

A Discussion of Indirect Effects In General Terms

(Bigger Picture Issues with ILUC)

Issues with Current ILUC

- **New Fuels Alliance Letter: Submitted October 23**
 - 30 Signatories largely from the advanced biofuels space
- **Focus of the Letter**
 - Discuss Broader Implications of Enforcing Indirect Effects
 - Raise Macro Concerns with GTAP and CGE Approach
 - Raise Micro Concerns with GTAP Assumptions/Data
- **Purpose of the Letter**
 - Raise Concerns About Inconsistent Application
 - Ask substantive questions where they have not been asked
 - Debunk myth that ILUC enforcement promotes advanced biofuels
 - Communicate Concerns of Advanced Biofuels Industry

Response to Questions

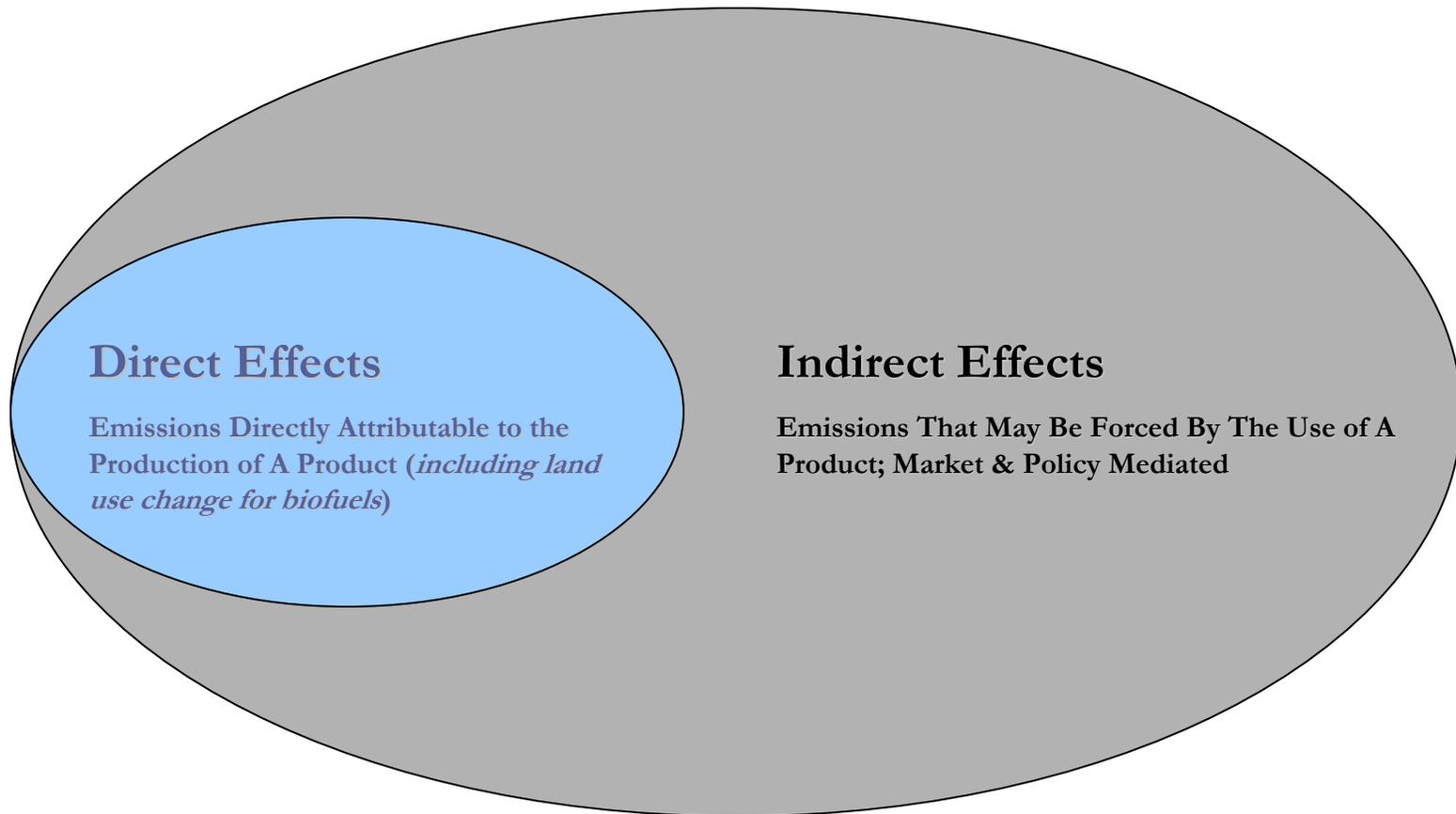
- **Response to those challenging ILUC science (inc. NFA) has not been substantive to date**
 - Many hollow accusations of “politics versus science”
 - Misleading claims that we are advocating for “zero ILUC” or misrepresenting the methodology
 - Remember Alex Farrell’s admission that “the complexities and uncertainties of indirect LUC make it difficult to decide what to do.” (3/19/08)
 - Bottom Line: We have not yet received substantive answers to substantive questions about GTAP, macro/micro concerns
- **Still looking for substantive answers ...**
 - Why a different system boundary for biofuels?
 - Macro: Does uncertainty overwhelm directionality in GTAP/ILUC?
 - Micro: there are a myriad of questionable assumptions made so far that fundamentally change the outcome, especially with regard to elasticity

Another Perspective

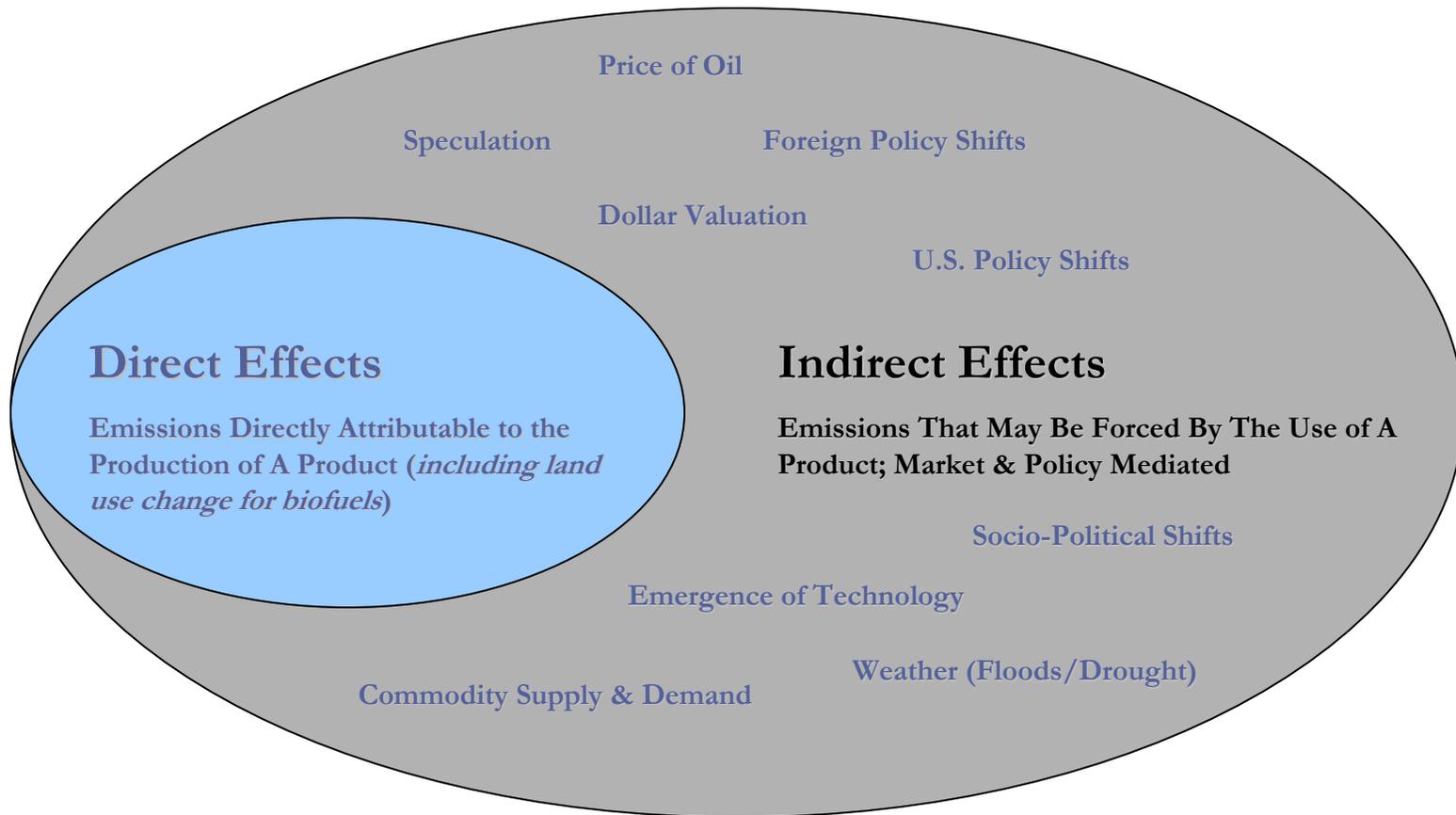
“CGE models can be useful quantitative supplements to experimental thinking about the importance of different potential causal linkages among economic variables at the country or world level. However, mechanically churning out ‘projections’ of welfare gains or any other indicator subject to one single set of causal assumptions and parameter values is a fundamental misuse of a sometimes helpful tool.”

Source: A Critique of Computable General Equilibrium Models, Lance Taylor and Rudiger von Arnim, New School for Social Research, New York, conducted for Oxfam (July 2006)

Direct vs. Indirect Effects

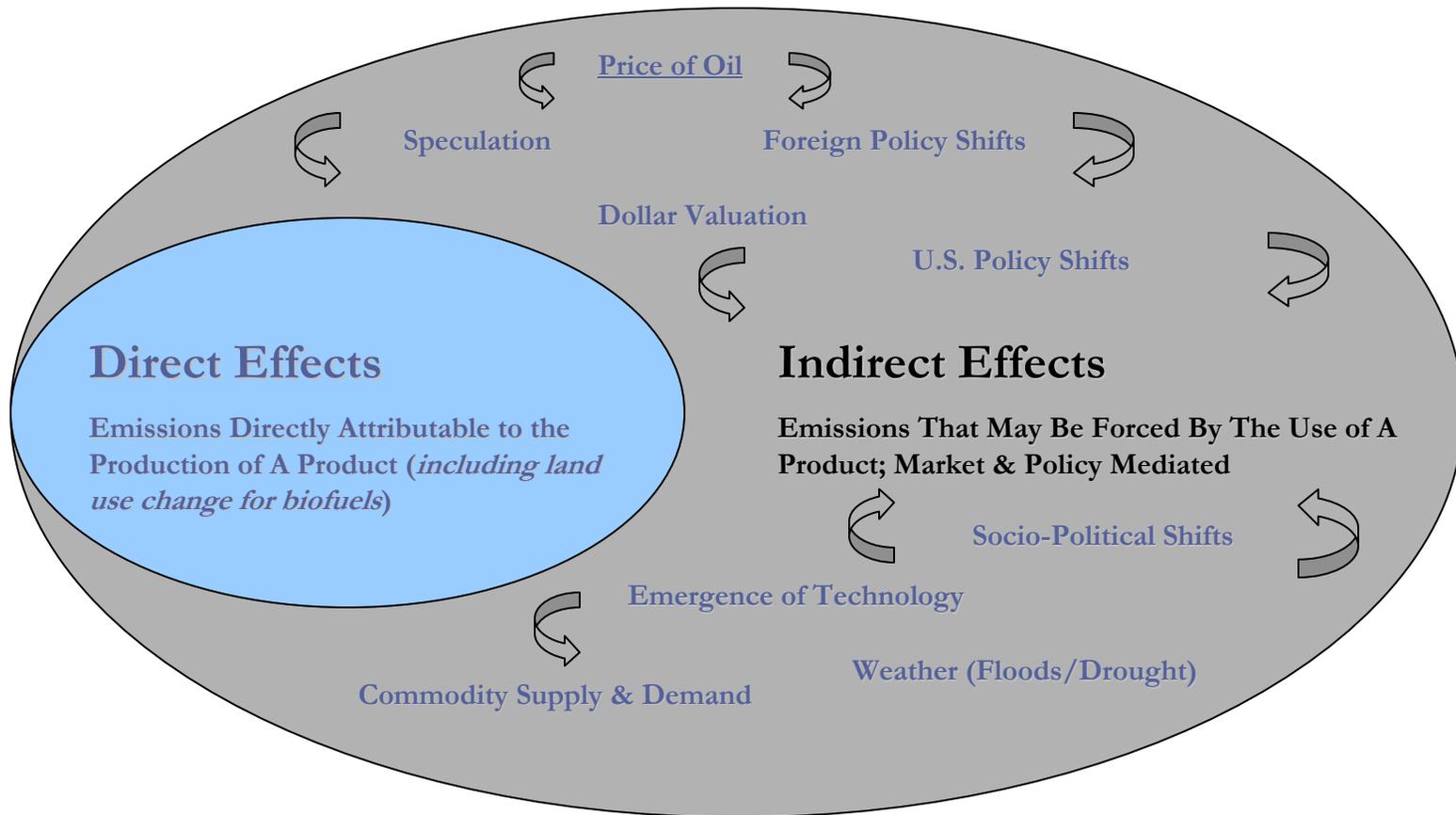


Indirect Effect Variables



Variables Are Synergistic & Dynamic

(Not Static Like GTAP Treats Them)

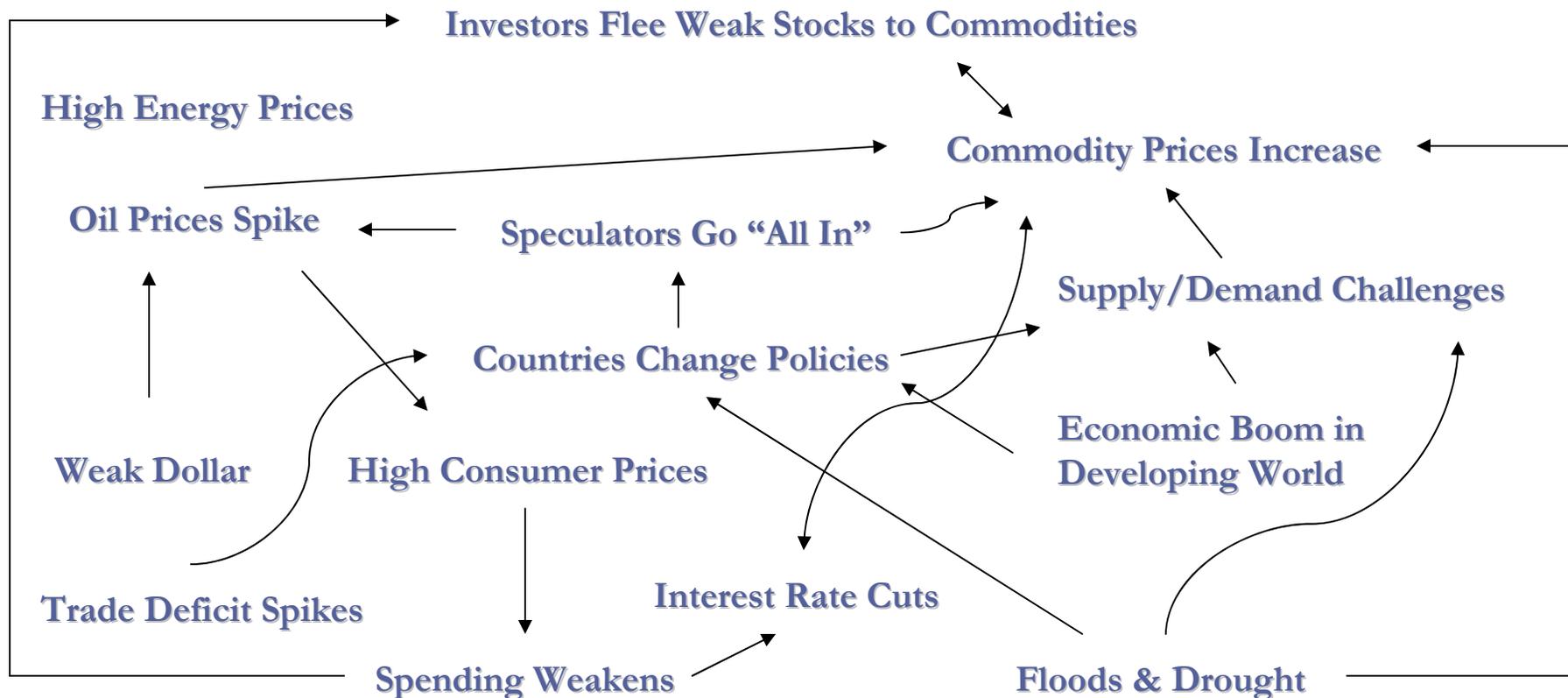


[a]t the underlying level, tropical deforestation is ... best explained by multiple factors and drivers acting synergistically rather than by single-factor causation, with more than one-third of the cases being driven by the full interplay of economic, institutional, technological, cultural and demographic variables.

Source: BioScience Magazine

2008 Commodity Price Spikes

What Did We Learn?



"This is a market that's being driven by speculation as much as it is by the fundamentals." Stephen Schork, President, Schork Group Inc.

2008 Commodity Price Spikes

A Closer Look At Variables

- **Perfect Storm Spiked Commodity Prices**
 - Investors left weak stocks for commodities
 - Dollar weakened & Demand Increased
 - Energy Prices At All Time Highs
 - Fed Repeatedly Cut Interest Rates
- **But also ...**
 - Countries Suddenly Started Changing Policy (e.g. China & Soybeans)
 - Major Floods in the Midwest (intensified speculation)
 - Economic Boom in Developing Countries (increased demand/speculation)
 - Countries Responded by Changing Policies
- **Some Trends Defied Economic Fundamentals**
 - Soybean prices doubling in 24 months despite record stocks
 - Corn prices doubling despite healthy stocks
 - Corn acreage down in 2008 despite higher prices

So What Does GTAP Do?

Difficult to Really Understand Model

- **Databases are not openly accessible**
- **GTAP: All About Single Factor Causation**
 - Problem 1: it is well recognized that land use decisions do not come as a result of single factor causation
 - Problem 2: single factor causation means that many of the modeling outcomes are built into the model, not created by the model
- **Rigid Treatment of Macro-Economics**
 - Assumes Market Driven By Fundamentals
 - Central Macro-Economic Indicators Are Held Constant
 - Translation I: The synergies and dynamic nature of the indirect effect variables (e.g. weak dollar, speculation, policy) are disabled
 - Translation II: GTAP predicts changes in economies over time, but is not sensitive to changes in macro-economics over time
 - Problem according to Oxfam Report: *“the price changes often dance to macro-economic and not micro-economic tunes.”*
- **Does Uncertainty Overwhelm Directionality?**

A Word About Uncertainty

- **Our Position: we must carefully consider uncertainty**
 - What does are the models doing and not doing?
 - Is the modeled effect real, observed or even directionally accurate?
 - How many sets of assumptions should we consider? Wrong Answer: 1
 - Not Our Position: uncertainty means we must omit the ILUC consideration
- **Misleading Comparisons to Air Quality Uncertainty**
 - Urban airshed models are customized to stratospheric conditions of the airshed
 - Emissions calculations are based on extrapolations from actual tailpipe testing
 - Isolating one variable by holding all others constant is consistent with application of regulatory scheme & real world behavior (e.g. changing fuel parameters)
 - Verification is possible & ongoing
- **GTAP**
 - Lots of equations but very little customization
 - Moved from airshed-specific forecasts based on tailpipe tests to world economy forecasts based on limited data and without inclusion of confounding variables
 - Isolating one variable by holding all others constant is inconsistent with application of regulatory scheme & real world behavior
 - Verification is impossible & will not be ongoing

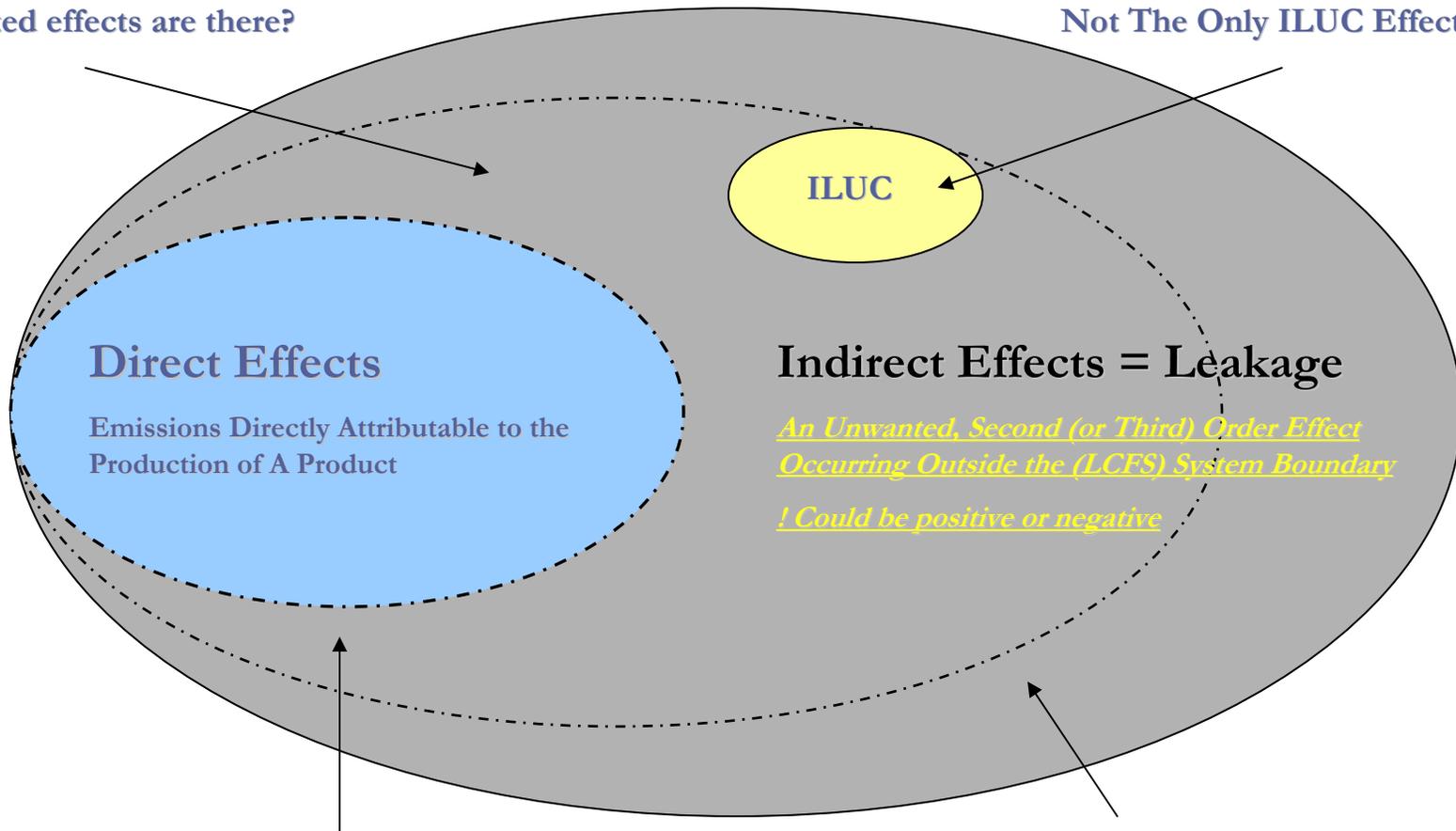
Where Do We Go From Here?

- **Properly Define Indirect Effects & ILUC**
 - Indirect Effects Are Really Leakage (outside system boundary)
 - Goes Beyond The “Polluter Pays” Philosophy
- **Establish Set of Principles for Inclusion of Leakage**
 - Principles must apply to all fuels
- **Design & Implement Comprehensive Approach to Leakage**
 - Understanding leakage is critical
 - But the policy solution must be based on sound science
 - If “zero is not the right number” is an argument for including ILUC leakage, it is also an argument for including other leakage

Indirect Effects Are Leakage

What other economically-mitigated effects are there?

Reductive Effect of Corn Acreage Is Not The Only ILUC Effect



LCFS System Boundary Before Public ILUC Debate

Proper System Boundary Now?

Argument for ILUC As Leakage

A Better Way to Define the Problem

- **The term “indirect effects” is misleading**
 - All effects are direct because they occur as a direct result of someone making a decision (especially true for LUC)
- **ILUC is not a part of the biofuels carbon footprint**
 - Indirect effects are, by definition, *directly* caused by something else
 - Even if you believe that biofuels cause land expansion, it is the decision to extract timber, graze cattle, produce food that causes the land clearing
 - If clearing occurs for biofuel feedstock, it is a direct effect & is already included
 - An indirect effect is not an inherent carbon effect of the biofuels gallon; it is an inherent carbon effect of someone else’s supply chain that is being proposed for inclusion in the biofuels carbon score.
- **Leakage is a better way to describe the real concern:**
carbon emissions outside of the system boundary
 - *Land use is only one part of this equation*
 - *Shuffling is another concern*
 - *Other price driven effects – including speculation – also relevant*

Leakage Inconsistently Applied

A Comparison Between Biofuels & Petroleum

- **For Biofuels**

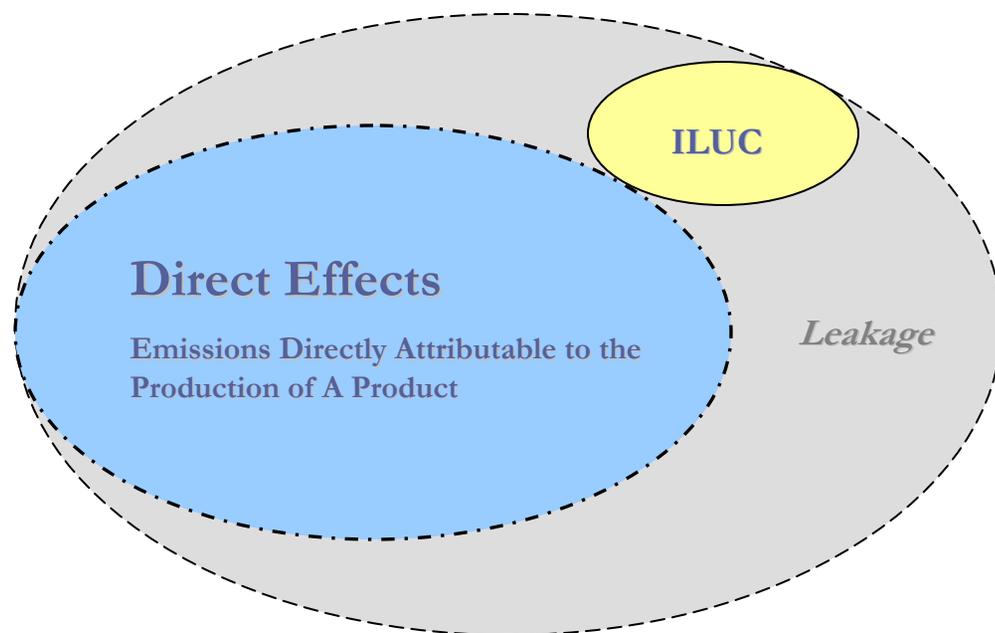
- **Benchmark Used: National Gallon (w/ potential to customize)**
- **Treatment of Leakage: Included (ILUC via GTAP)** ←
- **Many Workshops Dedicated to This Perceived Effect**

- **For Petroleum**

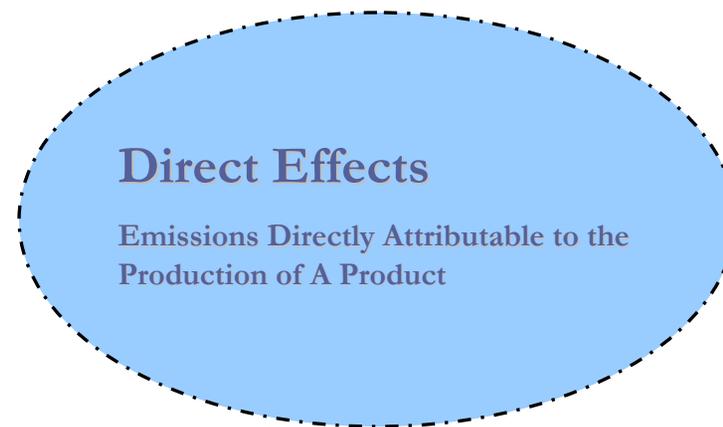
- **Benchmark Gallon: California Basket**
- **Treatment of Leakage: Not Included** ←
- **“California Basket” Will Simply Push Heavy/Tar Outside CA**
- **Shuffling Effect is well understood, but not proposed to be added to petroleum carbon score**
- **Biofuels ILUC inclusion is not balanced by oil LUC inclusion**
 - **Adding Land Use Change to Petroleum Is Direct Effect**

Inconsistent System Boundaries

System Boundary for Biofuels



System Boundary for All Other Fuels



Leakage Effects For Fuels

● Petroleum

- Land Use Change (neither direct nor indirect LUC included to date)
- Shuffling: Shifts Demand for Heavy and TEOR to other regions
 - Will heavy crude be refined in China/other countries because less stringent air quality requirements?
- Military & Occupation
- Commodity prices (including soybeans and corn) historically track to oil prices

● Biofuels

- Increased demand for agricultural land
- Innovation and technological advancement across all agricultural sectors from biofuels
- Crop shifting away from more energy-intensive crops
- Rural Economic Development & Less Urban Sprawl

● Natural Gas

- Same As Petroleum (perhaps lesser magnitude)

● Electrification

- Market-Mediated Impacts of Increased Reliance on electricity feedstocks (NG, Coal)
- Increased heavy metal demand for batteries; nickel mining & related emissions
- Shuffle low-efficiency, non-electric light-duty vehicles to other markets?

● Hydrogen

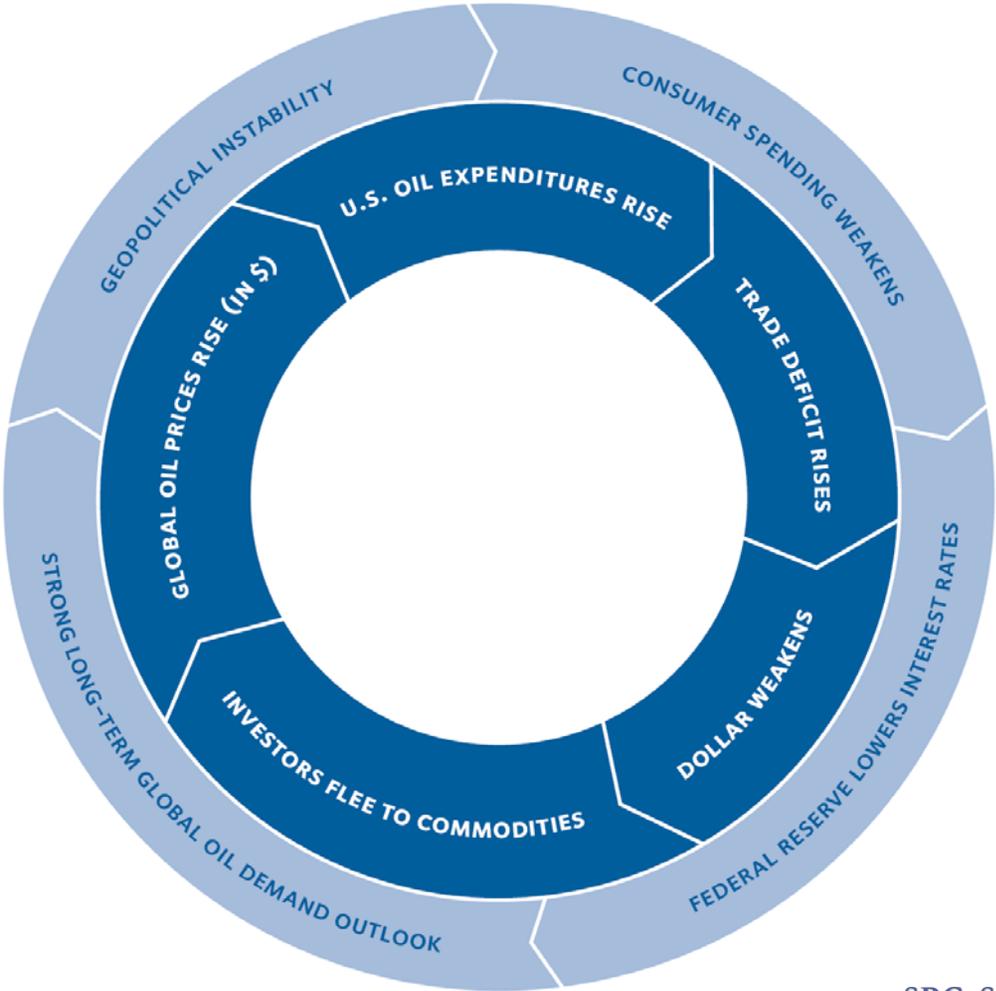
- First Generation Hydrogen From Coal & Natural Gas

Other Examples of Leakage Effects

- **Wilderness Areas & National Parks**
 - Indirect Land Use Change
- **Conservation Reserve Program**
 - Indirect Land Use Change
 - Corn-to-Ethanol Acreage: ~ 17 million acres
 - Agriculture-to-CRP Acreage: ~ 35 million acres
- **Banning of Lead & MTBE, Lower Benzene in Gasoline**
 - Exportation of Lead, MTBE & Benzene to Foreign Market (e.g. China)
- **California Reformulated Gasoline Program (CaRFG)**
 - Significantly Reduced Sulfur in Gasoline (~ 12 PPM), but Shipping Fuel (up to 27,000 PPM)
 - *Where Does The Sulfur Go? Where Do The Toxics Go?*
- **Public Transportation**
 - Lower Fuel Prices + Less Traffic = Increased Driving & Fuel Combustion
- **Fuel Efficiency Standards (CAFÉ)**
 - Lower Fuel Prices + Lower Cost/Mile = Increased Driving & Fuel Combustion

The Vicious Circle

Oil, Commodities & The Economy



TRACKING KEY PRICES (PROJECTED)

| DATE | CRUDE | GASOLINE | COST AT THE PUMP |
|--------------------------------|------------------|-------------------|-------------------------|
| AUGUST 7, 2009 (SEGMENT START) | \$125 PER BARREL | \$4.63 PER GALLON | \$106.03 (MID-SIZE SUV) |
| AUGUST 7, 2009 (SEGMENT END) | \$165 PER BARREL | \$5.58 PER GALLON | \$127.78 (MID-SIZE SUV) |

“Given today’s precarious balance between oil supply and demand, taking even a small amount of oil off the market could cause prices to rise dramatically. In Oil ShockWave, a simulated 1.2 percent disruption in global oil supplies caused prices to rise by 75 percent (from \$95 to \$165) in just four months.”

- Oil Shockwave, Executive Crisis Simulation (November 2007)

Proposed Principles

- **All Fuels Should Have The Same System Boundary**
 - Alternative is to pick winners and losers, which conflicts with LCFS goals
- **ARB Should Design & Implement Comprehensive Approach to Leakage**
 - Leakage should be addressed across all fuel pathways
- **Uncertainties of CGE/GTAP Model Runs Should Be Addressed**
 - GTAP Should Be Run With Several Sets of Differing Exogenous Assumptions to Address Fundamental Flaw of Fixed Macro-Economic State
 - GTAP Model Should Be Run To Available Verifiable Results (i.e. USDA data)
- **Proper Scenario Must Be Modeled**
 - Why are we modeling federal RFS I?
 - Why are we shocking a model set to today's market with tomorrow's gallons?
 - We now have federal RFS II with GHG controls and advanced technology mandate
- **Other Principles?**