Toward Resolution of the Conflicting Joint Interests in Carbon Sequestration

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Why the Notion of "Conflicting Joint Interests"?

- Most people including farmers experience internal conflict on this matter of global warming and what to do about it, i.e. driving SUVs or full sized pickup trucks while expressing concern for global warming, conservation
- Farmers in particular tend to prefer weed-free and orderly looking fields, driving powerful tractors with large tillage equipment, mining the carbon out (history of agriculture) while also having concerns over long term sustainability (reverse mining, as it were), and for ecosystems especially wildlife

What know about conflicted behavior? (see Nowak and Korsching, 1998)

- Lack of consistency across studies on how measure conservation behavior
- Treating adoption of technologies and practices as a dichotomous event rather than a process
- Inadequate sampling of the biophysical context
- Inadequate attention to the appropriateness of the practice to that setting
- Inconsistency and inadequate care in modeling across people, time and place

Overall Assessment of Conservation Behavior Literature

"… the literature provides little information about which farmers conserve … and why"

(Nowak and Korsching, 1998, p. 170, attributed to Lockeretz, 1990)

Reflected in Shortfalls of Conservation Programs

- U.S. Government Accounting Office (1977)
- U.S. Department of Agriculture (1989)
- National Academy of Science (1993)

Conservation as a Behavioral Issue

"… systems are as much behavioral as technical. They require daily interactions within the … bureaucracies, among farmers, and between the bureaucracies and the farmers . . . Yet the thought, time and effort devoted to understanding and dealing with behavioral questions are infinitesimal by comparison to that devoted to the technical issues."

Committee on the Future of Irrigation (1996, p. 12, citing Levine)

Problems in Behavioral Science

- Few studies in the more fundamental behavioral sciences have been focused on the farming and ranching population
- Lack of an adequate theoretical representation of H. sapiens to guide the scientific research
- Polar extremes represented in theoretical models based in economics and sociology

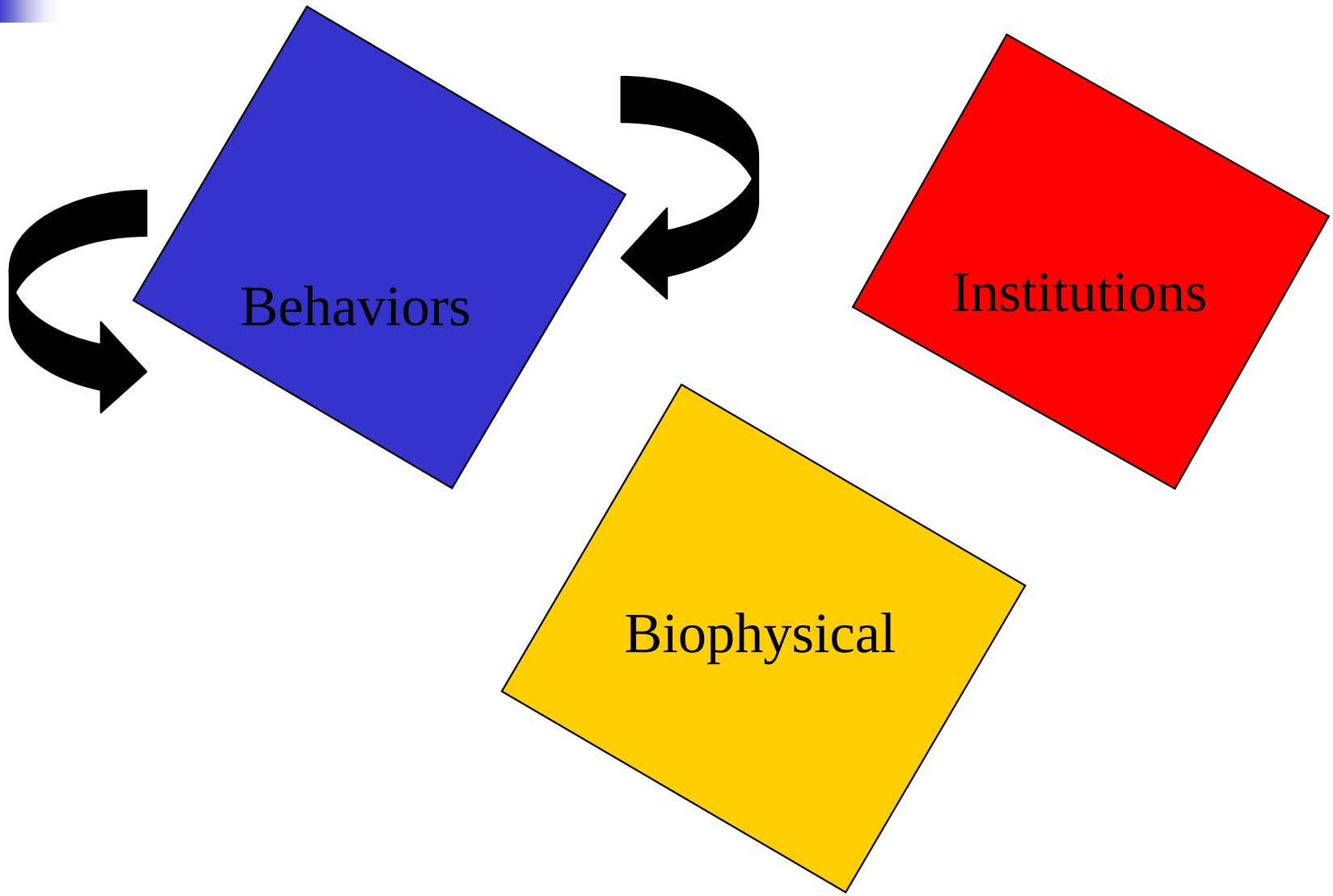
Polar Extremes

"Economics is all about how people make choices; sociology is all about how they don't have any choices to make" [Duesenberry (1960, p. 233)]

Problems in the Economic Model

- On biophysical: Frontier economy with no irreversibilities, i.e., conserve only if it is financially feasible; no intrinsic value
- On institutions: Invariant
  - Moral dimension is invisible and thus amoral, with scientists unknowingly functioning as activists
  - Networks and norms, the shared other-interest, is not a technical aspect of the model
- On volition: Full; prefer full individual control
- On interests: Only the egoistic self-interest

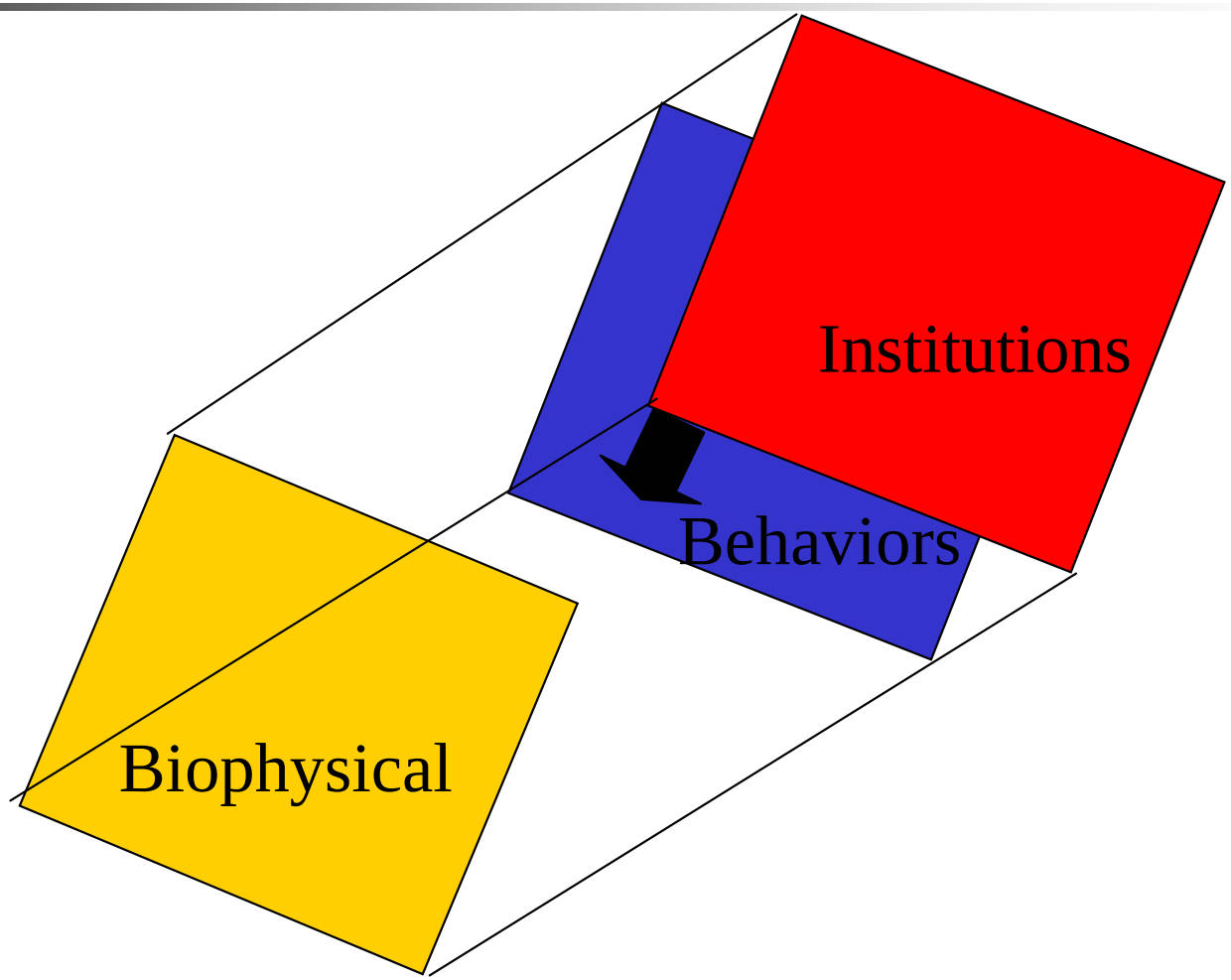
Economic Model



Problems in the Sociology Model

- On biophysical: Not generally included
- On institutions: Individual is bound tightly by the networks (with people and setting)
  - Moralistic, oft times find scientists as activists for a certain moral (changing) system
  - Individual pursuits (e.g., seeking profits, lower costs) not a technical aspect of the model
- On volition: None; prefer external control
- On interests: Only the empathetic other-interest

Sociology Model



Modeled after Nowak and Korsching, 1998, p. 176 (for a later rendition, see Nowak and Cabot, 2004, re: human dimension interacting with biophysical)

Result is Bipolar Policy

- Economists want to "get the prices right" = Financial incentives, emissions trading systems, offsets markets
- Sociologists want to "get the norms right" = Legislative (regulations), administrative, judicial procedures and programs

Need a “Third Way” Theory and Approach to Conservation Policy

Toward a Metaeconomics

Shift Focus to Motivation(s)

"...two lines of thought ... argue against … focus on motivation. ***First***, the standard rational - actor model assumes that all actors are ***identically motivated*** by self-interest. On that assumption, there is no reason to explicitly consider motivation and the empirically - observant heterogeneity of actors' motivations would be simply ignored. ***Second***, a strong version of formalistic sociology would posit **motivation as the effect of a network structure**, and on that assumption explicit attention to motivations would be redundant.“

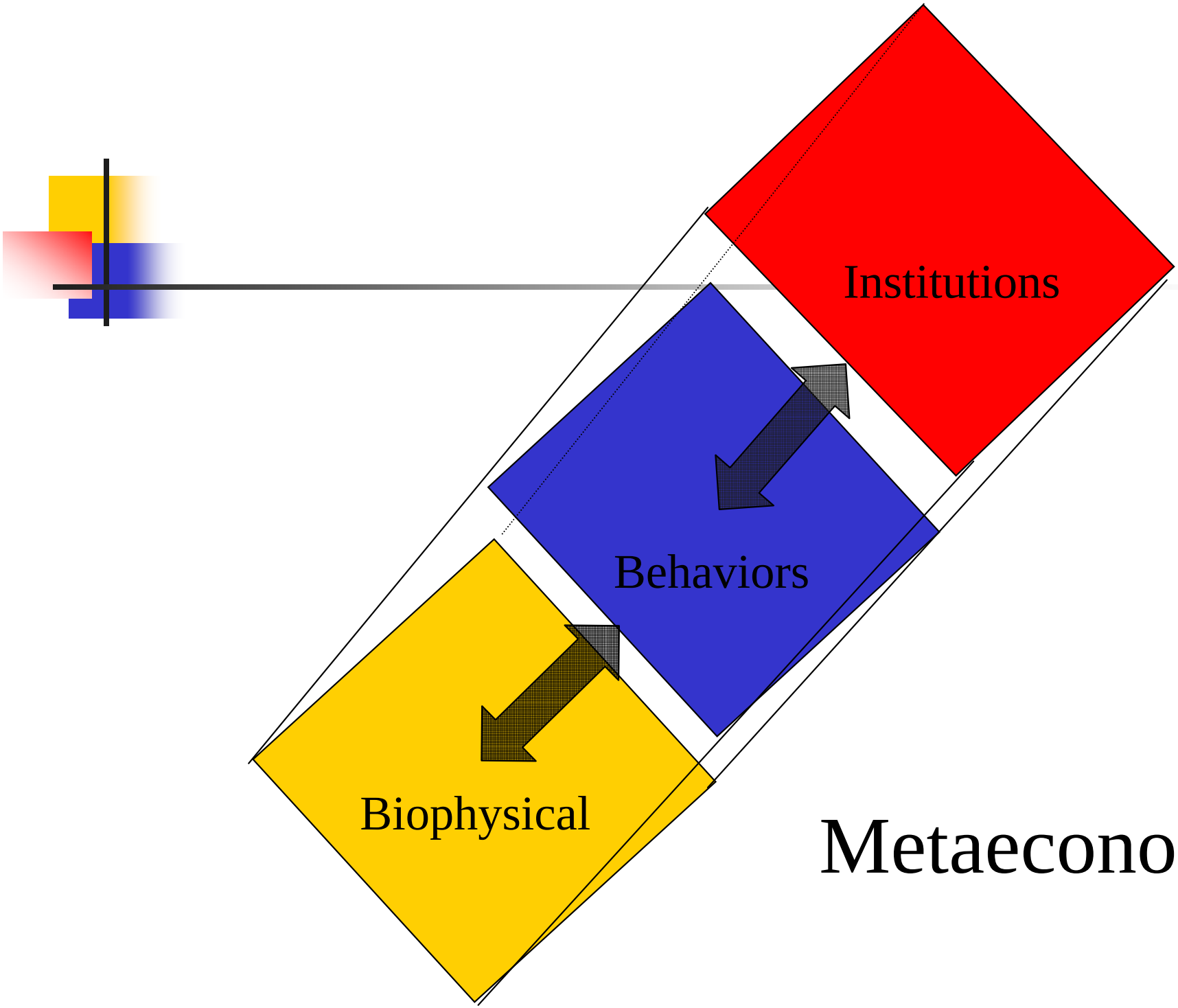
(Adler and Kwon, 2000)

Breakthroughs in Behavioral (Experimental) Science

- LeDoux (1996): Establishing that *emotion is at the base* of rational choice; we first feel; then we cognitively consider; and then feel again, in dynamic feedback
- Sober and Wilson (1998): Documenting there is *little scientifically based empirical evidence* that it is human nature to be *only egoistic-hedonistic or only empathetic-hedonistic*; rather, the empirical evidence points to human nature as being both, at the same time
- Cory (1999): Persuasively argues for the *triune brain* basis for dual motives, a conflict model, with rational choice for resolving conflict
- Kahneman, Smith winning the Nobel in 2002: The earthquake stirring the ***tsunami that is behavioral economics***
- Henrich, Boyd, Bowles, Camerer, Fehr, Gintis and McElreath (2004, p. 8): "Literally hundreds of experiments in dozens of countries... suggest that, in addition to their own material payoffs, *people have social preferences...* (and are) willing to change the distribution of material outcomes among others *at a personal cost* to themselves..."

Suggests a Metaeconomic Model

- On biophysical: Due to “spaceship earth” limits, sees intrinsic value in conservation
- On institutions: Variable
  - Moral dimension is visible and focused on the moral dimension; scientists make it explicit
  - Networks and norms are a technical aspect of the model
- On volition: Control as matter of degree
- On interests: Jointly pursued egoistic self-interest and empathetic other-interest



Metaeconomics

Carbon Sequestration as Conflicted Joint-Interest

- Two interests
  - Self-interest in profits, lower risk, better agronomic decisions
  - Other-interest in global warming, doing-the-right-thing
  - Both interests are *within the self/farmer&rancher*
- Two fields of utility (Self and Other)
- Value emerges as the two fields interact: A joint value emerges
- Resultant value is a *sum greater than the sum of the parts* allowing (implicitly) for intrinsic value

Meta-Math: Iso-curves

$$(1)\quad I_G = I_G(X_1, X_2)$$

$$(2)\quad I_M = I_M(X_1, X_2)$$

$$(7)\quad \frac{(\mu p + \gamma I_M)\frac{\partial I_G}{\partial X_1} + (\tau + \gamma I_G)\frac{\partial I_M}{\partial X_1}}{(\mu p + \gamma I_M)\frac{\partial I_G}{\partial X_2} + (\tau + \gamma I_G)\frac{\partial I_M}{\partial X_2}} = \frac{\kappa_1 r_1}{\kappa_2 r_2}$$

$$(9)\quad X_1^D = X_1^D(\kappa_1 r_1, \kappa_2 r_2, p, I_G, I_M, R)$$

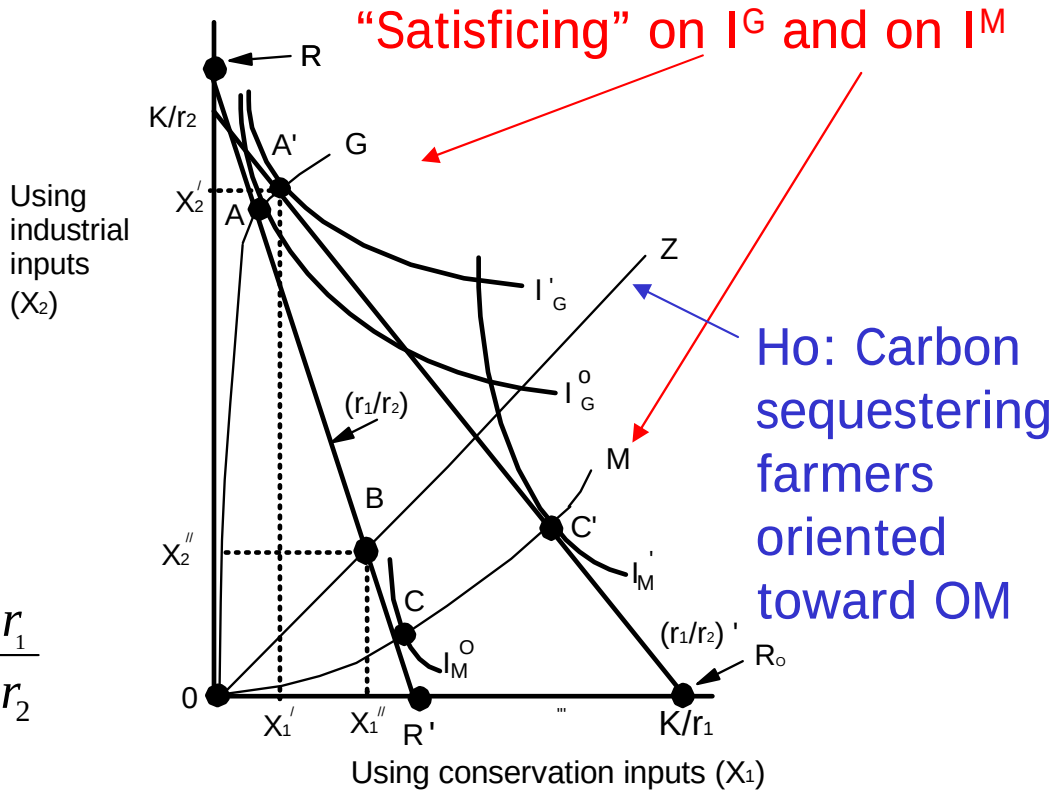


Fig. 1. Jointly egoistic self-interest (I_G) and empathic others-interest (I_M) isoquants for farming with industrial inputs (X_2) and conservation/ ecological inputs (X_1).

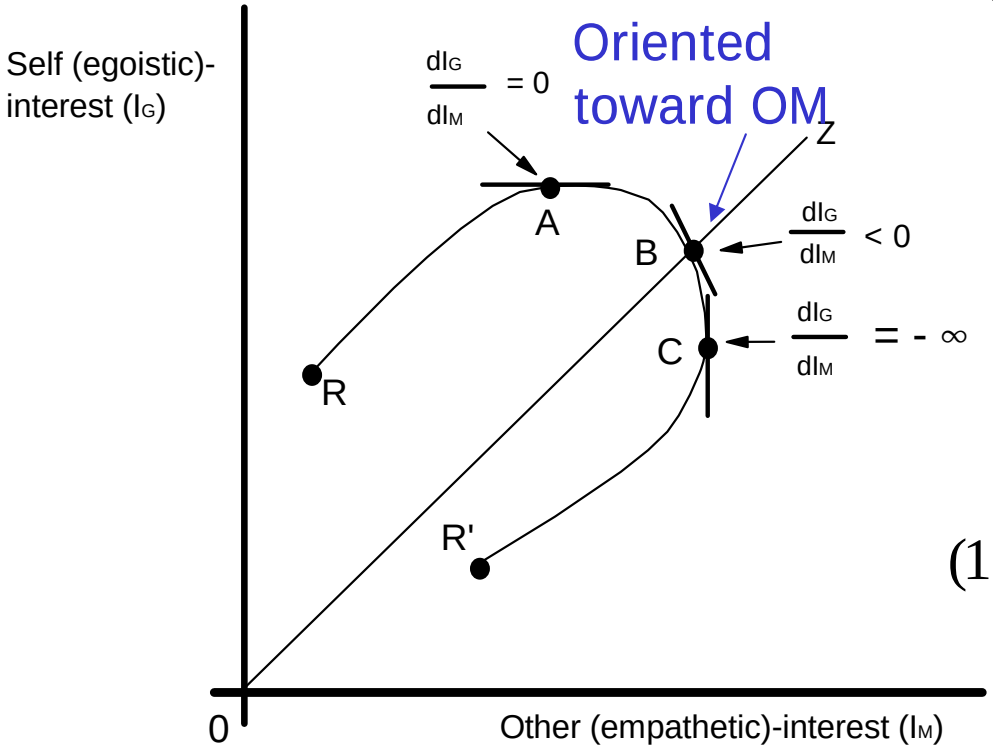
Joint-Interests--- Hypotheses

- Farmers are *conflicted* in trying to serve both interests with any given technology
- Farmers are *satisficers* in each domain (in seeking to profit and to do-the-right-thing)
- Farmers are *maximizers* only in the sense of seeking *peace of mind*
- Farmers more *oriented* (tipping the balance) *toward the other-interest* are:
  - More likely to be applying carbon sequestration technology
  - For those doing so, more effort in sequestering carbon

Meta-Math: Interests Frontier

Maximizing "Peace of Mind": Oriented toward OM

$$(11)\quad \Phi = \Phi\,(I_G, I_M, \kappa_1 r_1, \kappa_2 r_2, p, R)$$



$$(12)\quad \frac{\partial^2 \Phi}{\partial I_G\, \partial I_M} = J_{GM}$$

$$(13)\quad dI_G / dI_m = -\frac{\partial \Phi}{\partial I_M} / \frac{\partial \Phi}{\partial I_G} = D_{G/M}$$

Figure 2. Ego-empathy frontier representing the tradeoffs in the joint pursuit of the egoistic self-interest (I_G) and the empathetic other-interest (I_G).

Survey Instrument

- 3200 questionnaires mailed to farm operators in 5-counties (1700 to 3-more in process)
- 3-agriecozones: rainfed corn-soybean; irrigated corn-soybean; irrigated corn
- 776 responses, with 24% response rate
- Survey included forty-five questions pertaining to farmer beliefs and values about carbon sequestration

Survey Questions

"Using conservation tillage results in increasing financial risks":

Highly Unlikely Highly Likely

1 2 3 4 5 6 7

Or,

"Using conservation tillage results in helping to combat global warming":

Highly Unlikely Highly Likely

1 2 3 4 5 6 7

The Metaeconomic Model

Explanatory Variables:

- Internalized Balance iin Ego and Empathy
- External Influence of Others on the Decision
- Need for Control Over Environment and Decision Process.
- Farm Income
- Past choices embedded in the emotions due to cognitive choices in the past: It “feels” right

Still working to introduce:

- Costs
- Biophysical setting: Using GIS approaches
- Irrigated continuous corn regime: Only the other two systems represented in empirical results

Model...

Dependent Variable:

Ratio: Conservation Tillage as a Proportion of Total Acres

Resulting Model:

$$\Pr(0, CTRatio) = f[\frac{(Influence)x(Balance)}{Control}, Income, Past]$$

Processing the Variables

- Applied factor analysis
  - To reflect the essence of the orientation in their beliefs (the tipping of the balance)
  - To reflect the essence of the extent to which farmers are allowing external influences on how they integrate the self- and other-interests
  - To reflect the essence of the preference for more control over farming processes (which is sacrificed as one moves to CT)
- Farm income is proxied by $1000s in farm sales

Factor Analysis of Balance

	Component			
Belief (*2-3 years ago*)	1	2	3	4
Reducing fertilizer	.180	.495	.127	.043
Environmental stewardship	**.660**	-.013	.374	-.102
Increasing financial risk	.014	-.035	-.006	**.827**
Reducing labor	.268	-.192	**.645**	.122
Providing for family	.270	.379	**.645**	-.196
Increasing overall farm profit	.072	.260	**.717**	-.048
Enhancing success	.277	.331	**.674**	-.157
Reducing insecticide	.022	**.800**	.106	.079
Increased respect from community	.400	**.517**	.200	-.031
Healthier environment	**.647**	.359	.253	-.111
Reducing crop disease	.117	**.833**	.033	.053
Combating global warming	**.627**	.462	-.068	.128
Controlling weeds	.174	**.720**	.091	-.145
Building up organic matter	**.668**	.117	.303	-.120
Increasing equipment costs	-.186	.115	-.091	**.694**
Decreasing fuel use	.360	-.109	.310	.231
Sustainability of agriculture	**.558**	.357	.419	-.164
Reduce levels of CO2	**.709**	.305	.047	.086
Protecting from soil erosion	**.672**	.107	.186	-.287

Factor Analysis of Influence

	Component		
	1	2	3
Influence of landlord	.724	.225	.264
Influence of commodity group	.813	.122	.243
Influence of lender	.822	.223	.268
Influence of extension agent	.377	.618	.260
Influence of crop consultant	.628	.472	.118
Influence of farm service agency	.167	.816	.139
Influence of chemical supplier	.387	.630	.228
Influence of NRCS or NRD	.133	.866	.133
Influence of equipment dealers	.563	.425	.197
Influence of spouse	.109	.151	.795
Influence of child	.200	.114	.856
Influence of other relatives	.372	.206	.757
Influence of close friends	.419	.311	.641

Factor Analysis of Control

	Component		
	1	2	3
Hesitancy to change	.313	.784	.113
Amount of time to learn	.249	.817	.213
Increased costs in equipment	.455	.622	.068
Finding work for hired labor	-.002	.474	.485
Concern over weeds	.727	.275	.034
Concern over rainfall	.552	.342	.214
Concern over soil temperature	.709	.039	.195
More difficult to use	.604	.436	.138
Environmental concerns herbicides	.722	.195	.123
Difficulty in planting in leftover stalks	.757	.237	.112
Appearance of CT fields	.540	.219	.416
Landlord decides CT use	.234	.120	.835
Others control decision	.167	.109	.872

Regression Results

Model type	Logit (0=No CT; 1= CT)		Tobit (0=No; X= CT ratio)		Tobit (0=No; X= CT ratio)	
Constant	-1.7592	a	-0.1646	b	-0.1412	
(BalanceXInfluence)/Control	0.3244	a	0.0849	a	0.0755	a
Farm Income	0.4469	a	0.0925	a	0.0704	a
CT on Farm 5 years ago					0.0937	a
RT on Farm 5 years ago					-0.0942	a
IT on Farm 5 years ago					0.0059	
Adjusted R-Sq.	0.1256		0.1280		0.21993	
Observations						
at 0	169		169		169	
at 1, or X	391		391		391	
Total	560		560		560	
[a]p < 0.0001; [b]p < 0.05;						

Tentative Conclusions

- Conservation effort to enhance carbon content of soil increases as a result of joint *"satisficing"* efforts
  - To achieve satisfactory profits and other self-interest outcomes
  - To achieve satisfactory rates of global warming and other (shared)-interests ***(still within the self)***
- Farmers *more oriented to I^M concerns*, e.g. environmental stewardship, sustainable agriculture and global warming:
  - More likely to be using technologies that sequester carbon,
  - For those doing so, are practicing sequestration more intensely
- Farmers more willing to be *influenced by others* will be more active in sequestering carbon
- Farmer willingness to operate with *less direct control* over agronomic/tillage decisions will be more likely to sequester carbon using conservation technology, and, for those doing so, will sequester more carbon

Implications for a "Third Way" Policy (and Education Programs)

- Need to "get *both* prices and norms (and networks) right"
- Also adds a *spatial dimension*: Need to measure *"personological typologies"* in particular farming areas
- Policy now focuses on *re-orienting, tipping the balance* in the interests demonstrated in each area or region
  - Not strictly an incentives issue
  - Not strictly an appeal to doing-the-right-thing
  - Rather, focus on affecting the relative orientation that results in more carbon sequestered in the soil
- Need to *educate those who influence* farmers
- Policy is also about *finding the "just right" level of control* to assert: Need a better understanding of the role of control
- Watch for the *threshold in financial incentives:* ***Could be counter-productive to shift the orientation to the self-interest***