Including Use Values in General Equilibrium Descriptions of Environmental Policies

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August 2, 2004

Objective

To integrate non-market valuation and general equilibrium modeling in the evaluation of environmental policy.

Context

Describing the general equilibrium welfare consequences of new environmental policies in a distorted economy.

- pre-existing labor market distortions are important
- can include some of these pre-existing effects in **practical** welfare measures (Goulder & Williams 2003)
- assuming separable environmental effects implies only non-use values

Use Value

Consumers **use** resource amenities by combining them with particular market goods — their time, housing, health services.

This is the basis of the revealed-preference methodology. . . which is itself the basis for most environmental cost-benefit analysis.

Two Challenges

- **conceptual** — how does it impact our ability to measure general equilibrium welfare consequences?

- **implementation** — how does one design and calibrate an empirical model?

The Bottom Line

A PM_{10}-based air quality amenity introduces substantial error in practical measures of the excess burden of a new energy tax.

The **sign** of this error depends on the substitution pattern between leisure and air quality.

Need to consider model calibration procedures that are inclusive of non-market feedback effects.

Definition and Measurement of Excess Burden

Representative agent:

$$U(C_1, \ldots, C_n, L, Q)$$

depends on market goods (C_i), leisure (L) and environmental quality (Q). Q is quasi-fixed.

Q has a physical relationship to market activity:

$$Q \equiv G(C_1, \ldots, C_n)$$

dU and FOCs for consumer and firms $\Rightarrow$ measures of welfare change in terms of:

- direct, taxed sector response (*observable*) (Harberger Triangle)
- labor supply response (*observable-ish*) (Goulder-Williams)
- other cross-market interactions
- **non-market interactions**

Our Strategy

Reproduce Goulder-Williams energy tax simulations adding non-separable air quality amenity.

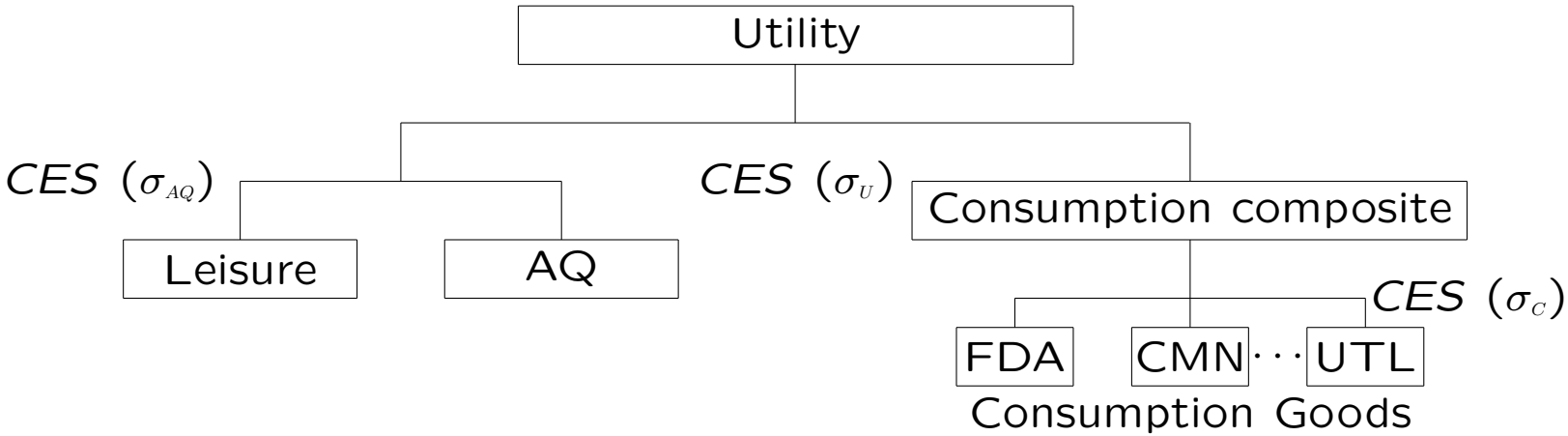
- same benchmark data for 1995 US economy
- same benchmark labor supply elasticities
- representative range of air quality benefit estimates from hedonic property value models
- PM_{10} emissions from U.S. EPA (1995)

Calibration Issues

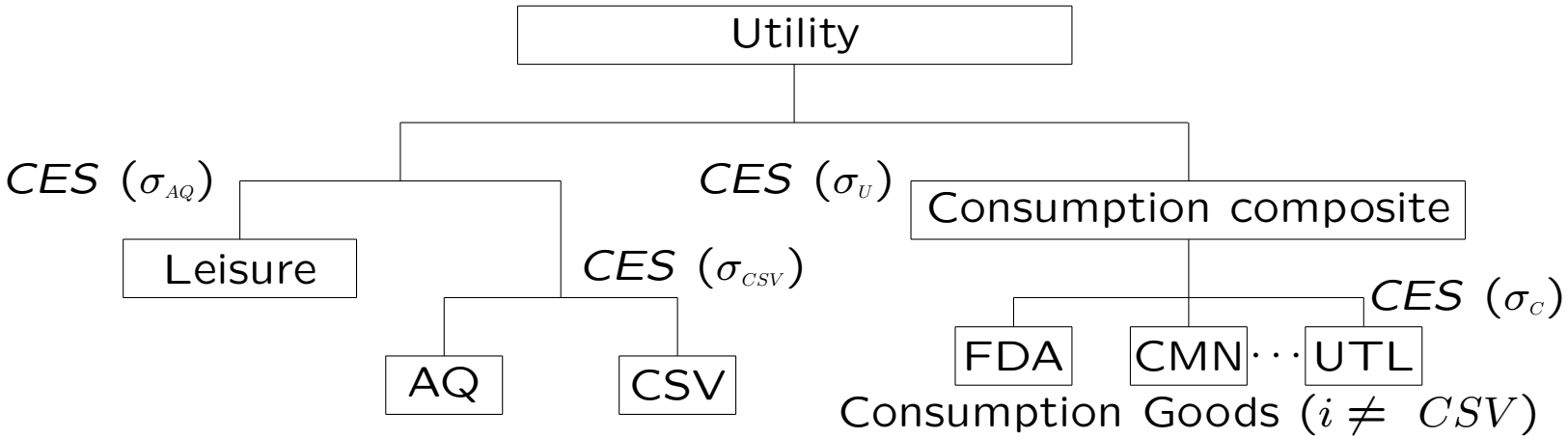
1. Air quality and other demands calibrated as shares of virtual income, where $(MWTP \cdot AQ_0)$ is the benchmark value of air quality.

2. **Elasticities must reflect air quality feedbacks when leisure and AQ are non-separable.**

Nesting in Household Consumption (Specification #1)



Nesting in Household Consumption (Specification #2)



Excess Burden by MWTP for Air Quality Improvements
5% Energy Tax, Preference #1

	EV	EB	EB(H)	EB(GW)	% error(H)	% error(GW)
			Complements			
0.6%	2.61	3.07	0.54	2.80	-82.51	-8.82
2%	2.31	3.81	0.54	2.81	-85.75	-26.39
			Substitutes			
0.6%	2.05	2.52	0.53	2.80	-78.89	10.81
2%	0.84	2.32	0.53	2.80	-77.16	20.22

EV, EB, EB^H, EB^{GW} in billions of 1995 dollars; 40% pre-existing labor tax.

EV — Equivalent variation (true policy cost)

EB — Appx. **market-based** policy cost

EB(H) — Harberger triangle estimate

EB(GW) — Goulder-Williams estimate

% error(H) — $(EB^H - EB)/EB \cdot 100$

% error(GW) — $(EB^{GW} - EB)/EB \cdot 100$

Preference #2 Results

- Qualitatively similar

- Errors tend to be larger because we have **both** market and non-market interactions with labor supply.

Implications

Non-market interactions are quantitatively significant.

They affect the errors in practical welfare measures to extent of **sign changes**. (G-W remains superior Harberger triangle approach)

Need to better understand empirical **connections** between market and non-market goods in use values.

Calibration techniques must incorporate amenity feedbacks.