

Appendix B: Differences in Estimated Surplus Changes for Herbicide-Tolerant Soybeans Due to Different Analytical Frameworks

This section attempts to reconcile differences in the estimates of surplus changes resulting from two separate analytical frameworks. This study relies on an approach used by Falck-Zepeda et al. (2000a) to estimate the size and distribution of benefits resulting from the adoption of biotech crops. Two key characteristics of their framework are (1) linear supply and demand functions, and (2) parallel shifts in supply. In contrast, the model developed by Moschini et al. allows for a nonlinear specification of the supply and demand curves and nonparallel shifts in supply. These two approaches are chosen for reconciliation here since both address the size and distribution of benefits resulting from the adoption of herbicide-tolerant soybeans. While herbicide-tolerant soybeans are highlighted in this example, the general conclusions would likely be applicable to other commodities.

Differences in the findings arising from these two approaches may be attributed to several factors, including key features of the frameworks, supply and demand elasticity assumptions, and the farm-level effects. To assess the effect of these two frameworks on estimated surplus changes, differences in other factors must be controlled. To do this, assumptions concerning supply and demand elasticities and farm-level effects were equalized across the two frameworks. That is, the assumptions made by Falck-Zepeda et al. (2000a) were replaced by those in the Moschini et al. study.

To reconcile these two different approaches, the following key parameters in this study's framework were altered:

- (a) Elasticities of supply were changed to 0.8 for both the United States and ROW. Because Moschini et al. specify a three-market model, South America and the ROW were combined into one ROW region to conform with the two-market model in Falck-Zepeda et al. (2000a). The 0.8 supply elasticity for the combined ROW region is an average of the elasticities for the ROW (0.6) and South America (1.0) in Moschini et al.
- (b) Herbicide cost savings was changed to \$20 per hectare.
- (c) Yield advantage was eliminated.

- (d) Soybean demand elasticity was lowered to -0.4 .
- (e) Per-hectare seed cost was changed to \$45 for the United States and \$40 for the ROW.
- (f) Herbicide-tolerant seed costs were adjusted to be 43 percent and 22 percent higher than that for conventional seed in the United States and the ROW, respectively, to reflect the technology fees paid by adopters.

Altering the supply and demand elasticity assumptions and farm-level effects to conform with those used in Moschini et al. leads to similar changes in the estimated stakeholder welfare, except for ROW producer surplus (appendix table B-1). Using the Falck-Zepeda et al. (2000a) framework, U.S. producers captured nearly 20 percent of the estimated surplus gain created by the adoption of the herbicide-tolerant soybeans. In both cases, innovators' profits account for approximately half of the estimated total world benefit. However, in the case of ROW farmers, the re-estimation of the model renders an estimated welfare loss of about \$112 million—significantly higher than the estimated \$31-million loss based on the Moschini et al. framework. Although equalizing many of the assumptions largely reconciles the differences between the two approaches, specification of the model structure appears to account for the remaining discrepancies between the two sets of results.

Appendix table B-1—Comparison of analytical frameworks for herbicide-tolerant soybeans

Stakeholder	Surplus gain in this study ¹		Surplus gain from Moschini et al. ²	
	\$ million	% of total	\$ million	% of total
U.S. producers	135.2	19	156.0	19
U.S. consumers	93.0	13	81.0	10
Innovators	368.8	51	358.0	45
ROW producers	-112.1		-31.0	
ROW consumers	227.7		237.0	
Net ROW	115.7	16	206.0	26
World benefit	702.7		804.0	

¹ Incorporates the assumptions described above in this appendix so as to reflect those made by Moschini et al. However, the framework is the same as the one used in this study to generate estimated surplus gains for the various stakeholders.

² Reported in Moschini et al., who use a different framework from the one used in this study.