Generalized Bilateral Exchange

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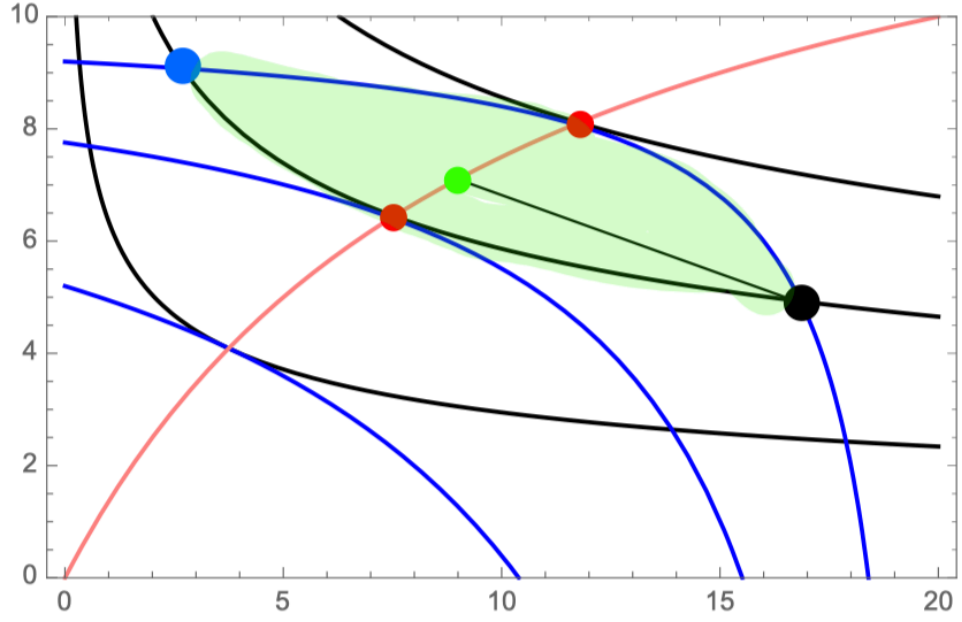
Agenda

1. Motivation
2. Demonstration
3. Psuedo-code
4. Shuffling
5. Extensions
6. More visualizations

Motivation

- Two agents trading two goods is already pretty gnarly to solve.



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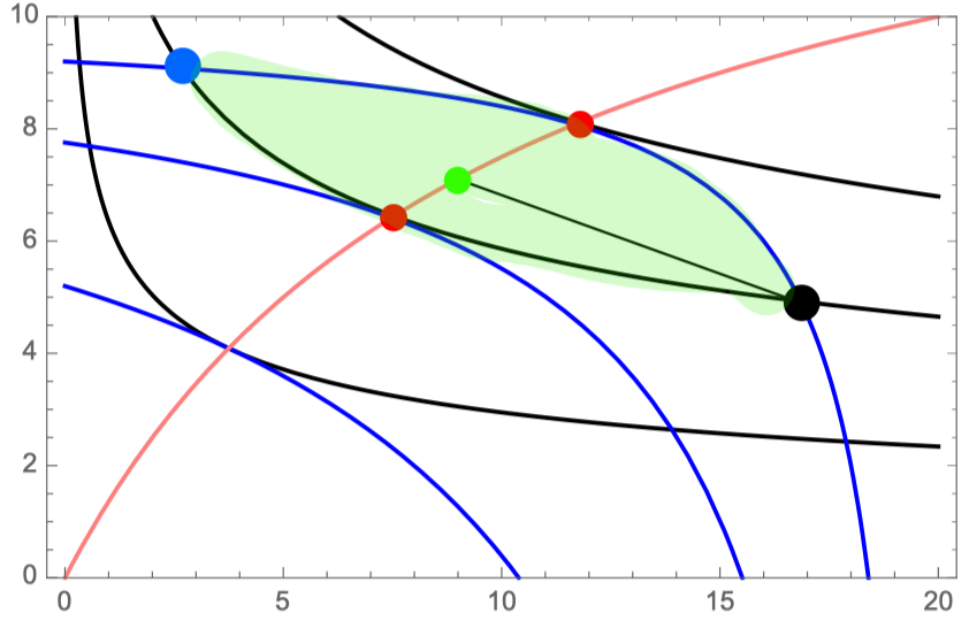

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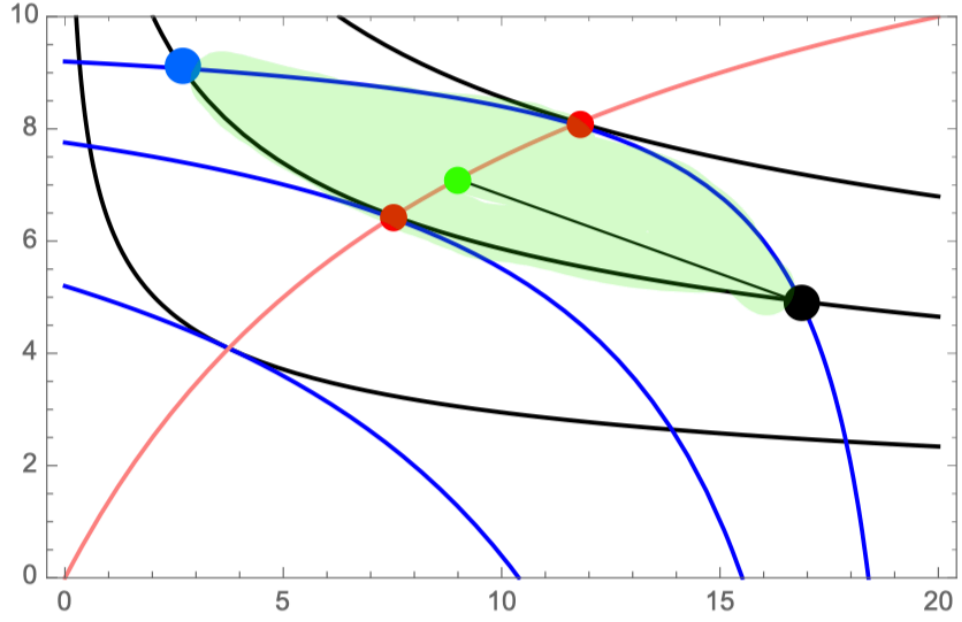

- What if we increase the number of agents to three? Or four? Or any arbitrary A?
- Or what if we increase the number of goods to N?

Demonstration

Pseudo-code

```
initialize Market(agents = A, goods = N):
  generate goods list
  for 1:A:
    initialize agent
    generate N random elasticities that sum to 1
    generate N random inventories
-----------------------------------------
execute exchange(days = 1):
  shuffle agents list and goods list
  FOR a in 1:A:
    pair agent a with agents a+y until a+y = A
    FOR n in 1:N
      FOR q in n+z to N:
        agent with higher MRS(n, q) offers n
        other agent offers q
        WHILE trade increases both agents' utilities:
          trade one n for one q
```

Shuffling

1. Agents are stored in a list of agents that is never shuffled.

$$[a_1 \quad a_2 \quad a_3 \quad a_4 \quad a_5 \quad a_6 \quad a_7 \quad a_8 \quad a_9 \quad a_{10}]$$

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4. Retrieve agent (a_4, a_9), then (a_4, a_6), and so forth.

Extensions: random strategies

```
execute exchange(days = 1):
  shuffle agents list and goods list
  FOR a in 1:A:
    pair agent a with agents a+y until a+y = A
    FOR n in 1:N
      FOR q in n+z to N:
        agent with higher MRS(n, q) offers n
        other agent offers q
        WHILE trade increases both agents' utilities:
          draw u from U[0,1]
          IF u < threshold
            break
          trade one n for one q
```

Extensions: networks

```
initialize Market(..., friends = 3):
  ...
  create Phonebook
  for 1:A:
    sample agents list for 3 friends
    store friends' indices in dictionary
    append dictionary to Phonebook
execute exchange(days = 1):
  shuffle agents list and goods list
  FOR a in 1:A:
    FOR p in Phonebook[a]:
      FOR n in 1:N
        FOR q in n+z to N:
          agent with higher MRS(n, q) offers n
          other agent offers q
          WHILE ...
```

More visualizations!

1. Inventory over time
2. Utilities over time
3. Multilateral Edgeworth box