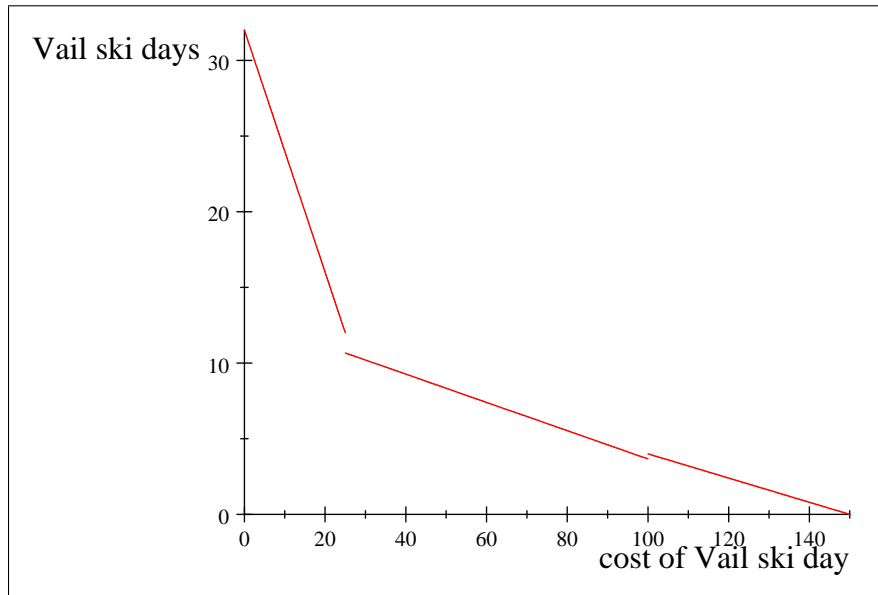


Days Edward will ski Vail as a function of where he lives

This is an estimate of my demand function for ski days at Vail as a function of how far I live from Vail. Why only an estimate?

Now convert things to money by assuming it cost 50 cents a mile to operate my new car (member I have a pass, free parking, etc.)

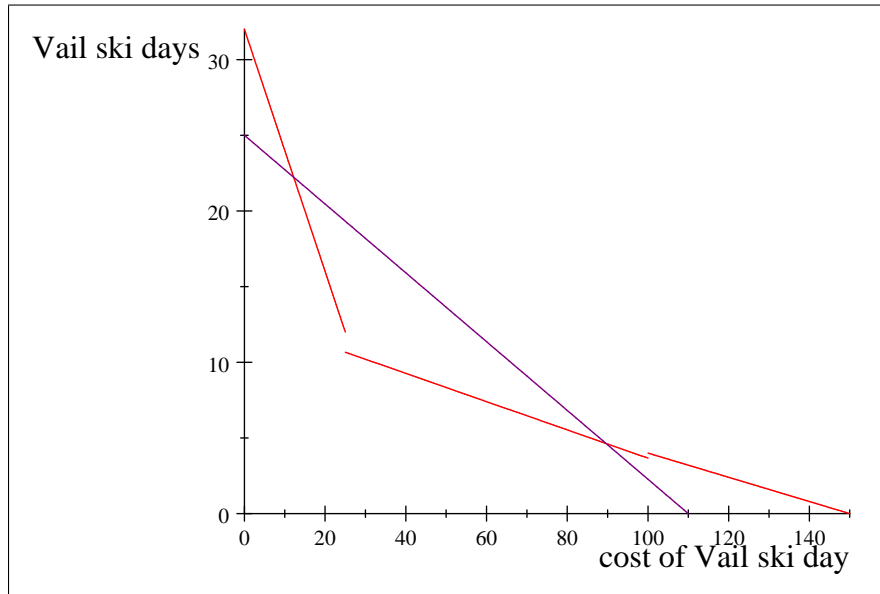
So at \$0 go 32 times, at \$25 I would go 12 times, at \$100 I would go 5 times, and at \$150 I would go once.



Days Edward will ski Vail as a function of his cost per day

Note that it does not look like my demand function is a straight line.

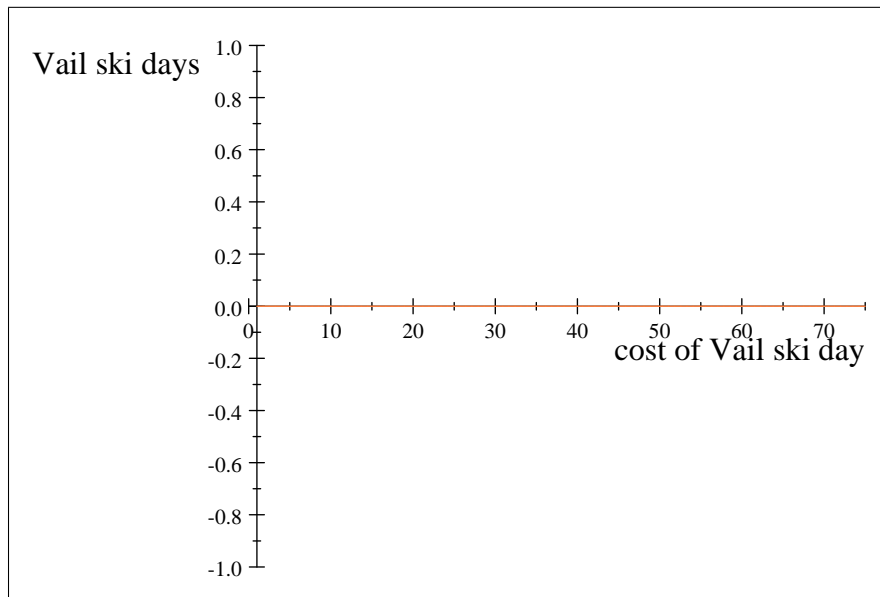
If we forced my demand function to be a straight line, what would be a good guess of where the straight line will lie?



Days Edward will ski Vail as a function of his cost per day

Note that the straight purple first underestimates, then overestimates, then underestimates.

What would Wanda Sue's demand function for Vail ski days look like if Wanda hated skiing?

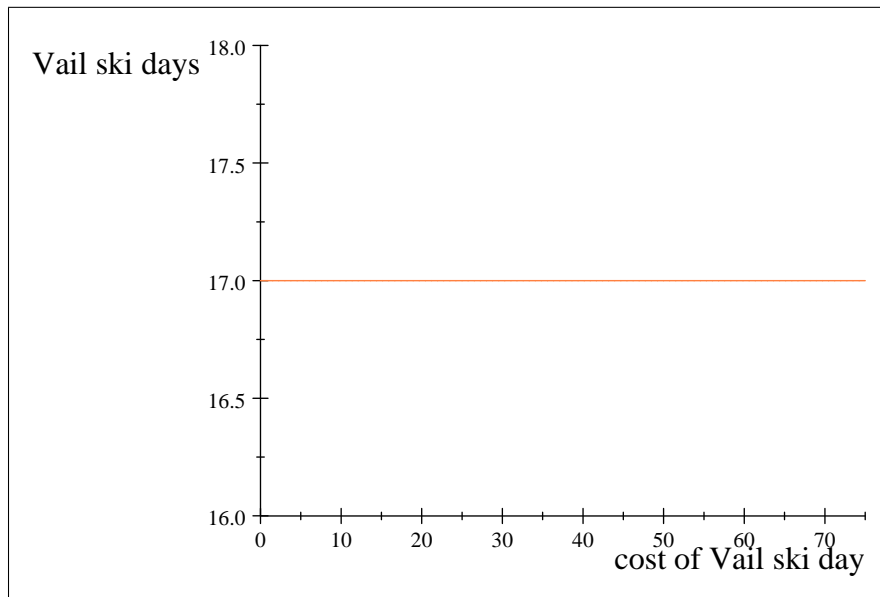


Days Wanda will ski Vail, 0, as a function of her cost per day

The orange line is her demand function.

Wanda is insensitive to price because she hates skiing. She goes the same amount, zero, independent of the cost

What if Wanda's abusive boyfriend **forced** her to ski Vail 17 days this year. Her "demand" function would look like



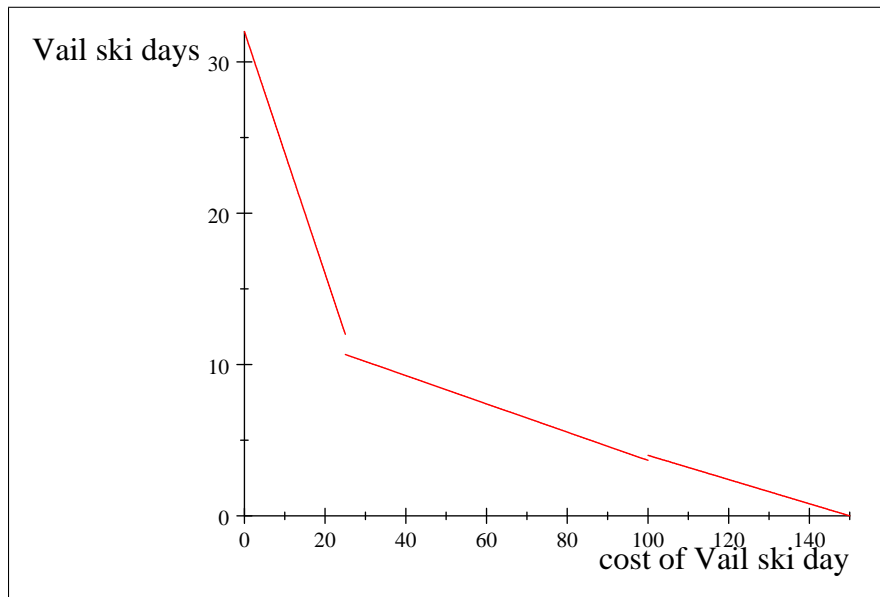
Days Wanda will ski Vail, 12, as a function of her cost per day

Wanda is again insensitive to price.

Is this really a demand function? It is a conditional-demand function, conditional on Wanda keeping her jerk boyfriend.

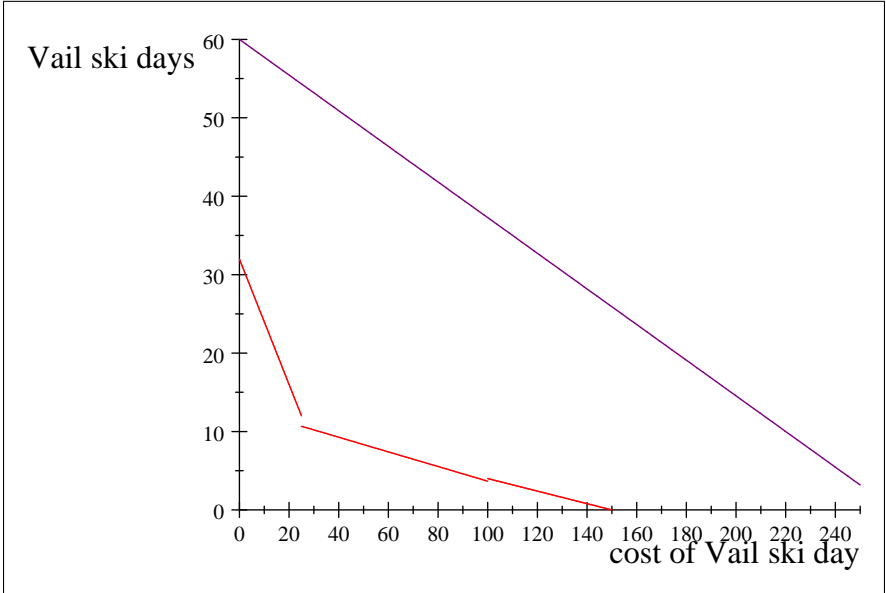
Let's return to my demand curve for Vail ski days

Let's assume my guesstimates were based on the fact that I currently work 60 hours a week (the black demand function is based on my 60-hour work week)



Days Edward will ski Vail as a function of his cost per day

Draw a new guesstimated demand function for my Vail ski days assuming I cut back work to 30 hours a week (or my wife and daughter dump me for George and I have a lot more free time).

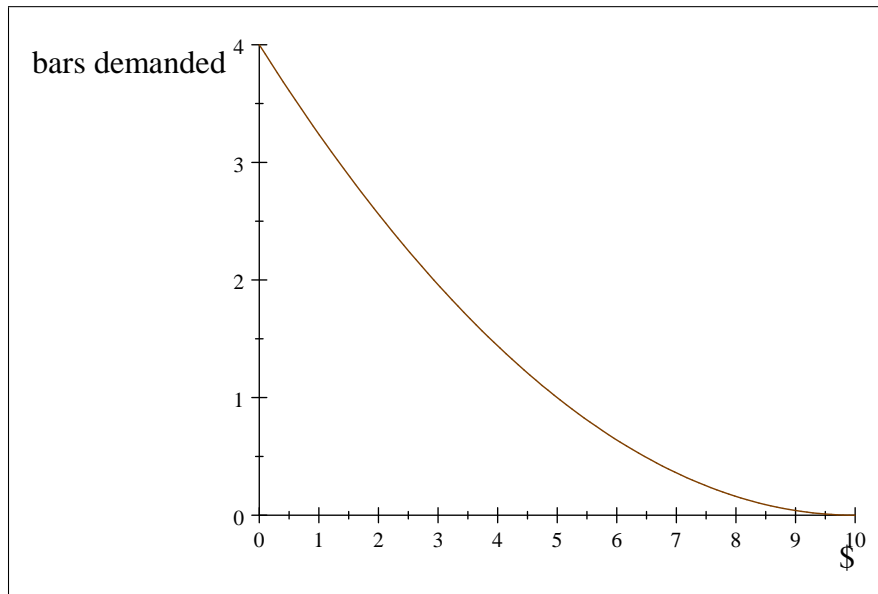


Days ERM will ski Vail as a function of his cost per day (30hrs)

What other things might cause my demand curve to move around? Good or bad snow year? If the new wife does not ski? If the kid enjoys skiing? What if I don't want to ski with kids?

2 Changing pleasures: the daily demand for bars of dark chocolate

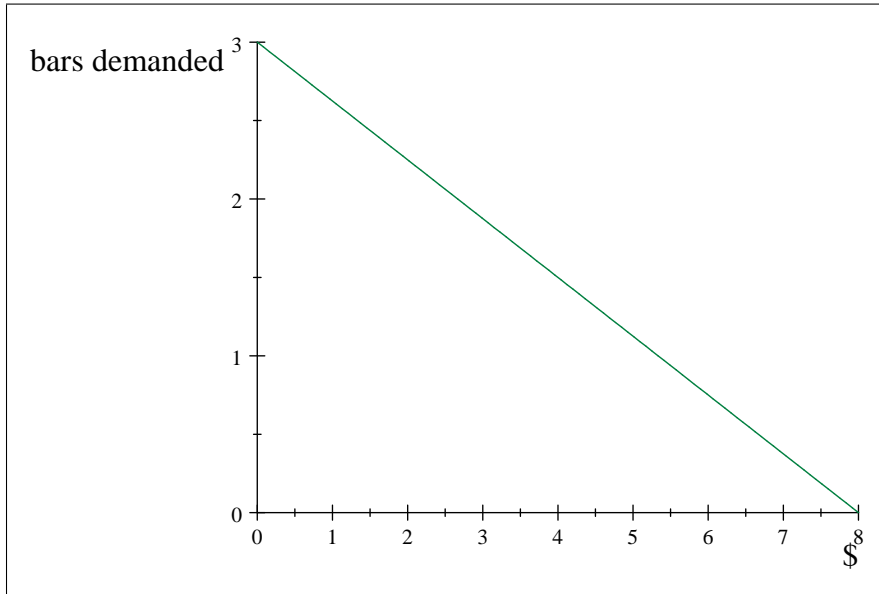
Assume Edward's daily-demand curve for chocolate bars is



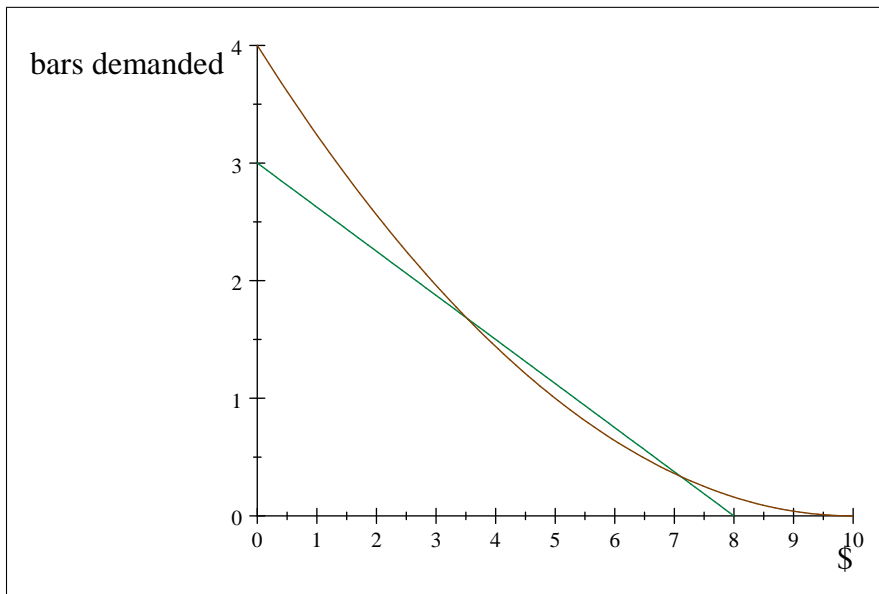
Edward's demand for chocolate bars

Note that my demand curve is chocolate colored, and I can demand fractions of a bar. Note that I actually eat about two bars a days.

Assume Shirley's daily-demand curve for chocolate bars

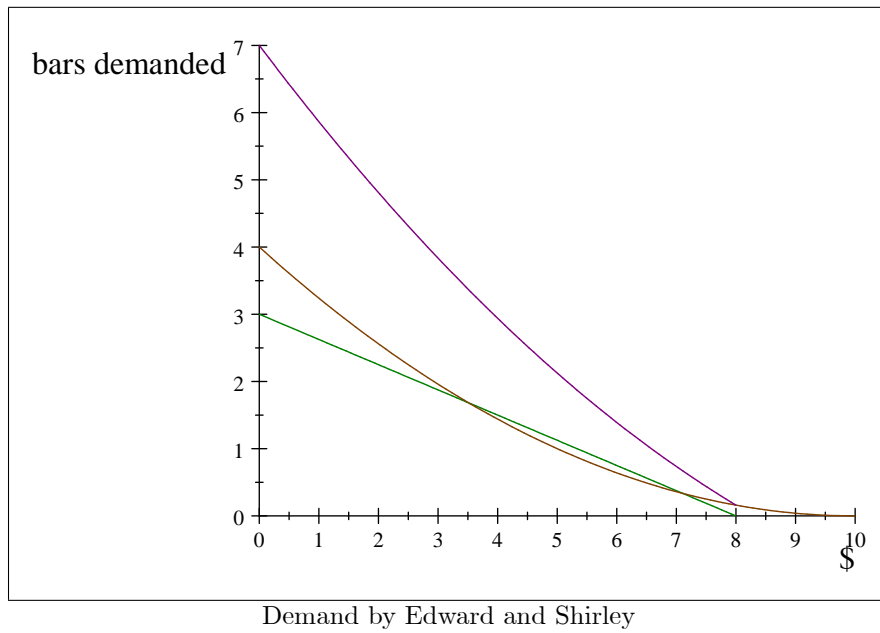


Shirley's demand curve for chocolate bars

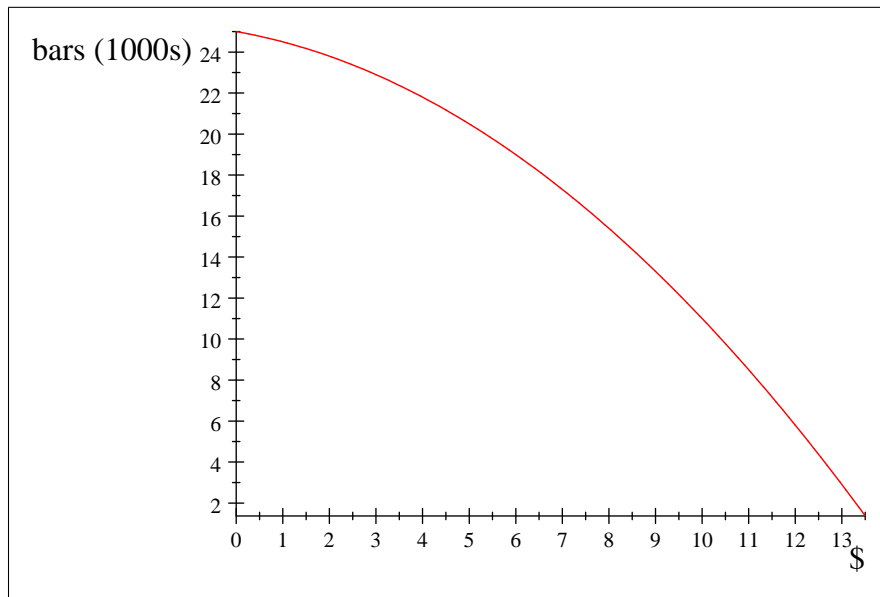


Edward's demand (in brown), Shirley's in green

2.1 What does their aggregate demand function look like?
Aggregated demand is their total demand as a function of price



2.2 If there were a hundred thousand people living in Boulder the demand function might look like



Boulder's aggregate demand for chocolate

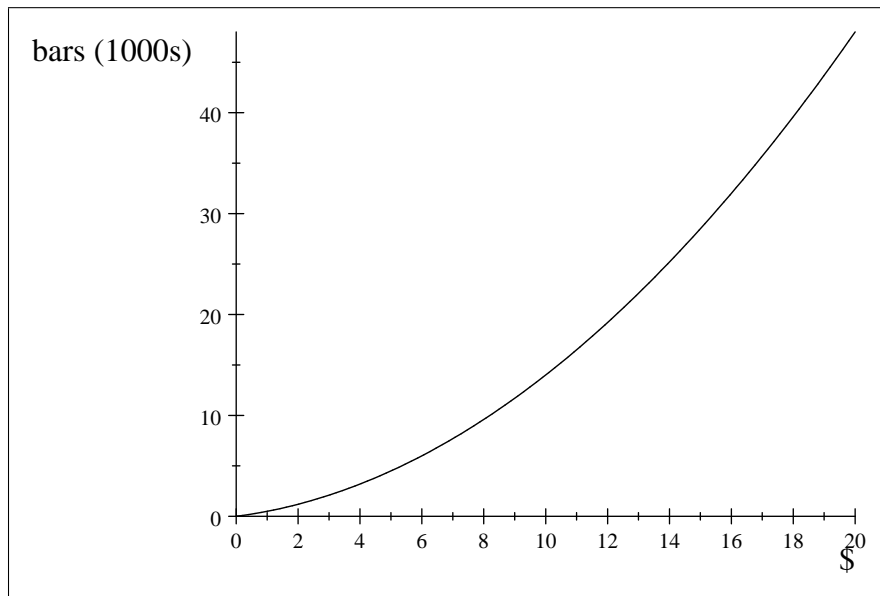
This demand curve traces out how many bars will be sold in Boulder everyday as a function of the price of a bar. At a zero price 25,000 bars, and 0 at \$13.50 a bar.

3 How many chocolate bars will the stores want to sell to sell?

They sell chocolate bars to make money, so, *ceteris paribus*, at higher prices they will want to sell more.

If a bar sells for a little and they make only a penny or two on each bar, they won't devote much effort or shelf space to selling bars. If they can make \$5 a bar, they will stock a lot of chocolate.

Assume, for example, that the following curve represents how many bars all the stores together want to sell at each price.



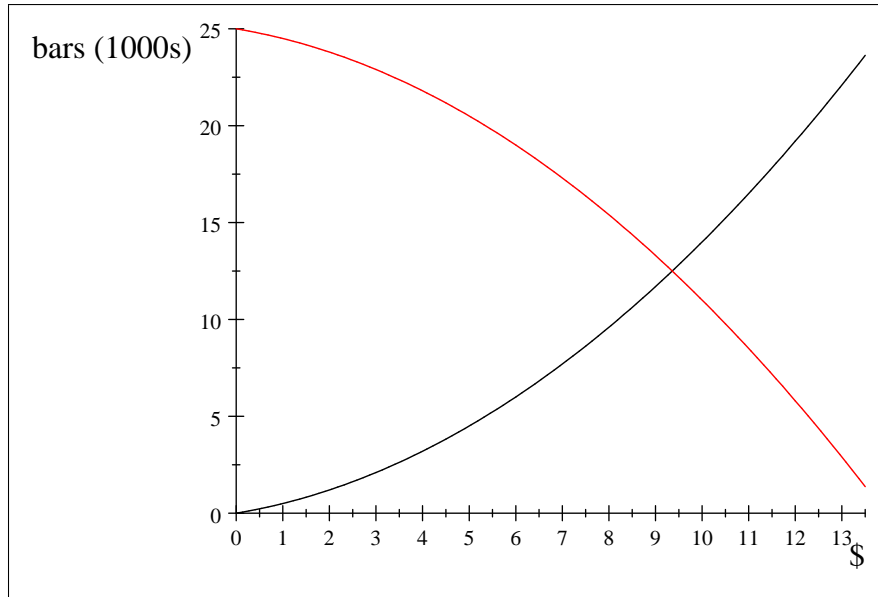
Aggregate supply of chocolate bars in Boulder

This is called an aggregate supply function (curve) because it identifies how many bars all the stores together will want to sell (supply) at each price point.

What would make it shift around? Temperature in Boulder? Rainfall in Costa Rica?

Make sure you can tell a story about how a temperature change in Boulder or a rainfall change in Costa Rica might affect Boulder's aggregate supply curve for chocolate bars.

4 Supply and demand for chocolate bars in Boulder



Aggregate demand and supply for chocolate bars in Boulder

What will happen? That is, how many bars will be bought and sold, and at what price?

It depends on whether the price of chocolate bars is, or is not, flexible.

4.1 Disequilibrium and equilibrium in the Boulder chocolate-bar market

Imagine that the price is fixed by the City of Boulder at \$1 a bar (according to the City Council, "everyone in Boulder, even the poor, deserve access to fine dark chocolate")

In this situation, Boulder residents will **try** to buy approximately 25,000 bars, but the stores will have almost no bars for sale. The stores will be crowded with unfulfilled and frustrated shoppers. Sellers will be frustrated as well, everyone wants to buy chocolate from you and you have none to sell because you do not want to sell many at that price.

One would not be surprised if people starting offering the store owners illegal bribes to get one of the few available chocolate bars. Some of the people who manage to acquire one of the few bars available at \$1, will turn around and sell them for a higher price on Craig's List or EBay (chocolate scalpers)

What would happen if the price was flexible rather than fixed artificially low by the government?

At \$1 a bar, demand greatly exceeds supply and the stores will raise the price and start to stock more bars. As the price rises the number of frustrated buyers (those who want to buy at the going price but cannot) will decline. Price and supply will continue to rise as long as demand exceeds supply at the going price.

\$1 a bar is not an equilibrium price

Alternatively, if the current price is \$15, the stores will want to stock approximately 30,000 new bars each day, and will. This will lead to great disappointment/frustration on their parts, because at this price not even Richy Rich the chocolate fanatic will buy a bar - demand is zero at \$15.

The stores will respond by putting their stock of chocolate bars on sale. The more they lower the price the more bars they will sell.

\$15 is not an equilibrium price, the stores will want to change their behavior: lower their price

Equilibrium is where supply equals demand. Examining the graph one see that the equilibrium price is approximately \$9 and the equilibrium quantity is approximately 12 thousand bars. In explanation, people in Boulder are rich and love chocolate.

The exact numbers are \$9.36 and 12,505 bars.¹

¹The mathematical function that produced the aggregate demand function in the above graph is $25 - .4p - .1p^2$ and the mathematical function that produced the aggregate supply curve is $.4p + .1p^2$. In equilibrium demand equals supply ($25 - .4p - .1p^2 = .4p + .1p^2$). Solving this equation for p , the equilibrium price is \$9.36

$$.4p + .1p^2 = .4(9.36) + .1(9.36)^2 = 12,505.$$

If prices are flexible, the market will move toward equilibrium and get to the equilibrium unless supply or demand shifts before it is achieved; in which case the market will start moving toward the new equilibrium.

4.1.1 Remember how equilibrium in an economic system was defined in an earlier lecture: everyone is doing the best they can given what everyone else is doing - given everyone else's behavior no one can make themselves better off by changing their behavior.

This is the case when Boulder price of chocolate bars is \$9.36: everyone who want to buy a bar at this price can and does, and everyone who want to sell a bar at this price can and does. There are no frustrated sellers or buyers wanting to change their behaviors.

Just like when both me and my soon to be ex-wife have divorce lawyers (given that the other has a lawyer neither has an incentive to fire their lawyer (change their behavior)).

4.1.2 Is equilibrium in the Boulder chocolate market a good thing? efficient?

Consider the buyers, potential buyers, sellers, and potential sellers.

Consider a situation where the market is not in equilibrium but some trades have taken place, and cannot be undone. At this point, there are additional un-consumated trades that would make both parties to the potential trade (the potential buyer and seller) better off: both potential traders parties would gain from consummating the trade. Therefore consummating these trades will increase efficiency; some will be made better off and no one will be made worse off.

In this case, A move from disequilibrium in the chocolate market to a point closer to the equilibrium will make some buyers and some seller better off, without making anyone else worse off, assuming prior trades stand.

Once we get to equilibrium, among the traders and potential traders, there is no remaining potential to make some of them better off without hurting some of the others. (At equilibrium the only way to make some of the players in this market better off will require that other players in this market be made worse off.)

So this equilibrium in a competitive chocolate market is efficient from the perspective of the buyers and sellers, and potential buyers and sellers, in this market.

It will also be efficient from the perspective of society, if the production of the production or consumption of chocolate does **not** directly effects third parties (other consumers or other firms).

If the production or consumption of chocolate effects third parties, there are *external effects*, and things are more complicated.

If there are external effects in the production or consumption of chocolate, competitive, unregulated equilibrium in the chocolate market will not be efficient from society's perspective.

When this occurs, we say the market has failed, a *market failure*.

For example, if consuming chocolate makes people aggressive sexual predators, the market equilibrium price of chocolate will be too low (too much chocolate will be consumed from society's perspective).

In such a case, the market is "failing" because it is not accounting for the negative impact chocolate consumption is having on third parties.

Alternatively, if eating chocolate reduces the incidence of spousal abuse (it does at my house; I get hit less when my wife eats chocolate)—it mellows one out—then the benefits to society of you eating another bar are more than the benefits to you. In which case, in the market equilibrium, there will be too few bars sold and consumed from an efficiency perspective.

Equilibrium in the chocolate market would also be inefficient if the production of chocolate involved a lot of unregulated pollution, or, possibly inefficient if it drove some plants and animals in Costa Rica to extinction.

Think about the cigarette market and second-party smoke. The cigarette producers are happy to sell me cigarettes at the going rate. I will keep smoking another cigarette as long as the benefit to me of the last-one smoked is greater than the what it cost me to be it. Put simply, I will maximize the net benefits to me from my smoking cigarettes. Of course, I will include, in costs, any negative health effects on me. Will I smoke the efficient number from society's perspective?

Example of buying, selling, and a negative external effect.

The competitive market for gasoline does not account for the pollution costs imposed by the oil producers and drivers, so fails to achieve efficiency—a market failure.

When oil is produced a lot of pollution is produced, a cost to society, if the oil producers don't have to pay these costs, too much oil will be produced from an efficiency point of view.

When you drive you impose pollution and congestion costs on others. If you don't have to internalize these costs, you don't; too much gasoline will be consumed from an efficiency perspective.

4.1.3 You need to play with how equilibrium in a competitive market will change in terms of equilibrium price and quantity when the supply or demand curve shifts

Make sure you can do it with either price on the horizontal axis or on the vertical axis.