**Comments on Paper by S.T. Berry, “Biofuels policy and the Empirical inputs to GTAP Models.”**

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Calculations of indirect land use changes for low carbon fuel standards have been conducted not only assuming the usual 0.25 price-yield elasticity parameter used by GTAP, but also a sensibility analysis has been conducted assuming 0.10 and 0.05 price-yield elasticities. These lower elasticity estimates are based on Berry’s (2011) conclusions pointing at lower crop yield responsiveness to prices. Although Berry (2011) critical review has some valid points regarding pitfalls of existing studies, a comprehensive analysis and computation of the price-yield elasticity parameter with pertinent theoretical producer behavior assumptions, appropriate econometric techniques, and updated information regarding current economic conditions has not been performed.

Berry’s (2011) review has some valid points regarding the appropriateness of the parameter value. For instance, a review of the literature supporting the 0.25 elasticity suggests that base studies use outdated data, ranging from 1951 through 1988. Another critical point is that most of these studies use ordinary least square (OLS) techniques to estimate yields as a function of prices, and ignore price endogeneity, resulting in potentially biased parameter estimates. However, Berry’s (2011) conclusion suggesting a lower responsiveness of crop yields to prices do not provide a superior foundation for the price-yield elasticity parameter, and should not be considered final when making policy decisions shaping the future fuel/ethanol industry.

Berry (2011) favors two recent studies of yields providing evidence of a price-yield elasticity ranging from 0 to 0.15. Roberts and Schlenker (2010) model supply and demand for corn, soybeans, wheat and rice by aggregating four crops to their caloric equivalents. The authors estimate crop caloric equivalent supply as a function of a world-production-weighted index of caloric-equivalent prices and use past yield shocks as instrumental variables for this price index. The use of past yield shocks as instrumental variables is based on the “Theory of competitive storage,” and assumes that yield shocks are exogenous and are primarily driven by weather. Thus, Roberts and Schlenker (2010) model assumes away price-yield endogeneity, and heuristically support their assumption by noting that farm and county yields have almost no autocorrelation, while prices are highly autocorrelated. Further, they argue that if yields were endogenous to prices, they would be correlated across countries, when in reality they are not. In other words, their analysis does not measure price-yield responsiveness, but assumes it away.

Berry (2011) computes his own price-yield elasticity using one-year lagged crop prices as instrumental variables, and rather stringent assumptions to come up with a 0.05 parameter estimate. However, Berry’s (2011) use of lagged prices in the yield equation has been heavily criticized in the agricultural economics literature (see Gardner, 1976). It is argued, that futures price is a more accurate economic signal for producers and should better capture producer’s expectations when making production decisions. Importantly, most reviewed studies of agricultural yields use OLS or Instrumental Variables as the main econometric method for estimation, which assumes normality of the error term to provide the best linear unbiased parameter estimates. However, crop yields have been consistently found to follow a beta distribution, for being highly negatively skewed (See Nelson and Preckel, 1989).

Various theoretical economic models and empirical evidence support a significant responsiveness of crop yields to prices. For instance, Hayami and Rutan (1985) formalized and empirically verified their induced innovation theory that links the emergence of innovation with economic conditions. According to the induced innovation theory, food shortages or high prices of agricultural commodities are likely to lead to the introduction of new high-yielding varieties.

The introduction of genetically modified (GM) crops since the mid 1990’s is a direct evidence of the induced innovation hypothesis. Ervin et al. (2010) provide a comprehensive assessment on the effects of GM crops on U.S. agriculture. The study finds that genetic-engineering technology has produced substantial net environmental and economic benefits to U.S. farmers. Further, the analysis points out significant yield gains brought about by genetic modification, especially under weather stress conditions. It is likely that a new farming environment counting with the genetic modification technique and a more responsive seed developing industry may provide farmers with greater farm management flexibility to influence corn yields in response to higher prices.

The Berry (2011) study has major theoretical limitations. Friedman has argued that one must impose logically valid models on statistical models. To validate, the model that forecasts “best” is the one to use. See Swamy, Conway, and Von ZurMuehler (1985). Berry (2011) is looking at the wrong time sequence. His paper looks at annual yield effects and finds the price yield effect to be small. However, one wants longer term elasticities to allow full adjustment by the agricultural sector. In one year, there is not much the farmer can change, assuming the farmer is already optimizing inputs. Berry (2011) is mis-specified because the GTAP model should be looking at mid-term effects. Farmers over time may look at investment in drain tile, new equipment, better seeds (purchased in the fall season before planting, etc). What should be looked at is induced technological yield change.

In summary, though there is a consensus that existing literature supporting price-yield elasticity parameter currently used for GTAP runs is based on outdated data and inappropriate econometric techniques, no comprehensive estimation of this parameter has been undertaken taking current economic and farmer behavioral conditions into account. Berry (2011) explicitly mis-specifies his analysis by looking at the wrong behavioral time period. The correct analysis should also use appropriate time series data and econometric methods out of sample analyses and stochastic coefficients should be employed. Given the importance of the price-yield elasticity parameter for the future fuel/ethanol industry, it is recommended that CARB relies on objective, updated, and peer-reviewed studies of yield-price responsiveness for future sensitivity analysis and policy decisions making.

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