

Graphing Payouts When Strategies are Mixed

- We won't be graphing payouts when the opposing player mixes between three strategies.
- We will graph three or more strategies when our opponent only mixes between 2.

Steps to graph payout

1. Define the opponent's mixed strategy, let's say they are mixing between strategies (Left) and (Right). Define strategy $(1 - \alpha)L + \alpha R$.
2. Construct a graph with α on the x-axis and your utility on the y-axis. Label $\alpha = 0$ and $\alpha = 1$
3. For each strategy (s_i) , follow these steps
 - i. Plot at $\alpha = 0$ your utility $U(s_i, L)$ from playing the selected pure strategy.
 - ii. Plot at $\alpha = 1$ your utility $U(s_i, R)$ from playing the selected pure strategy.
 - iii. Connect these two points with a line.

Example 1

Graph both players' pure strategies when the opponent uses a mixed strategy.

		Player 2	
		T	P
Player 1	H	(0,1)	(0,2)
	K	(2,2)	(0,1)

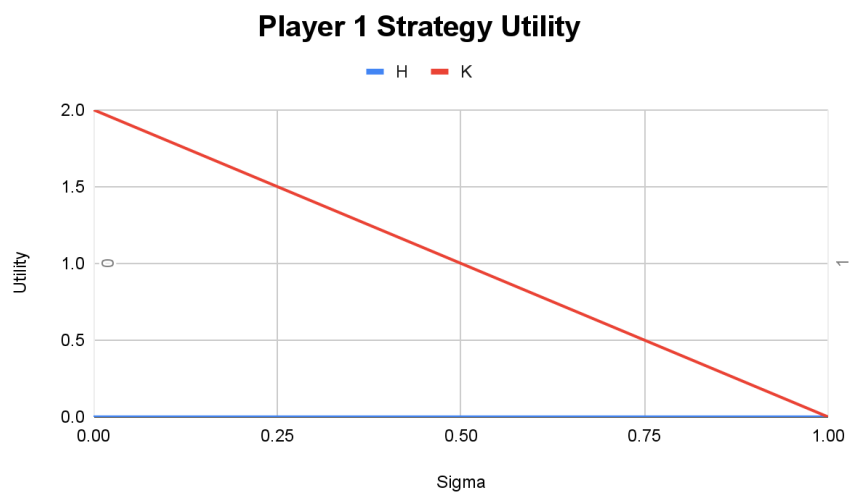
Step 1: Define Strategies and Graph Pure Strategy Payouts

Player 1: $(1 - \theta)H + \theta K$

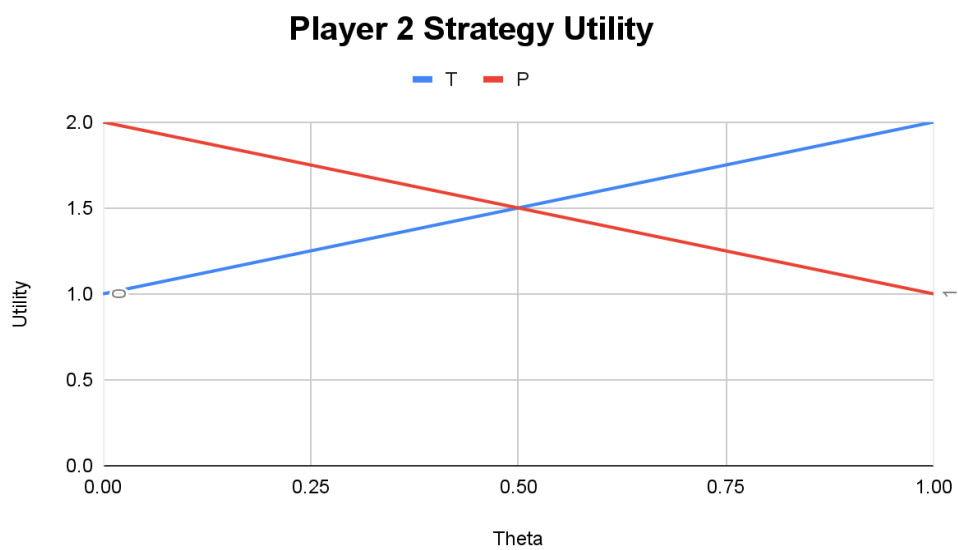
Player 2: $(1 - \sigma)T + \sigma P$

What are we graphing?

$$U_1(s_1, (1 - \sigma)T + \sigma P) \quad \forall s_1 \in \{(H), (K)\}$$



$$U_2((1 - \theta)H + \theta K, s_2) \quad \forall s_2 \in \{(T), (P)\}$$



Graphing Utility

Example Tax Cheat

A taxpayer can either comply with the IRS code or cheat and receive some benefit. The IRS can either audit the tax payer at a cost or do nothing. If the taxpayer cheats and the IRS audits, then the taxpayer faces a penalty, and the IRS receives the fine.

(Taxpayer, IRS)

		IRS	
		Audit	Not Audit
Taxpayer	Cheat	(-2000, 1500)	(1000, 0)
	Comply	(-500, -300)	(0, 0)

Define Strategies

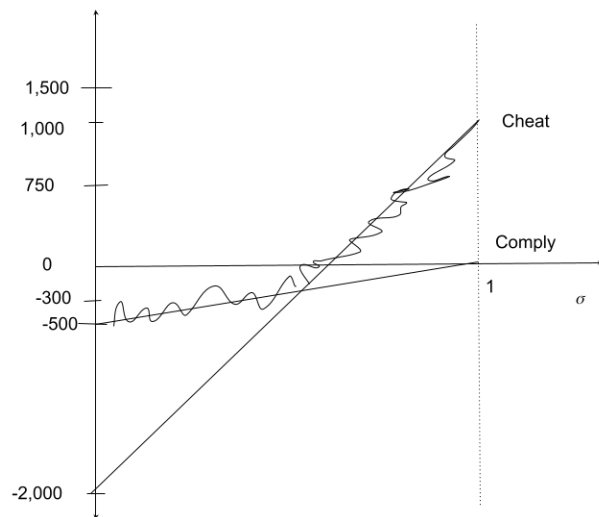
Taxpayer is playing the mixed strategy $(1 - \theta)Cheat + \theta Comply$

IRS is playing the mixed strategy $(1 - \sigma)A + \sigma NA$

Taxpayer

What are we graphing?

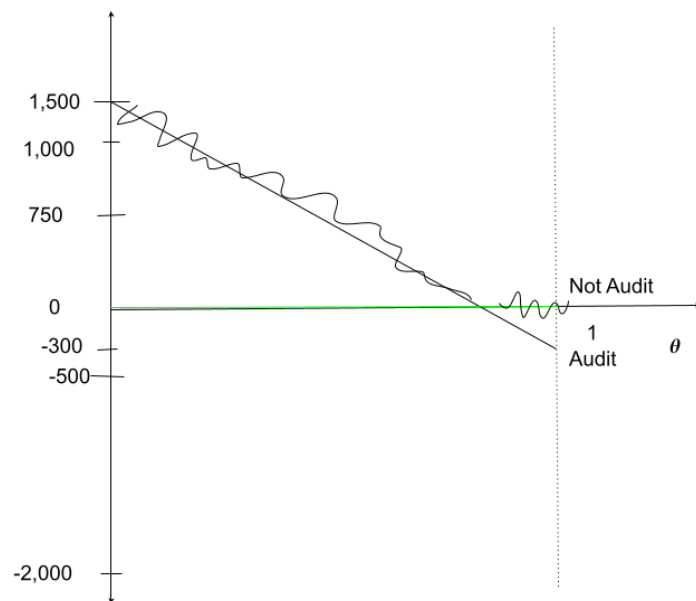
$$U_T(s_T, (1 - \sigma)A + \sigma NA) \quad \forall s_T \in \{(Cheat), (Comply)\}$$



IRS

What are we graphing?

$$U_{IRS}((1 - \theta)Cheat + \theta Comply, s_{IRS}) \quad \forall s_{IRS} \in \{(Audit), (Not Audit)\}$$



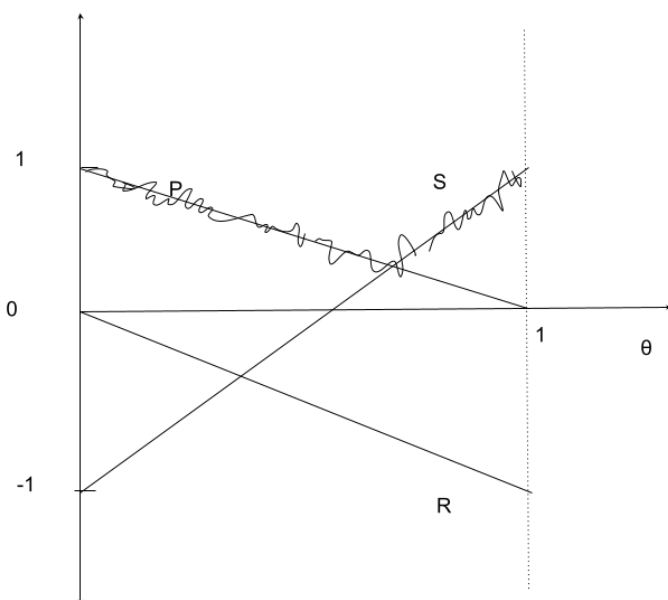
Example: Rock Paper

Graph player 1's pure strategies when player 2 uses a mixed strategy.

		Player 2	
		R	P
Player 1	R	(0,0)	(-1,1)
	P	(1,-1)	(0,0)
	S	(-1,1)	(1,-1)

Step 1: player 2 is playing the mixed strategy $(1 - \theta)R + \theta P$

Step 2: Graph



You and your date Michel were planning to meet at one of two restaurants (Bistro LeRoux or Pizza Hut) but your phone died before you could pick which. Michel prefers Pizza Hut and you prefer the Bistro. Though neither of you wants to eat alone since eating alone would give you zero enjoyment.

- a. State the players and pure strategies
- b. Graph both players' pure strategies when the opponent uses a mixed strategy.

- a. Players: Michel, You
Strategies: (Bistro) and (Pizza)

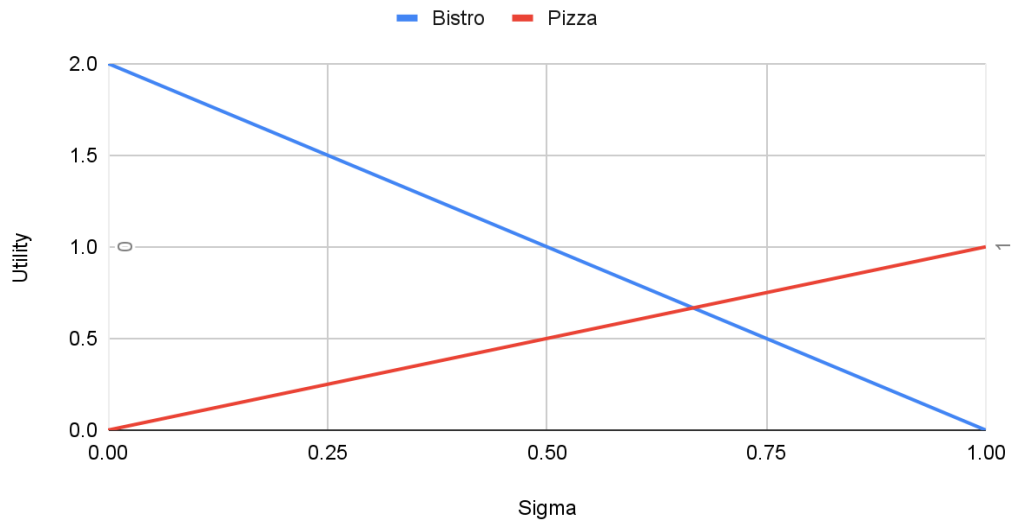
(You, Michel)		Michel	
		Bistro	Pizza
You	Bistro	(2,1)	(0,0)
	Pizza	(0,0)	(1,2)

Define mixed Strategies and graph pure strategy utilities

You: $(1 - \theta)B + \theta P$

Michel $(1 - \sigma)B + \sigma P$

Your Pure Strategy Utility



Michel's Pure Strategy Utility

