Supply
natural → retail

Efficiency
four initial types

Demand
people & firms

MNBs
for retail water

WATER SUPPLY
economically speaking

Supply
- physical availability is just the beginning
- natural water is transformed into retail water

natural: streams, lakes, springs, aquifers
wholesale: reservoirs, unfinished water
retail: tap water, finished water
finishing can be costly, or not
- fixed costs are often very large in relation to variable costs
- Suppliers (utilities, districts, authorities) are usually monopolies, with good reason
- the usual cost functions are interesting
  \[ C(W), \, MC(W), \, AC(W) \]

Given a formula for \( C(W) \), can you get \( MC \) and \( AC \) equations and use them?

long-run \( C(W) \); no fixed costs depicted here
- \( MC(W) \) might be decreasing across some range
- Textbook begins by omitting natural water costs/values from \( C(W) \)
- so it’s omitted from \( MC(W) \) and \( AC(W) \) too
Supply (continued)

Observations (cont.)

- Economists have been weakly engaged with cost estimation (we too)
- Water managers are more interested in AC(W) than MC(W)

Supply (continued)

Given equations for these things, can you compute interesting stuff?

Efficiency

economically appropriate meanings
EFFICIENCY

Individualistic, private:
1. for the water-using firm (including farms)
   Efficient water use maximizes profit
2. for the water-using household or person
   Efficient water use maximizes utility

EFFICIENCY (CONTINUED)

and for Society as a whole:
3. Aggregate efficiency means to
   Maximize social net benefits (ΣNB)
4. Neutral efficiency means to
   Maximize any one agent’s NBs without lessening any other agent’s NBs (Pareto)

EFFICIENCY (CONTINUED)

Observations

- Each definition has a role to play.
- Nos. 1 & 2, properly applied, give rise to water demands.
- Planning contexts compel the use of No. 3 or 4; no. 3 suffices for most situations and is pivotal.
- The results of no. 3 may not always be regarded as “fair”. No. 4 exists for this reason.
Water Demand

a point of departure for water resource economics

Demand Theory

Firms

- Producers have technological options which permit some control over water use.
- Production functions capture these options.

\[ y = f(w; x_1, x_2, ..., x_n) \]

- Water is rarely required in some proportional sense to output. Though modeling often loses sight of this.

Demand Theory (continued)

- As with other inputs, firms rationally select a level of water use such that \( VMP_w = p_w \).
- Since the marginal product of water is declining across a relevant range of water use, the firm’s demand for water is negatively sloped.
- Thus, higher water value begets less water use.
Notes

- Fortunately, one does not need to exercise this theory in order to make use of it (e.g. point expansion method).

- The basic idea – that efficient water use declines as value & scarcity increase – is very slow to be grasped and respected within typical planning processes.

Quick Facts

The population in Texas is expected to increase 82 percent between the years 2010 and 2060, growing from 25.4 million to 46.3 million people.

Water demand in Texas is projected to increase by only 22 percent, from about 18 million acre-feet per year in 2010 to about 22 million acre-feet per year in 2060.

Existing water supplies — the amount of water that can be produced with current permits, current contracts, and existing infrastructure during drought — are projected to decrease about 10 percent, from about 17.0 million acre-feet in 2010 to about 15.3 million acre-feet in 2060, due primarily to Ogallala Aquifer depletion and reduced reliance on the Gulf Coast Aquifer.

If Texas does not implement new water supply projects or management strategies, then homes, businesses, and agricultural enterprises throughout the state are projected to need 13 million acre-feet of additional water supply by 2060.

Annual economic losses from not meeting water supply needs could result in a reduction in income of approximately $11.9 billion annually if current drought conditions approach the drought of record, and as much as $115.7 billion annually by 2060, with over a million lost jobs.

The regional planning groups recommended 562 unique water supply projects designed to meet needs for additional water supplies for Texas during drought, resulting in a total, if implemented, of 0.9 million acre-feet per year in additional water supplies by 2060.

The capital cost to design, construct, or implement the recommended water management strategies and projects is $53 billion. Municipal water providers are expected to need nearly $27 billion in state financial assistance to implement these strategies.