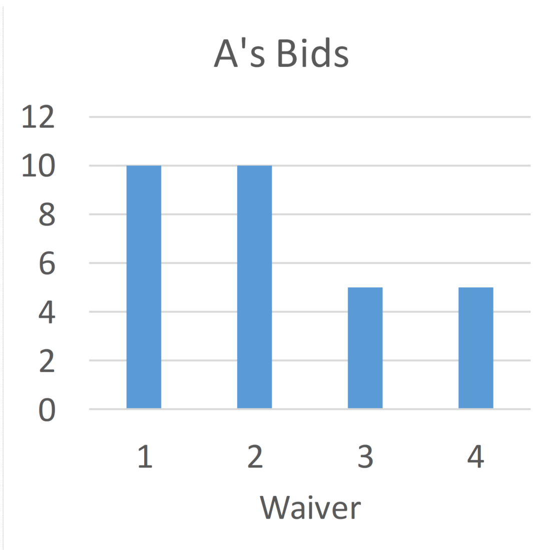
Individual Demand

Start by graphing **WTP** bids for person A:

Waiver	WTP
1	10
2	10
3	5
4	5



Height: WTP for a particular waiver

$WTP(Q)$ = WTP for waiver number Q

A's WTP for waiver 2 is $WTP_A(2) = 10$

A's WTP for waiver 3 is $WTP_A(3) = 5$

WTP for several waivers?

Add up WTP's for individual waivers

WTP for N waivers:

$$\sum_{i}^{N} \mathrm{WTP}(Q_i)$$

Example: A's WTP for waivers 1 & 2

$$WTP_A(1) + WTP_A(2) = 10 + 10 = 20$$

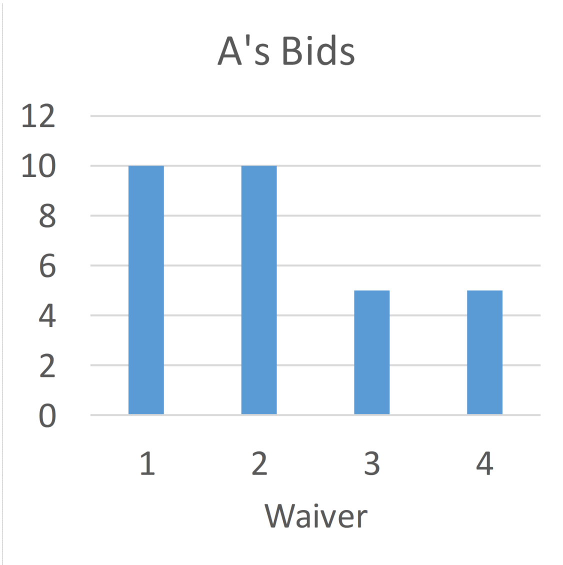
Can also find quantity A would **buy** at a given price P:

A's decision rules:

1. Buy any units with $WTP_A > P$ (net gain)
2. Buy any units with $WTP_A = P$ (indifferent)
3. Don't buy units with $WTP_A < P$

Result: A's *demand* at P

Example: suppose $P = 6$:



Applying decision rules:

Waiver	WTP	P	**Net**	**Buy?**
1	10	6	+4	**Yes**
2	10	6	+4	**Yes**
3	5	6	-1	No
4	5	6	-1	No

Gain on purchased waivers is consumer surplus (CS):

Consumer surplus (CS) on a single waiver i:

$$CS_i = WTP_i - P$$

Person A, waivers 1 and 2: $CS_1 = 4, CS_2 = 4$

Consumer surplus on purchase of N waivers:

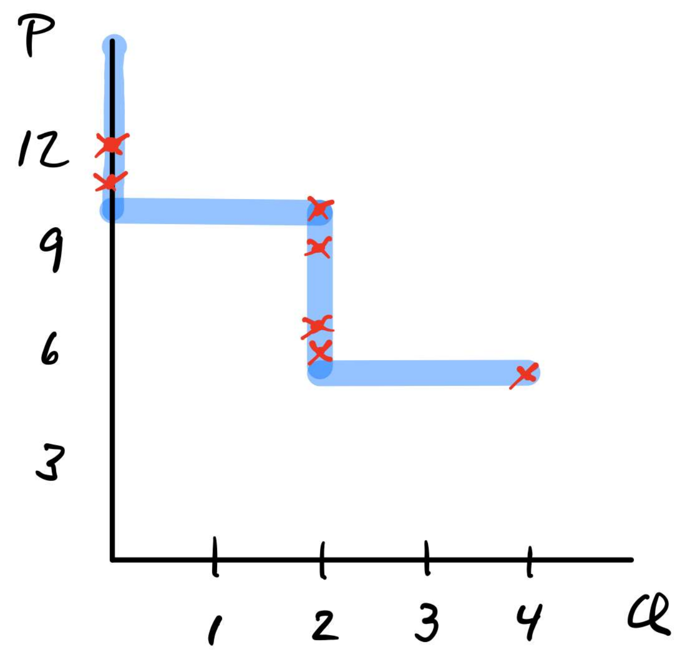
$$CS = \sum_i^N CS_i$$

Person A, total: $CS = CS_1 + CS_2 = 4 + 4 = 8$

Demand *curve* is Q demanded for each possible P:

- Start at high price and sweep down axis:

P	Q
12	0
11	0
10	2
9	2
…	
7	2
6	2
5	4
…	



Third use of data beyond $WTP(Q)$ and $Q^D(P)$:

Marginal benefit (MB) of *giving* someone a unit

Take to be equal to what they would have been WTP:

$$MB_i = WTP_i$$

Giving person A waiver 1: $MB_1 = 10$

Market Demand

Market demand is the sum of individual demands:

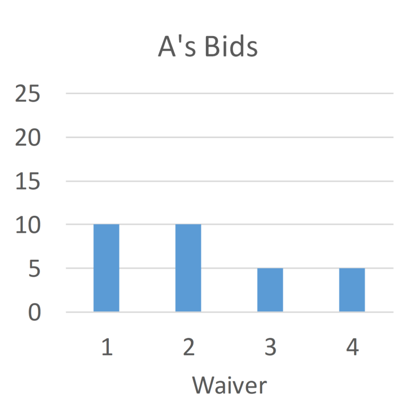
$$Q_M^D = \sum_i^N Q_i^D(P)$$

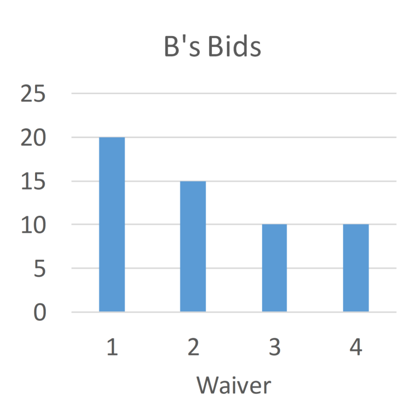
⚠ Sum of Qs, not WTPs ⚠

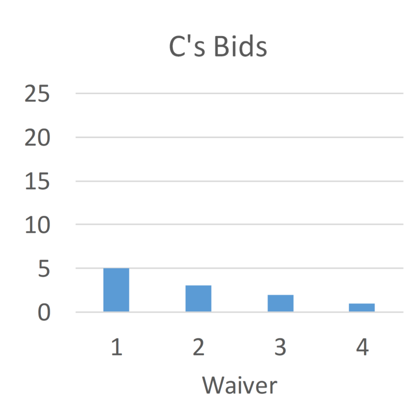
Computing for three people: A, B and C:

Individual WTP data:

Waiver	WTP_A	WTP_B	WTP_C
1	10	20	5
2	10	15	3
3	5	10	2
4	5	10	1

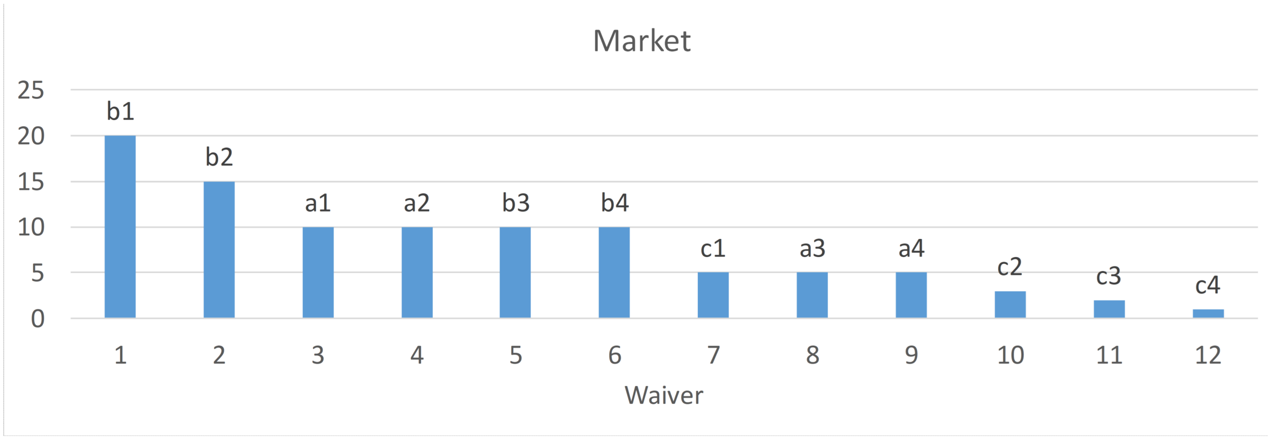






Market demand:

- As before, start with high prices and sweep down
- Count individual waivers demanded at each price
- In effect, lists bids from highest to lowest



Height of curve at given Q is WTP:

$WTP_M(Q_i)$ = WTP by the buyer of unit Q_i

Examples:

- Waiver 2 (b2) has $WTP_M(2) = 15$
- Waiver 6 (b4) has $WTP_M(6) = 10$

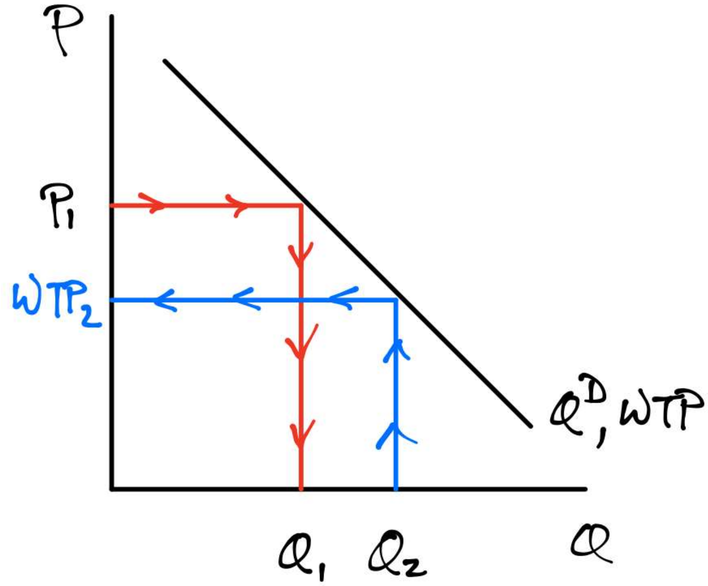
Width of curve at a given P is demand:

$Q_M^D(P)$ = quantity demanded at a given P

Examples:

- At $P = 12, Q_M^D = 2$
- At $P = 9, Q_M^D = 6$

Abstract, stylized WTP and demand curve:



Red:

From P_1 can infer Q_1

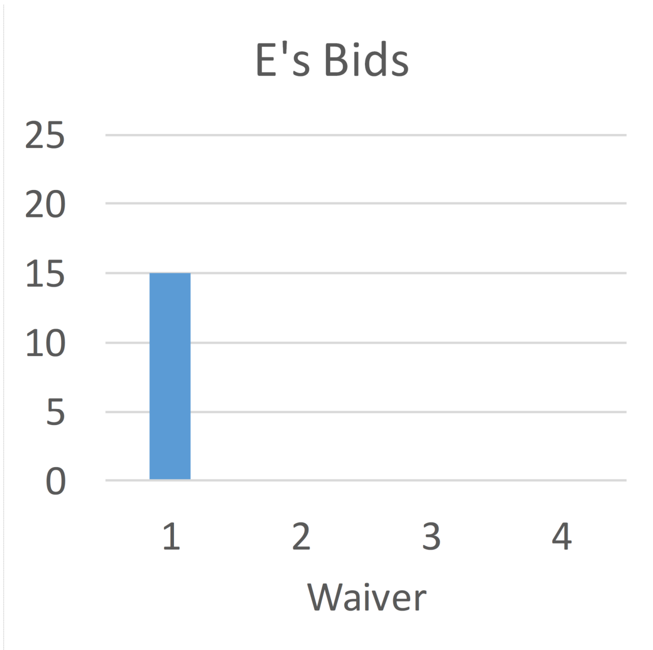
Blue:

From Q_2 can infer WTP_2

Individual Supply

Start by graphing **WTA** bids for person E:

Waiver	WTA
1	15



Height: WTA for the waiver

E's WTA for waiver is $WTA_E(1) = 15$

Can also find quantity E would **sell** at a given price P:

E's decision rules:

1. Sell if $P > WTA_E$ (net gain)
2. Sell if $P = WTA_E$ (indifferent)
3. Don't sell if $P < WTA_E$

Result: E's supply at P

Example: suppose $P = 20$

$P = \$20$
$WTA_E(1) = \$15$

Would sell 1 waiver

Gain on sold waivers is producer surplus (PS)

Producer surplus (PS) on a single waiver i:

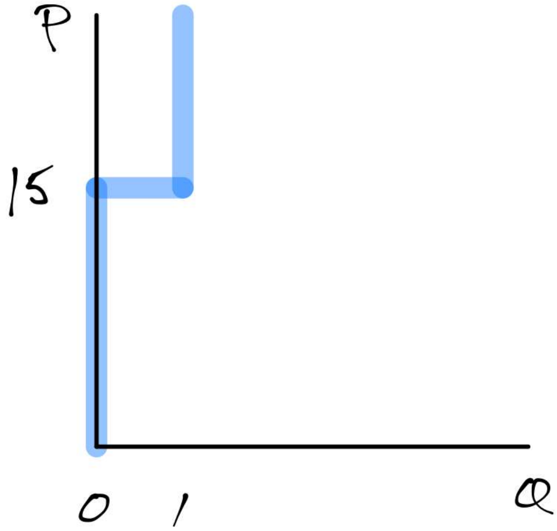
$PS_i = P - WTA_i$

E's surplus: $PS_1 = \$20 - \$15 = \$5$

Producer surplus on sales of N waivers:

$$PS = \sum_{i}^{N} PS_i$$

Supply curve is the Q supplied for each possible P:



If $P \geq 15$:
Q = 1

If $P < 15$:
Q = 0

Market Supply

Market supply is the sum of individual supplies:

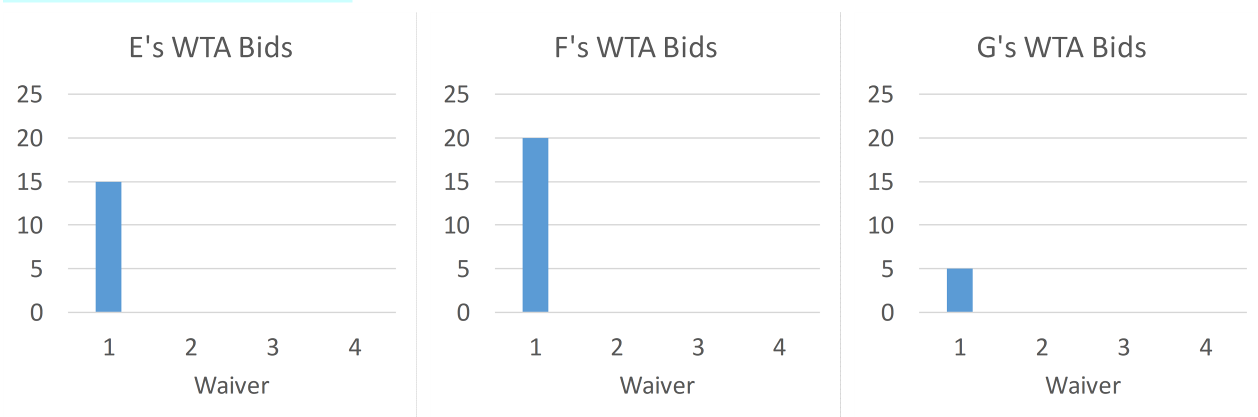
$$Q_M^S = \sum_i^N Q_i^S(P)$$

⚠ Sum of Qs, not WTAs ⚠

Extracting 2 more WTA bids:

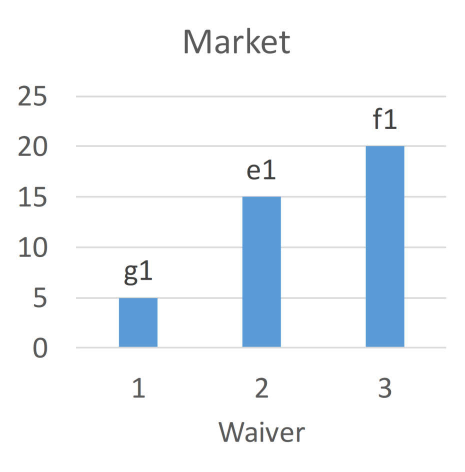
$$WTA_E = \$15$$
$$WTA_F = \$20$$
$$WTA_G = \$5$$

Individual supplies:



Market supply:

- Here, start with low prices and sweep up
- Count individual waivers supplied at each price
- In effect, lists bids from lowest to highest



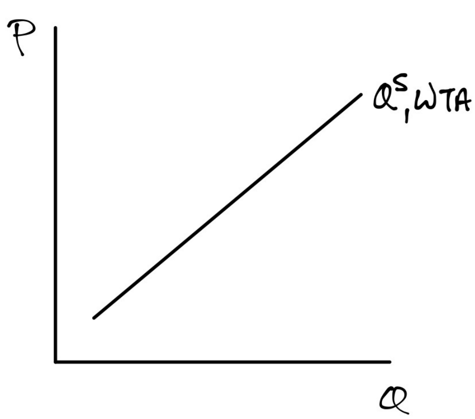
Height of curve:

$WTA_M(Q_i)$ = WTA by the seller of unit Q_i

Width of curve:

$Q_M^S(P)$ = quantity supplied at a given P

Abstract, stylized WTA and supply curve:



Market Equilibrium

Now have market demand and supply:

Demand	Supply
$Q_M^D(P)$	$Q_M^S(P)$

Give Q^D and Q^S for every possible price P

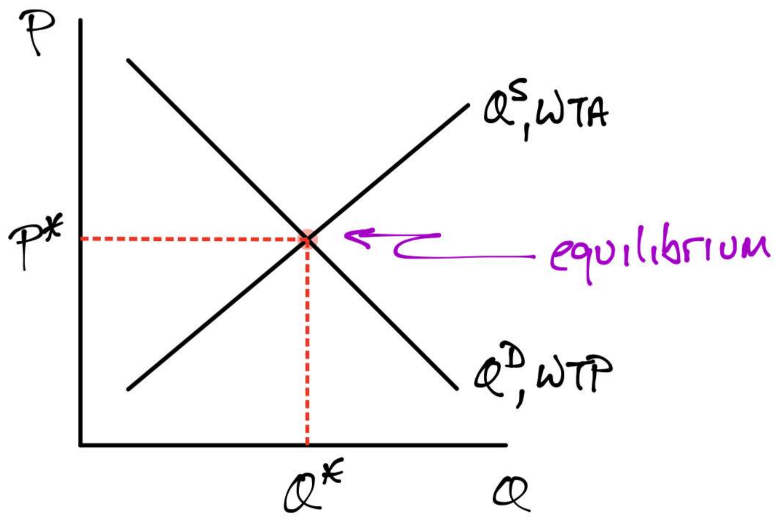
Can use to find *equilibrium price* P^* where Qs are equal:

Solve for P^* that makes $Q_M^D(P^*) = Q_M^S(P^*)$

Corresponding Q is the *equilibrium quantity* Q^*:

$$Q_M^D(P^*) = Q_M^S(P^*) = Q^*$$

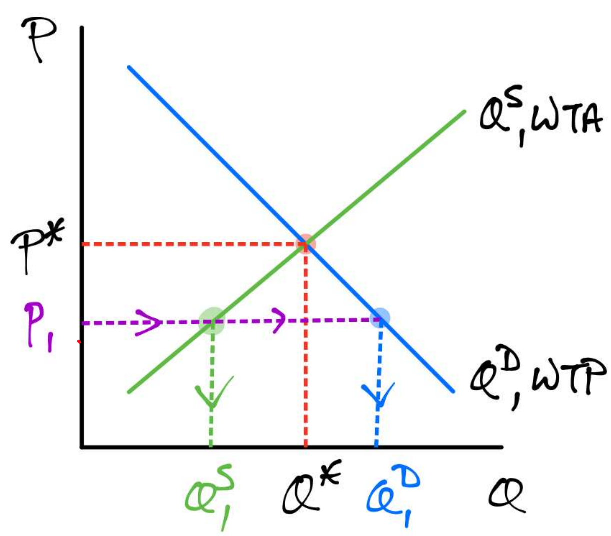
Graphically, the equilibrium is where the curves cross:



Equilibrium:

- P is *stable*: no forces pushing it up or down
- All other prices are **not** stable:

Case 1: P_1 below P^*

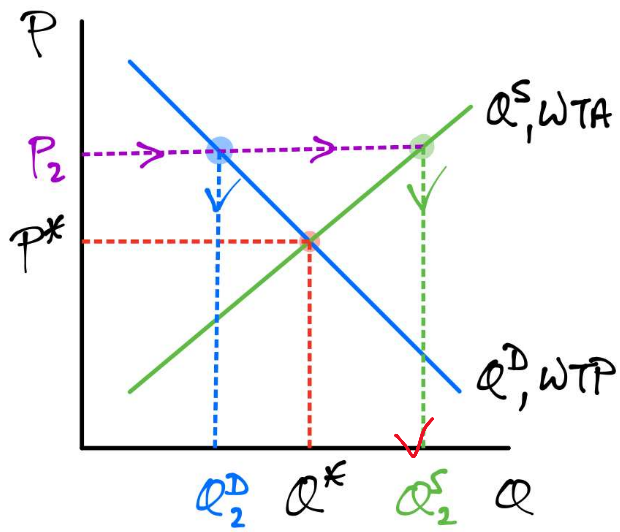


Buyers want more: $Q^D_M(P_1) > Q^*$
Sellers sell less: $Q^S_M(P_1) < Q^*$

$Q_M^D(P_1) > Q_M^S(P_1)$

- Excess **demand**
- Price will tend to **rise**

Case 2: P_2 above P^*



Buyers want less: $Q_M^D(P_2) < Q^*$

Sellers sell more: $Q_M^S(P_2) > Q^*$

$Q_M^D(P_2) < Q_M^S(P_2)$

- Excess **supply**
- Price will tend to **fall**

Finding P^* and Q^* algebraically:

Can solve either equation:

(I) Use demand = supply and solve for P^* first:

Solve for P^*: $Q_M^D(P^*) = Q_M^S(P^*)$
Solve for Q^*: $Q^* = Q_M^D(P^*)$ or $Q^* = Q_M^S(P^*)$

OR, (II) use WTP = WTA and solve for Q^* first:

Solve for Q^*: $WTP_M(Q^*) = WTA_M(Q^*)$
Solve for P^*: $P^* = WTP(Q^*)$ or $P^* = WTA(Q^*)$