

# Decomposition Analysis of U.S. Corn Use for Ethanol Production from 2001-2008

California Air Resources Board  
(CARB) Low Carbon Fuel Standard  
Expert Workgroup Meeting  
Sacramento, CA  
October 14-15, 2010

Summary - Recommendations

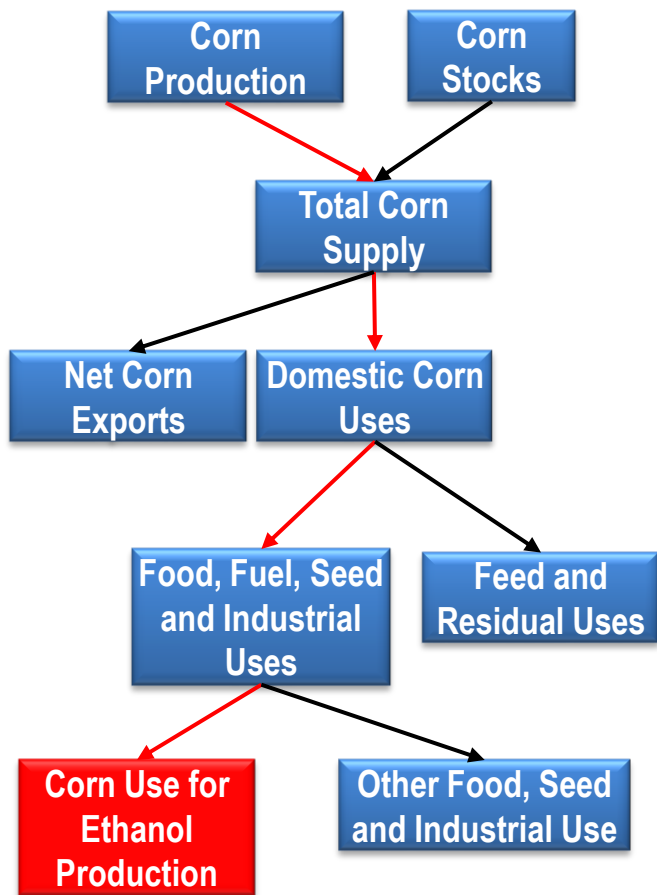
'Debo Oladosu and Keith Kline  
October 6, 2010

\*This research was supported by the U.S. Department of Energy (DOE) under the Office of the Biomass Program and performed at Oak Ridge National Laboratory (ORNL). Oak Ridge National Laboratory is managed by the UT-Battelle, LLC, for DOE under contract DE-AC05-00OR22725. The views in this presentation are those of the authors, who are also responsible for any errors or omissions.

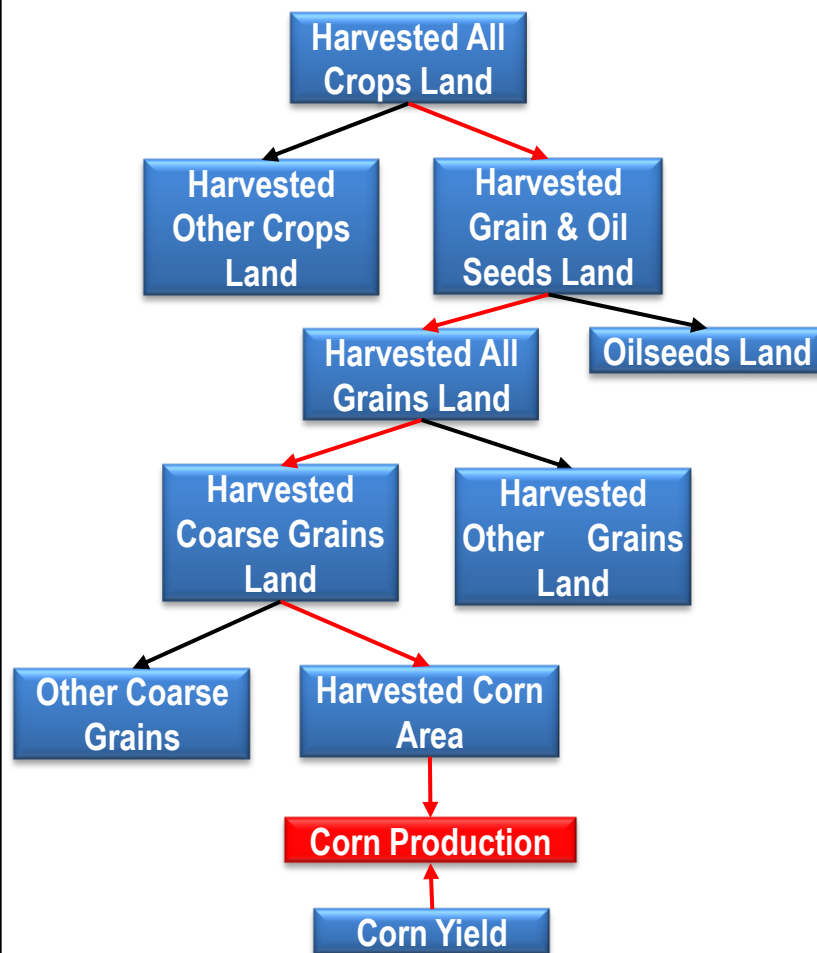


# Decomposition Analysis of Empirical Corn Use for Ethanol Data with LMDI I: Linkages in the Chain

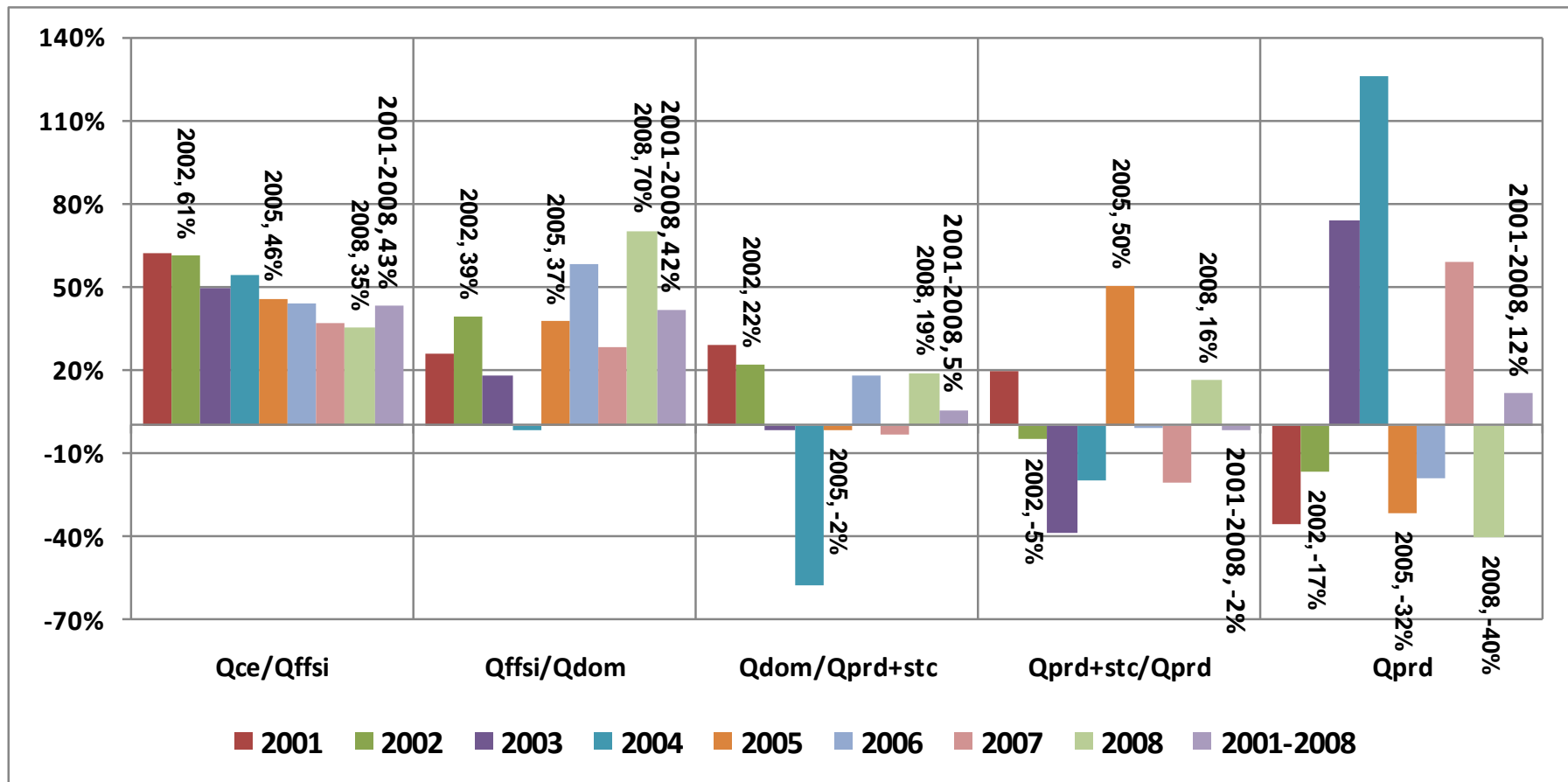
## Corn Production and Distribution Chain



## Land Use Chain



# Decomposition Results of Corn Use for Ethanol: Domestic Adjustments Account for Most Change



➤ Contribution across all years, 2001-2008

➤ Domestic Reallocation: 85%; Production: 12%;

Domestic Corn Use Share: 5%; Corn Stock Withdrawals: -2%;

# Conclusions: Decomposition analysis of empirical data does not support key ILUC assumptions

- The analysis of empirical data (2001-2008) indicates that:
  - Feedstock for ethanol expansion was mainly derived from domestic reallocations (85%) and increased yields (6%)
  - Empirical evidence does not support significant effects on:
    - US commodity exports
    - Other crops or cropland expansion in the U.S.
- Understanding the interactions of policy with baseline trends is crucial to improve estimates of policy effects on land use
  - Models calibrated to historic data could not adequately capture implications of large, new changes in the economy (such as the 78 million ton increase in corn use for ethanol)
  - Analysis of the data can illustrate how the economy actually adjusted to biofuel policy that increased demand (and supply) of corn for ethanol
    - More detailed analysis of policy effects on prices is needed
- The analysis suggests minimal to zero indirect land use change was induced by use of corn for ethanol over the last decade

# Recommendations

- Analysis of policy effects – considering intended and unintended costs and benefits (including actual land use and emissions) – needs to be updated frequently
  - Assess factors affecting progress toward meeting goals
  - Focus on manageable time horizons (4-6 years)
  - Consider regulatory options that reduce uncertainty and transaction costs, and facilitate evaluation of performance
- Apply the analysis of recent empirical evidence to adapt regulations to better fulfill goals for an effective, efficient, performance-based, LCFS
- Research is needed to clarify interactions among policy, shifting production, domestic and global markets. For example, to:
  - Better reflect trends and production capacities in baselines
  - Distinguish how current economy responded to “advance notice” (versus an imposed “demand shock” on prior economy)
  - Assess how an expanding production base interacts with cyclic markets, volatility and risks to disruption (from weather, policy)
  - Refine policy to provide incentives for improved efficiency, competitiveness and more sustainable land management practices
- The CARB ILUC approach needs to incorporate ongoing gains in knowledge and experience

# References and Data Sources

1. Albrecht J. D. Francois and K. Schoors (2002) "A Shapley decomposition of carbon emissions without residuals", Energy Policy 30:727-736
2. Ang B.W. (2004) "Decomposition analysis for policymaking in energy: which is the preferred method", Energy Policy 32:1131-1139
3. Ang B.W. (2005) "The LMDI approach to decomposition analysis: a practical guide", Energy Policy 33:867-871
4. Ang B.W. and F.Q. Zhang (2000) "A survey of index decomposition analysis in energy and environmental studies", Energy 25:1149-1176
5. Ang B.W. and N. Liu (2007) "Handling zeros values in the logarithmic mean Divisia index decomposition approach", Energy Policy 35:238-246
6. Ang B.W., F.L. Liu and H. Chung (2004) "A generalized Fisher index approach to energy decomposition analysis", Energy Economics 26:757-763
7. Ang B.W., H.C. Huang and A.R. Wu (In Press) "Properties and linkages of some index decomposition analysis methods", Energy Policy
8. BRDI 2008. Biomass Research and Development Initiative (BRDI). 2008. Increasing feedstock production for biofuels: economic drivers, environmental implications, and the role of research. Washington, DC. 146 p.
9. Bremer V.R., A.J. Liska, T.J. Klopfenstein, G.E. Erickson, H.S. Yang, D.T. Walters and K.G. Cassman (2010) "Emission Savings in the Corn-Ethanol Life Cycle from Feeding Coproducts to Livestock", Technical Reports: Ecological Risk Assessment, Journal of Environmental Quality 39:1-11
10. CARD - Center for Agricultural and Rural Development (2010) "FAPRI - Food and Agricultural Research Institute - Model", <http://www.fapri.iastate.edu/>
11. CGTA - Center for Global Trade Analysis (2010) "GTAP - The Global Trade and Analysis Project", <https://www.gtap.agecon.purdue.edu/default.asp>
12. Chunbo M. and D.I. Stern (2008) "China's changing energy intensity trend: A decomposition analysis", Energy Economics 30:1037-1053
13. CRS - Congressional Research Service (2008) "Fuel Ethanol: Background and Public Policy Issues", CRS Report for Congress. Order Code RL33290
14. de Boer P. (2009) "Generalized Fisher index or Siegel-Shapley decomposition?", Energy Economics 31(5): 810-814
15. EIA - United States Energy Information Administration (2003) "Status and Impact of State MTBE Bans", <http://www.eia.doe.gov/oiaf/servicerpt/mtbeban/>
16. FAO - Food and Agricultural Organization (2010) "FAOSTAT - Food and Agricultural Commodities Production", <http://faostat.fao.org/site/339/default.aspx>
17. Lenzen M. (2006) "Decomposition analysis and the mean-rate-of-change index", Applied Energy 83:185-198
18. Ma C. and D.I. Stern (2008) "China's changing energy intensity trend: A decomposition analysis", Energy Economics 30:1037-1053
19. Muller, M. T. Yelden and H. Schoonover (2008) "Food versus Fuel in the United States: Can Both Win in the Era of Ethanol", Institute for Agriculture And Trade Policy. <http://www.iatp.org/iatp/publications.cfm?accountID=258&refID=100001>
20. RFA - Renewable Fuels Association (2010) "The Industry - Statistics", <http://www.ethanolrfa.org/industry/statistics/>
21. Searchinger T., R. Heimlich, R. A. Houghton, F. Dong, A. Elobeid, J. Fabiosa, S. Tokgoz, D. Hayes, and T. Yu (2008) "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change", Science 319 (5867):1238 - 1240
22. U.S. Department of Agriculture. 2009. Summary Report: 2007 National Resources Inventory, Natural Resources Conservation Service, Washington, DC, and Center for Survey Statistics and Methodology, Iowa State University, Ames, Iowa. 123 pages.
23. United States Department of Agriculture - USDA (2010) " Production, Supply and Distribution Online", <http://www.fas.usda.gov/psdonline/>
24. United States Department of Agriculture - USDA (2010a) " Feed Grains Database", <http://www.ers.usda.gov/Data/FeedGrains/>
25. Wood R. (2009) "Structural decomposition analysis Australia's greenhouse gas emissions", Energy Policy 37(1):4943-4948