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**AJAE Appendix for**  
***“Removing Distortions in the U.S. Ethanol Market: What Does It Imply for  
the United States and Brazil?”***

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## **Appendix A: Overview of U.S. and Brazilian Ethanol Markets**

In the U.S., ethanol is produced primarily from corn using either a wet-milling or a dry-milling process. Wet mills produce ethanol and the by-products corn gluten meal, corn gluten feed, corn oil, and CO<sub>2</sub>. Dry mills, which are the predominant mill-type, produce ethanol with dried distillers grains (DDG) and solubles and CO<sub>2</sub> as by-products (Coltrain 2001; Tiffany 2002). The recent boost in ethanol demand is largely the result of several states banning the use of a gasoline additive called MTBE, as it is suspected of contaminating drinking water. Another boost to ethanol demand comes from the U.S. Energy Bill of 2005. The recent increase in crude oil and gasoline prices has also opened a new market for ethanol as a fuel extender (Eidman 2006).

There are numerous state and federal legislations that affect the U.S. ethanol market. One of the earliest is the Energy Tax Act of 1978, which introduced the motor fuel excise tax exemption that gives ethanol blends of at least 10% by volume a 40¢ per gallon exemption on the federal motor fuels tax. Since then, various tax laws have been adopted to change the level of tax credit, which currently stands at 51¢ per gallon through 2010. The Energy Policy Act of 1992 extended the fuel tax exemption to two additional blend rates containing less than 10% ethanol; i.e., 5.7% and 7.7%. It also created a number of alternative-fueled vehicle requirements for government and state motor fleets to encourage biofuel use. The Clean Air Act Amendments of 1990 established the Oxygenated Fuels Program and the Reformulated Gasoline Program, which in turn increased ethanol demand as an additive. The Energy Policy Act of 2005 introduced RFS, which requires U.S. fuel production to include a minimum amount of renewable fuel each

year, starting at 4 billion gallons in 2006 and reaching 7.5 billion gallons in 2012. After 2012, renewable fuel production must grow by at least the same rate as gasoline production. The Energy Policy Act also eliminated the oxygenate requirement for reformulated gasoline (Duffield and Collins 2006; Yacobucci 2006a).

The U.S. trade policy on ethanol includes an ad valorem tariff of 2.5% in addition to a per unit tariff of 54¢ per gallon. One of the objectives of the tariff is to ensure that the benefits of the domestic U.S. ethanol tax credit do not accrue to foreign producers. The other important trade policy that affects ethanol imports is the Caribbean Basin Economic Recovery Act (CBERA) that groups Central American countries with Caribbean countries. This Act created the current import rules for ethanol under the Caribbean Basin Initiative (CBI). Under this agreement, if ethanol is produced from at least 50% agricultural feedstock grown in a CBERA country, it is admitted into the U.S. free of duty. If the local feedstock content is lower, limitations apply on the quantity of duty-free ethanol. The amount of ethanol that can be imported duty-free that is produced from non-CBERA agricultural feedstock is restricted to 60 million gallons or 7% of the U.S. domestic ethanol market, whichever is greater. To comply with this requirement, hydrous ethanol is imported to a CBI country and is dehydrated before it can be exported to the U.S. Dehydration plants are currently operating in CBI countries such as Jamaica, Costa Rica, and El Salvador, where hydrous ethanol produced in other countries, historically Brazil and Europe, can be dehydrated before it is exported to the U.S. (Yacobucci 2006b).

In 2005, U.S. ethanol production capacity was 4.3 billion gallons from 95 ethanol

refineries. Capacity expansion totaled 0.2 billion gallons, while capacity under construction was 1.8 billion gallons. Ethanol production consumed 1.4 billion bushels of corn (about 12.6% of U.S. corn production) in 2005. According to this study's baseline projections, 3.3 billion bushels of corn are expected to be utilized by 2015 (about 24.9% of a 13 billion bushel crop). Thus, ethanol production has already exceeded the 2006 target of the renewable fuels mandate. Despite the rapid increase in production, consumption of ethanol has been outpacing production for the past few years, which has led to increased imports into the U.S.

Brazil is currently the world's largest producer of ethanol, deriving its supply from sugarcane. Brazil is one of the first countries to promote ethanol widely through its National Alcohol Program, which was launched in late 1975 in response to high oil prices and declining sugar prices (Bolling and Suarez 2001). The program was intended to reduce Brazil's dependence on foreign oil and to find alternative markets for Brazilian sugar. The government implemented mandates on the blending ratio of ethanol with all gasoline sold in Brazil. It also promoted the production of ethanol by offering credit guarantees and low-interest loans for construction of new plants and by setting ethanol prices at favorable levels relative to gasoline. This resulted in a dramatic increase in ethanol production by the end of the 1970s. The ethanol sector was further boosted by the introduction in 1979 of ethanol cars that ran on hydrous ethanol. The government also provided incentives to citizens to drive ethanol cars.

The Brazilian ethanol program flourished during the early 1980s. By the mid-1980s, however, world oil prices fell and Brazil faced severe economic difficulties.

Support for the ethanol program was drastically cut and ethanol production began to decline. By the late 1980s, sugar prices began to recover and sugar became more profitable. As a result of the decline in ethanol production, along with the significant number of ethanol cars in use, Brazil experienced a serious shortage of ethanol in 1990 and the country was compelled to import ethanol to meet demand. Consumers lost confidence in ethanol and the sale of ethanol cars declined significantly. The setting of ethanol prices was eliminated and the industry was deregulated by 1999 (Brilhante 1997; Moreira and Goldemberg 1999).

The Brazilian government currently provides support to ethanol production through both market regulations and tax incentives. In terms of market regulations, a blending ratio of anhydrous ethanol with gasoline of between 20 and 25% in transport fuel is imposed. There are also credit provisions for ethanol storage, in the form of a lower excise tax for ethanol than for gasoline and through the use of strategic reserves. Imports of ethanol to Brazil are subject to an ad valorem duty of 20%. Ethanol in Brazil is produced from low-cost sugarcane and therefore can compete with gasoline on a production-cost basis without any subsidies.

Recently, increased demand for ethanol in Brazil has been driven by the popularity of flex-fuel cars that can run on gasoline, ethanol, or a combination of the two. Flex-fuel vehicles and ethanol vehicles, which run only on hydrous ethanol, both enjoy some tax incentives not offered to gasohol cars that run only on gasoline blended with ethanol at the mandate set by legislation. The sale of flex-fuel cars has increased dramatically (by 585% in 2004) since their introduction in 2003. The share of flex-fuel

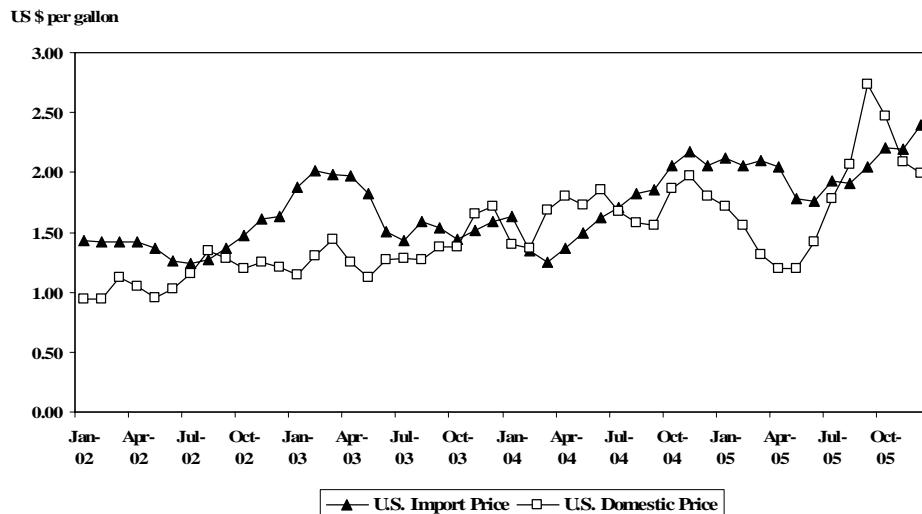
cars in vehicle fleet reached 22% in 2004, 40% in 2005, and is expected to rise to 60% in 2006. Flex-fuel vehicles are expected to be the predominant vehicle type in Brazil while ethanol vehicles are expected to diminish to insignificant numbers within the next decade (F.O. Lichts 2006b).

In Brazil, a large number of plants are dual plants producing both sugar and ethanol, and they can switch easily between the production of sugar and ethanol based on relative prices. Thus, sugar and ethanol prices have tended to move closely together, whereas in the U.S., movement in ethanol prices is affected primarily by the gasoline market and by government regulations. In the past few years, the relative price of sugar and ethanol has favored more sugarcane diverted to ethanol production rather than to sugar production. With the increased demand in ethanol both domestically and internationally, the share of sugarcane used in ethanol production is expected to rise steadily.

In 2005, production of sugar and ethanol in Brazil totaled 28.2 million metric tons and 4.8 billion gallons, respectively, continuing a record trend for the past few years. The record production has resulted in the export of 18 million metric tons of sugar and 0.6 billion gallons of ethanol in 2005. Baseline projections show that ethanol production in Brazil is expected to increase by 48.5% while ethanol exports are expected to nearly double by 2015. If both sugar and ethanol prices remain competitive in the near future, Brazil is expected to continue to increase sugarcane production for both sugar and ethanol. The country has enough land to significantly increase sugarcane area harvested.

### *Competitiveness of U.S. versus Brazilian Ethanol Sectors*

The cost of ethanol per gallon of fuel from sugarcane in Brazil is lower than the cost from corn in the U.S.(von Lampe 2006). In addition to the higher cost of production, there are additional costs in the U.S. associated with transporting ethanol from the production locations to the coastal regions. This has led to an increase in the competitiveness of Brazilian ethanol imports despite the steep tariffs in the U.S. Furthermore, volatility in U.S. domestic ethanol prices, which sometimes leads to spikes, provides Brazil with the opportunity to export ethanol to the U.S. For example, in October 2005, the U.S. domestic ethanol price was above the world ethanol price plus the tariff and the transportation cost. Consequently, Brazil was able to export 5.2 million gallons of ethanol to the U.S. up from zero exports in August and 2.7 million gallons in September 2005 (Renewable Fuels Association 2006). Figure 1 shows the domestic ethanol price in the U.S. versus the U.S. import price.



**Figure 1: U.S. domestic versus imported ethanol price**

## Appendix B: Scenario Analyses

**Table B.1: Removal of U.S. Trade Barriers on U.S and Brazilian Ethanol Markets**

|  | 2005   | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015                      |
|--|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------------------------|
| <b>World</b>   |        |         |         |         |         |         |         |         |         |         | (U.S. Dollars per Gallon) |
| <b>Anhydrous ethanol price</b>                       |        |         |         |         |         |         |         |         |         |         |                           |
| Baseline   | 1.29   | 1.34    | 1.24    | 1.21    | 1.19    | 1.22    | 1.25    | 1.28    | 1.30    | 1.32    | 1.35                      |
| Scenario 1   | 1.29   | 1.69    | 1.57    | 1.52    | 1.49    | 1.51    | 1.54    | 1.57    | 1.59    | 1.61    | 1.63                      |
| Percentage Change                                    | 0.00%  | 26.54%  | 26.43%  | 25.49%  | 25.19%  | 24.28%  | 23.48%  | 22.86%  | 22.41%  | 21.96%  | 20.30%                    |
| <b>Net Exports</b>                                   |        |         |         |         |         |         |         |         |         |         | (Million Gallons)         |
| Baseline   | 645.11 | 795.71  | 1006.10 | 1059.49 | 1101.50 | 1174.01 | 1229.27 | 1267.01 | 1286.57 | 1295.64 | 1299.49                   |
| Scenario 1   | 645.11 | 1313.45 | 1662.02 | 1769.31 | 1840.46 | 1931.26 | 1999.23 | 2047.61 | 2078.07 | 2098.55 | 2086.33                   |
| Percentage Change                                    | 0.00%  | 65.07%  | 65.20%  | 67.00%  | 67.09%  | 64.50%  | 62.64%  | 61.61%  | 61.52%  | 61.97%  | 60.55%                    |
| <b>Raw Sugar Price</b>                               |        |         |         |         |         |         |         |         |         |         | (U.S. Cents per Pound)    |
| Baseline   | 12.20  | 13.94   | 13.43   | 13.70   | 13.85   | 14.02   | 14.31   | 14.60   | 14.89   | 15.18   | 15.49                     |
| Scenario 1   | 12.20  | 14.47   | 13.69   | 13.87   | 14.02   | 14.20   | 14.51   | 14.83   | 15.14   | 15.45   | 15.75                     |
| Percentage Change                                    | 0.00%  | 3.83%   | 1.94%   | 1.24%   | 1.23%   | 1.33%   | 1.43%   | 1.56%   | 1.69%   | 1.82%   | 1.67%                     |
| <b>Crude Oil Price</b>                               |        |         |         |         |         |         |         |         |         |         | (U.S. Dollars per Gallon) |
| Baseline   | 1.17   | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46                      |
| Scenario 1   | 1.17   | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46                      |
| Percentage Change                                    | 0.00%  | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%                     |
| <b>United States Production</b>                      |        |         |         |         |         |         |         |         |         |         | (Million Gallons)         |
| Baseline   | 3886   | 4729    | 5196    | 5786    | 6396    | 6948    | 7479    | 7917    | 8333    | 8732    | 9123                      |
| Scenario 1   | 3886   | 4367    | 4751    | 5309    | 5898    | 6437    | 6956    | 7384    | 7789    | 8176    | 8571                      |
| Percentage Change                                    | 0.00%  | -7.67%  | -8.57%  | -8.24%  | -7.79%  | -7.36%  | -6.99%  | -6.73%  | -6.53%  | -6.37%  | -6.05%                    |
| <b>Consumption</b>                                   |        |         |         |         |         |         |         |         |         |         |                           |
| Baseline   | 4007   | 4950    | 5563    | 6168    | 6786    | 7381    | 7935    | 8375    | 8775    | 9147    | 9507                      |
| Scenario 1   | 4007   | 5155    | 5818    | 6441    | 7069    | 7669    | 8223    | 8663    | 9061    | 9432    | 9777                      |
| Percentage Change                                    | 0.00%  | 4.14%   | 4.57%   | 4.43%   | 4.17%   | 3.90%   | 3.63%   | 3.43%   | 3.26%   | 3.11%   | 2.84%                     |
| <b>Net Imports</b>                                   |        |         |         |         |         |         |         |         |         |         |                           |
| Baseline   | 127    | 217     | 370     | 385     | 393     | 434     | 456     | 459     | 443     | 417     | 386                       |
| Scenario 1   | 127    | 791     | 1073    | 1136    | 1175    | 1233    | 1267    | 1279    | 1273    | 1256    | 1207                      |
| Percentage Change                                    | 0.00%  | 264.84% | 189.77% | 194.98% | 198.87% | 184.35% | 177.66% | 178.59% | 187.25% | 201.55% | 212.55%                   |
| <b>Gasoline Consumption</b>                          |        |         |         |         |         |         |         |         |         |         |                           |
| Baseline   | 139894 | 140974  | 143476  | 146739  | 149905  | 152843  | 154767  | 156718  | 158738  | 160850  | 162955                    |
| Scenario 1   | 139894 | 141111  | 143642  | 146913  | 150081  | 153019  | 154941  | 156889  | 158906  | 161015  | 163110                    |
| Percentage Change                                    | 0.00%  | 0.10%   | 0.12%   | 0.12%   | 0.12%   | 0.12%   | 0.11%   | 0.11%   | 0.11%   | 0.10%   | 0.09%                     |
| <b>Share of Fuel Ethanol in Gasoline Consumption</b> |        |         |         |         |         |         |         |         |         |         | (Ratio)                   |
| Baseline   | 0.03   | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06                      |
| Scenario 1   | 0.03   | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    | 0.06                      |
| Percentage Change                                    | 0.00%  | 4.24%   | 4.63%   | 4.46%   | 4.18%   | 3.89%   | 3.60%   | 3.39%   | 3.22%   | 3.06%   | 2.79%                     |
| <b>Domestic Ethanol Price</b>                        |        |         |         |         |         |         |         |         |         |         | (U.S. Dollars per Gallon) |
| Baseline   | 1.80   | 2.00    | 1.92    | 1.89    | 1.87    | 1.90    | 1.93    | 1.96    | 1.98    | 2.01    | 2.01                      |
| Scenario 1   | 1.80   | 1.80    | 1.68    | 1.63    | 1.60    | 1.62    | 1.65    | 1.68    | 1.70    | 1.72    | 1.74                      |
| Percentage Change                                    | 0.00%  | -9.84%  | -12.70% | -13.79% | -14.45% | -14.50% | -14.38% | -14.28% | -14.19% | -14.08% | -13.51%                   |
| <b>Corn Farm Price</b>                               |        |         |         |         |         |         |         |         |         |         | (U.S. Dollars per Bushel) |
| Baseline   | 1.86   | 2.05    | 2.15    | 2.27    | 2.36    | 2.41    | 2.46    | 2.49    | 2.51    | 2.54    | 2.56                      |
| Scenario 1   | 1.86   | 2.02    | 2.11    | 2.22    | 2.32    | 2.38    | 2.43    | 2.45    | 2.48    | 2.50    | 2.53                      |
| Percentage Change                                    | 0.00%  | -1.53%  | -1.94%  | -1.92%  | -1.63%  | -1.52%  | -1.33%  | -1.36%  | -1.36%  | -1.39%  | -1.34%                    |
| <b>DDG Price</b>                                     |        |         |         |         |         |         |         |         |         |         | (U.S. Dollars per Ton)    |
| Baseline   | 77.66  | 76.59   | 78.98   | 79.74   | 79.75   | 79.70   | 79.64   | 78.98   | 78.18   | 77.10   | 75.99                     |
| Scenario 1   | 77.66  | 77.17   | 79.55   | 80.27   | 80.25   | 80.24   | 80.18   | 79.52   | 78.70   | 77.60   | 76.47                     |
| Percentage Change                                    | 0.00%  | 0.76%   | 0.72%   | 0.66%   | 0.63%   | 0.68%   | 0.67%   | 0.68%   | 0.66%   | 0.66%   | 0.64%                     |
| <b>Gluten Feed Price</b>                             |        |         |         |         |         |         |         |         |         |         |                           |
| Baseline   | 50.68  | 52.97   | 55.63   | 57.64   | 58.97   | 59.90   | 60.60   | 60.69   | 60.73   | 60.52   | 60.31                     |
| Scenario 1   | 50.68  | 52.75   | 55.26   | 57.24   | 58.62   | 59.60   | 60.35   | 60.44   | 60.47   | 60.26   | 60.05                     |
| Percentage Change                                    | 0.00%  | -0.43%  | -0.66%  | -0.69%  | -0.59%  | -0.50%  | -0.41%  | -0.41%  | -0.43%  | -0.44%  | -0.43%                    |
| <b>Gluten Meal Price</b>                             |        |         |         |         |         |         |         |         |         |         |                           |
| Baseline   | 278.20 | 259.78  | 266.70  | 266.95  | 265.16  | 264.64  | 263.72  | 261.19  | 257.51  | 252.94  | 248.07                    |
| Scenario 1   | 278.20 | 262.00  | 269.24  | 269.52  | 267.47  | 267.10  | 266.04  | 263.68  | 259.99  | 255.50  | 250.57                    |
| Percentage Change                                    | 0.00%  | 0.85%   | 0.95%   | 0.96%   | 0.87%   | 0.93%   | 0.88%   | 0.95%   | 0.96%   | 1.01%   | 1.01%                     |
| <b>Corn Oil Price</b>                                |        |         |         |         |         |         |         |         |         |         | (U.S. Cents per Pound)    |
| Baseline   | 25.46  | 24.25   | 25.62   | 26.56   | 27.07   | 27.53   | 28.07   | 28.56   | 29.01   | 29.51   | 30.07                     |
| Scenario 1   | 25.46  | 24.27   | 25.62   | 26.54   | 27.01   | 27.46   | 27.98   | 28.48   | 28.92   | 29.42   | 29.97                     |
| Percentage Change                                    | 0.00%  | 0.10%   | 0.00%   | -0.09%  | -0.25%  | -0.25%  | -0.33%  | -0.29%  | -0.32%  | -0.31%  | -0.32%                    |

**Table B.1: (continued)**

|   | 2005  | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Brazil</b>                                   |       |        |        |        |        |        |        |        |        |        |        |
| <b>Production</b>                               |       |        |        |        |        |        |        |        |        |        |        |
| (Million Gallons)                               |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4768  | 5087   | 5496   | 5700   | 5889   | 6092   | 6287   | 6479   | 6670   | 6867   | 7079   |
| Scenario 1                                      | 4768  | 5392   | 5964   | 6233   | 6460   | 6687   | 6898   | 7105   | 7310   | 7522   | 7728   |
| Percentage Change                               | 0.00% | 5.99%  | 8.53%  | 9.37%  | 9.69%  | 9.76%  | 9.73%  | 9.66%  | 9.60%  | 9.54%  | 9.18%  |
| <b>Total Consumption</b>                        |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4196  | 4326   | 4503   | 4643   | 4786   | 4918   | 5058   | 5212   | 5383   | 5571   | 5779   |
| Scenario 1                                      | 4196  | 4127   | 4319   | 4469   | 4618   | 4755   | 4899   | 5057   | 5232   | 5423   | 5642   |
| Percentage Change                               | 0.00% | -4.58% | -4.07% | -3.74% | -3.52% | -3.31% | -3.14% | -2.97% | -2.81% | -2.66% | -2.38% |
| <b>Anhydrous Ethanol Consumption</b>            |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 1398  | 1376   | 1394   | 1414   | 1439   | 1461   | 1464   | 1467   | 1470   | 1474   | 1478   |
| Scenario 1                                      | 1398  | 1335   | 1356   | 1379   | 1404   | 1427   | 1432   | 1435   | 1439   | 1443   | 1450   |
| Percentage Change                               | 0.00% | -2.94% | -2.69% | -2.51% | -2.39% | -2.28% | -2.22% | -2.16% | -2.10% | -2.06% | -1.90% |
| <b>Hydrous Ethanol Consumption</b>              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 2798  | 2950   | 3109   | 3229   | 3348   | 3458   | 3594   | 3745   | 3913   | 4098   | 4302   |
| Scenario 1                                      | 2798  | 2792   | 2963   | 3090   | 3214   | 3328   | 3468   | 3622   | 3793   | 3980   | 4192   |
| Percentage Change                               | 0.00% | -5.35% | -4.69% | -4.28% | -4.01% | -3.75% | -3.52% | -3.29% | -3.08% | -2.88% | -2.55% |
| <b>Net Exports</b>                              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 607   | 769    | 991    | 1056   | 1102   | 1174   | 1229   | 1267   | 1287   | 1296   | 1299   |
| Scenario 1                                      | 607   | 1283   | 1644   | 1763   | 1840   | 1931   | 1999   | 2048   | 2078   | 2099   | 2086   |
| Percentage Change                               | 0.00% | 66.89% | 65.87% | 66.98% | 67.09% | 64.50% | 62.64% | 61.61% | 61.52% | 61.97% | 60.55% |
| <b>Share of Sugarcane in Ethanol Production</b> |       |        |        |        |        |        |        |        |        |        |        |
| (Ratio)   |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 0.51  | 0.51   | 0.52   | 0.52   | 0.53   | 0.53   | 0.54   | 0.54   | 0.55   | 0.55   | 0.56   |
| Scenario 1                                      | 0.51  | 0.53   | 0.55   | 0.55   | 0.55   | 0.56   | 0.56   | 0.57   | 0.57   | 0.58   | 0.58   |
| Percentage Change                               | 0.00% | 4.42%  | 4.89%  | 4.96%  | 5.02%  | 4.99%  | 4.96%  | 4.93%  | 4.92%  | 4.90%  | 4.67%  |

**Table B.2: Removal of U.S. Trade Barriers and Federal Tax Credit on U.S and Brazilian Ethanol Markets**

|  | 2005   | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    |
|--|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>World</b>   |        |         |         |         |         |         |         |         |         |         |         |
| <b>Anhydrous ethanol price</b>                       |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Gallon)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.29   | 1.34    | 1.24    | 1.21    | 1.19    | 1.22    | 1.25    | 1.28    | 1.30    | 1.32    | 1.35    |
| Scenario 2   | 1.29   | 1.57    | 1.46    | 1.42    | 1.39    | 1.42    | 1.45    | 1.48    | 1.50    | 1.53    | 1.55    |
| Percentage Change                                    | 0.00%  | 17.92%  | 18.08%  | 17.40%  | 17.26%  | 16.70%  | 16.28%  | 15.95%  | 15.75%  | 15.56%  | 14.19%  |
| <b>Net Exports</b>                                   |        |         |         |         |         |         |         |         |         |         |         |
| (Million Gallons)                                    |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 645.11 | 795.71  | 1006.10 | 1059.49 | 1101.50 | 1174.01 | 1229.27 | 1267.01 | 1286.57 | 1295.64 | 1299.49 |
| Scenario 2   | 645.11 | 1146.25 | 1452.96 | 1542.19 | 1605.06 | 1691.69 | 1759.13 | 1807.59 | 1838.65 | 1860.05 | 1849.08 |
| Percentage Change                                    | 0.00%  | 44.05%  | 44.42%  | 45.56%  | 45.72%  | 44.10%  | 43.10%  | 42.67%  | 42.91%  | 43.56%  | 42.29%  |
| <b>Raw Sugar Price</b>                               |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Cents per Pound)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 12.20  | 13.94   | 13.43   | 13.70   | 13.85   | 14.02   | 14.31   | 14.60   | 14.89   | 15.18   | 15.49   |
| Scenario 2   | 12.20  | 14.30   | 13.60   | 13.81   | 13.97   | 14.14   | 14.45   | 14.76   | 15.06   | 15.37   | 15.66   |
| Percentage Change                                    | 0.00%  | 2.60%   | 1.33%   | 0.82%   | 0.82%   | 0.90%   | 1.00%   | 1.09%   | 1.19%   | 1.30%   | 1.12%   |
| <b>Crude Oil Price</b>                               |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Gallon)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.17   | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Scenario 2   | 1.17   | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Percentage Change                                    | 0.00%  | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   |
| <b>United States Production</b>                      |        |         |         |         |         |         |         |         |         |         |         |
| (Million Gallons)                                    |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 3886   | 4729    | 5196    | 5786    | 6396    | 6948    | 7479    | 7917    | 8333    | 8732    | 9123    |
| Scenario 2   | 3886   | 4154    | 4561    | 5128    | 5720    | 6261    | 6782    | 7212    | 7618    | 8006    | 8402    |
| Percentage Change                                    | 0.00%  | -12.16% | -12.22% | -11.36% | -10.56% | -9.88%  | -9.32%  | -8.91%  | -8.58%  | -8.31%  | -7.90%  |
| <b>Consumption</b>                                   |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 4007   | 4950    | 5563    | 6168    | 6786    | 7381    | 7935    | 8375    | 8775    | 9147    | 9507    |
| Scenario 2   | 4007   | 4753    | 5404    | 6020    | 6644    | 7241    | 7797    | 8239    | 8639    | 9012    | 9361    |
| Percentage Change                                    | 0.00%  | -3.98%  | -2.87%  | -2.40%  | -2.10%  | -1.89%  | -1.74%  | -1.63%  | -1.55%  | -1.48%  | -1.54%  |
| <b>Net Imports</b>                                   |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 127    | 217     | 370     | 385     | 393     | 434     | 456     | 459     | 443     | 417     | 386     |
| Scenario 2   | 127    | 605     | 849     | 896     | 926     | 980     | 1015    | 1027    | 1022    | 1007    | 959     |
| Percentage Change                                    | 0.00%  | 179.26% | 129.32% | 132.62% | 135.56% | 126.07% | 122.31% | 123.72% | 130.66% | 141.74% | 148.47% |
| <b>Gasoline Consumption</b>                          |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 139894 | 140974  | 143476  | 146739  | 149905  | 152843  | 154767  | 156718  | 158738  | 160850  | 162955  |
| Scenario 2   | 139894 | 140836  | 143365  | 146638  | 149810  | 152752  | 154679  | 156632  | 158653  | 160767  | 162867  |
| Percentage Change                                    | 0.00%  | -0.10%  | -0.08%  | -0.07%  | -0.06%  | -0.06%  | -0.06%  | -0.06%  | -0.05%  | -0.05%  | -0.05%  |
| <b>Share of Fuel Ethanol in Gasoline Consumption</b> |        |         |         |         |         |         |         |         |         |         |         |
| (Ratio)  |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 0.03   | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Scenario 2   | 0.03   | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Percentage Change                                    | 0.00%  | -4.28%  | -3.10%  | -2.57%  | -2.25%  | -2.02%  | -1.84%  | -1.72%  | -1.63%  | -1.55%  | -1.60%  |
| <b>Domestic Ethanol Price</b>                        |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Gallon)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.80   | 2.00    | 1.92    | 1.89    | 1.87    | 1.90    | 1.93    | 1.96    | 1.98    | 2.01    | 2.01    |
| Scenario 2   | 1.80   | 1.68    | 1.57    | 1.53    | 1.50    | 1.53    | 1.56    | 1.59    | 1.61    | 1.64    | 1.66    |
| Percentage Change                                    | 0.00%  | -15.61% | -18.08% | -18.98% | -19.50% | -19.36% | -19.04% | -18.79% | -18.55% | -18.29% | -17.62% |
| <b>Corn Farm Price</b>                               |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Bushel)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.86   | 2.05    | 2.15    | 2.27    | 2.36    | 2.41    | 2.46    | 2.49    | 2.51    | 2.54    | 2.56    |
| Scenario 2   | 1.86   | 2.00    | 2.09    | 2.21    | 2.30    | 2.36    | 2.42    | 2.44    | 2.47    | 2.49    | 2.52    |
| Percentage Change                                    | 0.00%  | -2.42%  | -2.78%  | -2.67%  | -2.22%  | -2.05%  | -1.77%  | -1.80%  | -1.79%  | -1.81%  | -1.75%  |
| <b>DDG Price</b>                                     |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Ton)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 77.66  | 76.59   | 78.98   | 79.74   | 79.75   | 79.70   | 79.64   | 78.98   | 78.18   | 77.10   | 75.99   |
| Scenario 2   | 77.66  | 77.54   | 79.81   | 80.48   | 80.44   | 80.44   | 80.36   | 79.70   | 78.87   | 77.77   | 76.63   |
| Percentage Change                                    | 0.00%  | 1.24%   | 1.05%   | 0.93%   | 0.86%   | 0.92%   | 0.90%   | 0.92%   | 0.88%   | 0.87%   | 0.84%   |
| <b>Gluten Feed Price</b>                             |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 50.68  | 52.97   | 55.63   | 57.64   | 58.97   | 59.90   | 60.60   | 60.69   | 60.73   | 60.52   | 60.31   |
| Scenario 2   | 50.68  | 52.62   | 55.10   | 57.08   | 58.50   | 59.49   | 60.26   | 60.36   | 60.39   | 60.18   | 59.96   |
| Percentage Change                                    | 0.00%  | -0.67%  | -0.95%  | -0.97%  | -0.80%  | -0.68%  | -0.55%  | -0.55%  | -0.56%  | -0.58%  | -0.57%  |
| <b>Gluten Meal Price</b>                             |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Cents per Pound)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 278.20 | 259.78  | 266.70  | 266.95  | 265.16  | 264.64  | 263.72  | 261.19  | 257.51  | 252.94  | 248.07  |
| Scenario 2   | 278.20 | 263.30  | 270.32  | 270.51  | 268.27  | 267.95  | 266.81  | 264.48  | 260.77  | 256.28  | 251.34  |
| Percentage Change                                    | 0.00%  | 1.35%   | 1.36%   | 1.33%   | 1.17%   | 1.25%   | 1.17%   | 1.26%   | 1.27%   | 1.32%   | 1.32%   |
| <b>Corn Oil Price</b>                                |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Cents per Pound)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 25.46  | 24.25   | 25.62   | 26.56   | 27.07   | 27.53   | 28.07   | 28.56   | 29.01   | 29.51   | 30.07   |
| Scenario 2   | 25.46  | 24.29   | 25.61   | 26.53   | 26.98   | 27.44   | 27.95   | 28.45   | 28.89   | 29.39   | 29.94   |
| Percentage Change                                    | 0.00%  | 0.16%   | -0.01%  | -0.12%  | -0.35%  | -0.33%  | -0.44%  | -0.39%  | -0.42%  | -0.41%  | -0.42%  |

**Table B.2: (continued)**

|   | 2005  | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Brazil</b>                                   |       |        |        |        |        |        |        |        |        |        |        |
| <b>Production</b>                               |       |        |        |        |        |        |        |        |        |        |        |
| (Million Gallons)                               |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4768  | 5087   | 5496   | 5700   | 5889   | 6092   | 6287   | 6479   | 6670   | 6867   | 7079   |
| Scenario 2                                      | 4768  | 5294   | 5814   | 6062   | 6277   | 6498   | 6707   | 6912   | 7116   | 7327   | 7532   |
| Percentage Change                               | 0.00% | 4.07%  | 5.80%  | 6.36%  | 6.59%  | 6.66%  | 6.68%  | 6.68%  | 6.68%  | 6.69%  | 6.41%  |
| <b>Total Consumption</b>                        |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4196  | 4326   | 4503   | 4643   | 4786   | 4918   | 5058   | 5212   | 5383   | 5571   | 5779   |
| Scenario 2                                      | 4196  | 4192   | 4377   | 4524   | 4671   | 4806   | 4948   | 5104   | 5277   | 5466   | 5683   |
| Percentage Change                               | 0.00% | -3.09% | -2.79% | -2.55% | -2.41% | -2.28% | -2.18% | -2.07% | -1.98% | -1.89% | -1.67% |
| <b>Anhydrous Ethanol Consumption</b>            |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 1398  | 1376   | 1394   | 1414   | 1439   | 1461   | 1464   | 1467   | 1470   | 1474   | 1478   |
| Scenario 2                                      | 1398  | 1349   | 1368   | 1390   | 1415   | 1438   | 1442   | 1445   | 1448   | 1452   | 1458   |
| Percentage Change                               | 0.00% | -1.99% | -1.84% | -1.71% | -1.64% | -1.57% | -1.54% | -1.51% | -1.48% | -1.46% | -1.33% |
| <b>Hydrous Ethanol Consumption</b>              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 2798  | 2950   | 3109   | 3229   | 3348   | 3458   | 3594   | 3745   | 3913   | 4098   | 4302   |
| Scenario 2                                      | 2798  | 2843   | 3009   | 3134   | 3256   | 3369   | 3506   | 3659   | 3829   | 4014   | 4225   |
| Percentage Change                               | 0.00% | -3.61% | -3.21% | -2.92% | -2.74% | -2.58% | -2.44% | -2.30% | -2.17% | -2.04% | -1.78% |
| <b>Net Exports</b>                              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 607   | 769    | 991    | 1056   | 1102   | 1174   | 1229   | 1267   | 1287   | 1296   | 1299   |
| Scenario 2                                      | 607   | 1117   | 1436   | 1537   | 1605   | 1692   | 1759   | 1808   | 1839   | 1860   | 1849   |
| Percentage Change                               | 0.00% | 45.29% | 44.87% | 45.55% | 45.72% | 44.10% | 43.10% | 42.67% | 42.91% | 43.56% | 42.29% |
| <b>Share of Sugarcane in Ethanol Production</b> |       |        |        |        |        |        |        |        |        |        |        |
| (Ratio)   |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 0.51  | 0.51   | 0.52   | 0.52   | 0.53   | 0.53   | 0.54   | 0.54   | 0.55   | 0.55   | 0.56   |
| Scenario 2                                      | 0.51  | 0.52   | 0.54   | 0.54   | 0.54   | 0.55   | 0.56   | 0.56   | 0.56   | 0.57   | 0.57   |
| Percentage Change                               | 0.00% | 3.02%  | 3.36%  | 3.41%  | 3.45%  | 3.45%  | 3.45%  | 3.46%  | 3.47%  | 3.49%  | 3.29%  |

## Appendix C: Model Elasticities

**Table C.1: International Ethanol Model Elasticities<sup>a</sup>**

|   | Model | Literature  |
|---|-------|---|
| <b>U.S. Ethanol Demand</b>                      |       |   |
| Share of Ethanol in Gasoline                    |       |   |
| Price of ethanol                                | -0.43 | -0.37 in Rask (1988)                                      |
| Price of gasoline                               | 0.19  | 5.05 and -2.13 in Rask (1988)                             |
| Mandate   |       |   |
| RFS   |       |   |
| Gasoline Consumption                            |       |   |
| Price of gasoline                               | -0.14 | -0.80 in Gallagher et al (2003)<br>-0.23 in Kayser (2000) |
|   |       | (-0.598,-0.026) in Nicol (2003)                           |
| Price of ethanol                                | -0.01 |   |
| Income  | 0.11  | 0.49 in Kayser (2000)<br>(0.285,0.941) in Nicol (2003)    |
|   |       | Population  |
|   | 0.10  |   |
| Ethanol Non-fuel Consumption                    |       |   |
| Price of Ethanol                                | -0.11 |   |
| <b>U.S. Ethanol Supply</b>                      |       |   |
| Production                                      |       |   |
| Profit margin                                   | 0.65  | 0.37 and 0.75 in Rask (1988)                              |
| Capacity  | 0.03  |   |
| Growth rate of capacity                         |       |   |
| Profit margin (t-1)                             | 1.39  |   |
| Expected demand                                 | 0.003 |   |
| <b>U.S. Ethanol Stocks</b>                      |       |   |
| Stocks (t-1)                                    | 0.24  |   |
| Price of ethanol                                | -0.23 |   |
| <b>U.S. Ethanol Trade</b>                       |       |   |
| Imports   |       |   |
| Ratio of domestic to world ethanol price        | 0.35  |   |
| <b>Brazil Ethanol Demand</b>                    |       |   |
| Anhydrous Ethanol Demand (mixed with gasoline)  |       |   |
| Price of ethanol                                | -0.10 |   |
| Price of gasoline                               | -0.17 |   |
| Interaction term                                | -0.01 |   |
| Income  | 0.13  |   |
| Population                                      | 0.13  |   |
| Hydrous Ethanol Demand (competes with gasoline) |       |   |
| Price of ethanol                                | -0.30 |   |
| Price of gasoline                               | 0.15  |   |
| Interaction term                                | 0.002 |   |
| Income  | 0.17  |   |
| Population                                      | 0.18  |   |
| <b>Brazil Ethanol Supply</b>                    |       |   |
| Share of sugarcane in ethanol                   |       |   |
| Ratio of ethanol to sugar price                 | 0.20  |   |
| <b>Brazil Ethanol Stocks</b>                    |       |   |
| Stocks (t-1)                                    | 0.10  |   |
| Price of ethanol                                | -0.40 |   |

<sup>a</sup> Elasticities are estimated at the sample average for 2000 through 2004.

Table C.1 compares elasticity estimates used in the international ethanol model with those found in the literature. For the U.S. ethanol market, elasticity estimates for supply of ethanol with respect to ethanol price, corn price, and by-product prices are provided in Rask (1988). In the international ethanol model, a net profit margin is used in the U.S. ethanol production equation, whereas Rask (1988) includes these variables separately. It is important to note that the elasticities provided by Rask (1988) and Gallagher et al. (2003) are estimated using a data series covering the period prior to the ethanol boom. Our elasticities are adjusted to accommodate the recent fundamental structural change that has occurred in the U.S. ethanol sector.

Literature on elasticity estimates for the Brazilian ethanol sector is limited. A study by Alves and Bueno (2003) which estimates gasoline demand elasticities for the Brazilian market is used as a guideline since ethanol is also a transportation fuel. In their study, elasticity of gasoline demand with respect to income is 0.122, elasticity of gasoline demand with respect to own price is -0.0919 in the short run and -0.4646 in the long run. Their short-run elasticity of gasoline demand with respect to the price of ethanol, the competing commodity, is 0.2297 while the long-run elasticity is 0.4803. The elasticities used in this model are within the range provided in Alves and Bueno (2003), although their estimates are for gasoline demand.

The international ethanol model has been used in a recent study titled “The Long-Run Impact of Corn-Based Ethanol on the Grain, Oilseed, and Livestock Sectors with Implications for Biotech Crops” by Elobeid, Tokgoz, Hayes, Babcock, and Hart (2007) and published in AgBioForum.

**Table C.2: U.S. Corn Model Elasticities<sup>a</sup>**

|                                    | <b>Model</b>    | <b>Literature (Stout &amp; Abler)</b> |
|------------------------------------|-----------------|---------------------------------------|
| <b>U.S. Corn Supply</b>            |                 |                                       |
| Regional Area Planted <sup>b</sup> |                 |                                       |
| Corn expected net returns          | (0.15,0.48)     | 0.29                                  |
| Soybean expected net returns       | (-0.15,-0.002)  | -0.20                                 |
| Wheat expected net returns         | (-0.09,-0.003)  | -0.04                                 |
| Sorghum expected net returns       | (-0.014,-0.001) | -0.01                                 |
| Barley expected net returns        | (-0.02,-0.001)  | -0.01                                 |
| Cotton expected net returns        | (-0.06,-0.002)  | -0.01                                 |
| Oats expected net returns          | (-0.00,-0.001)  | -0.01                                 |
| Rice expected net returns          | (-0.04,-0.001)  | -0.002                                |
| Sunflower expected net returns     | (-0.01,-0.001)  | 0.001                                 |
| Peanuts expected net returns       | (-0.02,-0.01)   | -0.001                                |
| <b>U.S. Corn Demand</b>            |                 |                                       |
| Feed demand per animal unit        |                 |                                       |
| Corn price/livestock price         | -0.20           | (-0.27,-0.06)                         |
| Soybean meal price/livestock price | 0.11            | (0.002,0.03)                          |
| Corn ending (free) stocks          |                 |                                       |
| Price of corn                      | -2.04           |                                       |
| Corn HFCS demand                   |                 |                                       |
| Price of corn                      | 0.18            | -0.06                                 |
| Corn demand for glucose & dextrose |                 |                                       |
| Price of corn/ price of raw sugar  | -0.07           | -0.06                                 |
| Corn demand for starch             |                 |                                       |
| Price of corn                      | -0.07           | -0.06                                 |
| Corn demand for beverage alcohol   |                 |                                       |
| Price of corn                      | -0.07           | -0.06                                 |
| Corn demand for cereals            |                 |                                       |
| Price of corn                      | -0.07           | -0.06                                 |
| <b>Corn export</b>                 |                 |                                       |
| Price of corn (t)                  | -1.61           |                                       |
| Price of corn (t-1)                | -1.19           |                                       |
| Price of corn (t-2)                | -0.10           |                                       |
| Price of corn (t-3)                | -0.02           |                                       |
| Price of wheat (t)                 | 0.23            |                                       |
| Price of wheat (t-1)               | 0.24            |                                       |
| Price of wheat (t-2)               | 0.04            |                                       |
| Price of wheat (t-3)               | 0.002           |                                       |
| Price of sorghum (t)               | 0.18            |                                       |
| Price of sorghum (t-1)             | 0.03            |                                       |
| Price of sorghum (t-2)             | 0.004           |                                       |
| Price of sorghum (t-3)             | 0.001           |                                       |
| Price of barley                    | 0.04            |                                       |
| Price of soybean meal (t)          | 0.03            |                                       |
| Price of soybean meal (t-1)        | 0.04            |                                       |
| Price of soybean meal (t-2)        | 0.01            |                                       |
| Price of soybean meal (t-3)        | 0.01            |                                       |

a Elasticities are estimated at the sample average for 2000 through 2004.

b U.S. corn area is divided into 9 regions and the elasticities presented in the above table refer to the range of elasticities used in this model. The regions are Corn Belt, Central Plains, Delta States, Far West, Lake States, Northeastern States, Northern Plains, Southeastern States, and Southern States.

Table C.2 presents the elasticities of the U.S. corn sub-model, which is a part of the U.S. crops model that includes other crops such as wheat, soybeans, sorghum, cotton and rice. The above elasticities for U.S. corn area are for expected net returns, which include the relevant policy variables in these equations. These elasticities also use information from a study by Adams, Westhoff, Willott, and Young (2001) that estimate the impact of production flexibility contract (PFC) and market loss assistance (MLA) payments on crop production in the U.S. The model elasticities in Table C.2 are compared to those provided by Stout and Abler (2004).

The U.S. crops model has been used in multiple studies including Westhoff, Brown, and Hart (2006), Kruse, Westhoff, Meyer, and Thompson (2007), and Fabiosa et al. (2005). A more detailed description of the U.S. crops model can be found in the report titled “Documentation of the FAPRI Modeling System” (FAPRI 2004).

**Table C.3: Sugar Model Elasticities<sup>a</sup>**

| Supply (Own Price Elasticity) | Model                             | OECD (SR) | OECD (MR) | OECD (LR) | Tyers & Anderson (SR) | Tyers & Anderson (LR) | Devadoss & Kropf        | Wohlgrenant       | Stout & Abler |
|-------------------------------|-----------------------------------|-----------|-----------|-----------|-----------------------|-----------------------|-------------------------|-------------------|---------------|
| Algeria                       |                                   |           |           |           | 0.10 <sup>b</sup>     | 0.20 <sup>b</sup>     | 0.02 <sup>b</sup>       |                   |               |
| Argentina                     | 0.08                              | 0.02      | 0.28      | 0.38      | 0.39                  | 0.69                  | 0.02 <sup>b</sup>       | 0.10              | 0.28          |
| Australia                     | 0.13                              | 0.50      | 0.53      | 0.55      | 0.10                  | 0.50                  | 0.07                    | 0.06              | 0.38          |
| Brazil                        | 0.19                              | 0.15      | 0.34      | 0.41      | 0.40                  | 0.80                  | 0.09                    | 0.09              | 0.47          |
| Canada                        | 0.17 <sup>c</sup>                 | 0.18      | 0.42      | 0.43      | 0.10                  | 0.50                  | 0.14                    | 0.07              | 0.40          |
| China                         | 0.10, 0.14 <sup>c</sup>           | 0.02      | 0.01      | 0.01      | 0.15                  |                       | 0.14 <sup>b</sup>       | 0.31              | 0.12          |
| Colombia                      | 0.10                              |           |           |           | 0.40 <sup>b</sup>     | 0.59 <sup>b</sup>     | 0.02 <sup>b</sup>       | 0.25 <sup>b</sup> |               |
| Cuba                          | 0.09                              | 0.18      | 0.30      | 0.46      | 0.13                  | 0.68                  |                         | 0.10              |               |
| Egypt                         | 0.10, 0.08 <sup>c</sup>           |           |           |           | 0.10                  | 0.32                  | 0.02 <sup>b</sup>       | 0.53              |               |
| European Union-15             | 0.31, 0.60 <sup>c</sup>           | 0.06      | 0.21      | 0.20      | 0.10                  | 0.50                  | 0.22 <sup>d</sup>       | 0.22              | 0.24          |
| EU NMS                        | 0.60 <sup>c</sup>                 |           |           |           | 0.05 <sup>b</sup>     | 0.08 <sup>b</sup>     | 0.03 <sup>b</sup>       | 0.03 <sup>b</sup> |               |
| Guatemala                     | 0.10                              |           |           |           | 0.40 <sup>b</sup>     | 0.59 <sup>b</sup>     | 0.01 <sup>b</sup>       | 0.10              |               |
| India                         | 0.21                              | 0.22      | 2.60      | 3.60      | 0.12                  | 0.46                  | 0.98                    | 0.08              |               |
| Indonesia                     | 0.09                              | 0.28      | 0.33      | 0.42      | 0.30                  | 0.59                  | 0.32                    | 0.48              |               |
| Iran                          | 0.06                              |           |           |           | 0.10 <sup>b</sup>     | 0.20 <sup>b</sup>     |                         |                   |               |
| Japan                         | 0.18, 0.22 <sup>c</sup>           | 0.38      | 0.67      | 1.50      | 0.10                  | 0.50                  | 0.34                    | 0.32              | 0.35          |
| Malaysia                      | 0.09                              |           |           |           | 0.10 <sup>b</sup>     | 0.20 <sup>b</sup>     | 0.14 <sup>b</sup>       | 0.58              |               |
| Mexico                        | 0.20                              | 0.25      | 0.59      | 0.72      | 0.15                  | 0.45                  | 0.89                    | 0.89              | 0.13          |
| Morocco                       | 0.11, 0.13 <sup>c</sup>           |           |           |           | 0.10 <sup>b</sup>     | 0.20 <sup>b</sup>     | 0.20 <sup>b</sup>       | 0.20 <sup>b</sup> |               |
| Pakistan                      | 0.08, 0.05 <sup>c</sup>           |           |           |           | 0.10                  | 0.13                  | 0.14 <sup>b</sup>       | 0.36              |               |
| Philippines                   | 0.12                              |           |           |           | 0.13                  | 0.68                  | 0.14 <sup>b</sup>       | 0.23              |               |
| Peru                          | 0.11                              |           |           |           | 0.40 <sup>b</sup>     | 0.59 <sup>b</sup>     | 0.02 <sup>b</sup>       | 0.25 <sup>b</sup> |               |
| Russia and Ukraine            | 0.10 <sup>c</sup>                 | 0.19      | 0.30      | 0.36      | 0.11                  | 0.21                  | 0.03 <sup>b</sup>       | 0.56              |               |
| South Africa                  | 0.12                              | 0.04      | 0.27      | 1.00      | 0.10                  | 0.30                  | 0.05                    | 0.05              |               |
| Thailand                      | 0.17                              | 0.45      | 0.78      | 1.00      | 0.35                  | 1.50                  | 0.14                    | 0.07              |               |
| Turkey                        | 0.10 <sup>c</sup><br>(0.22-0.51), |           |           |           | 0.10 <sup>b</sup>     | 0.20 <sup>b</sup>     |                         | 0.07              |               |
| United States <sup>e</sup>    | (0.46-0.76) <sup>c</sup>          | 0.21      | 0.48      | 1.16      | 0.07                  | 0.28                  | 0.05, 0.22 <sup>c</sup> | 0.13              | 0.72          |
| Venezuela                     | 0.10                              |           |           |           | 0.40 <sup>b</sup>     | 0.59 <sup>b</sup>     | 0.02 <sup>b</sup>       | 0.25 <sup>b</sup> |               |
| ROW                           | 0.15, 0.09 <sup>c</sup>           | 0.10      | 0.21      | 0.69      |                       |                       |                         |                   | 0.14          |

**Table C.3: (Continued)**

| Demand (Own Price Elasticity) | Model | OECD  | Tyers & Anderson   | Devadoss & Kropf   | Wohlgemant         | Stout & Abler |
|-------------------------------|-------|-------|--------------------|--------------------|--------------------|---------------|
| Algeria                       | -0.11 |       | -0.50 <sup>b</sup> | -0.02 <sup>b</sup> | -0.11              |               |
| Argentina                     | -0.10 | -0.04 | -0.60              | -0.48 <sup>b</sup> | -0.52              | -0.15         |
| Australia                     | -0.13 | -0.11 | -0.18              | -0.041             | -0.02              | -0.08         |
| Brazil                        | -0.08 | -0.04 | -0.60              | -0.01              | -0.01              | -0.20         |
| Canada                        | -0.07 | -0.32 | -0.08              | -0.07              | -0.07              | -0.09         |
| China                         | -0.18 | -0.19 | -1.50              | -0.12 <sup>b</sup> | -0.29              | -0.18         |
| Colombia                      | -0.10 |       | -0.60 <sup>b</sup> | -0.48 <sup>b</sup> | -0.15 <sup>b</sup> |               |
| Cuba                          | -0.11 | -0.45 | -1.40              |                    | -0.23              |               |
| Egypt                         | -0.11 |       | -0.80              | -0.02 <sup>b</sup> | -0.07              |               |
| European Union-15             | -0.11 | -0.10 | -0.12              | -0.02 <sup>b</sup> | -0.12              | -0.12         |
| EU NMS                        | -0.11 |       | -0.80 <sup>b</sup> | -0.02              | -0.02 <sup>b</sup> |               |
| Guatemala                     | -0.12 |       | -0.60 <sup>b</sup> | -0.02 <sup>b</sup> | -0.17              |               |
| India                         | -0.18 | -0.07 | -0.80              | -0.02              | -0.76              |               |
| Indonesia                     | -0.13 | -0.08 | -1.20              | -0.09              | -0.61              |               |
| Iran                          | -0.11 |       | -1.00 <sup>b</sup> |                    |                    |               |
| Japan                         | -0.11 | -0.15 | -0.05              | -0.002             | -0.81              | -0.28         |
| Korea                         | -0.10 | -0.20 | -0.8               | -0.12 <sup>b</sup> | -0.79 <sup>b</sup> | -0.11         |
| Malaysia                      | -0.07 |       | -1.00 <sup>b</sup> | -0.12 <sup>b</sup> | -0.06              |               |
| Mexico                        | -0.12 | -0.12 | -0.85              | -0.02              | -0.02              | -0.20         |
| Morocco                       | -0.11 |       | -0.50 <sup>b</sup> | -0.02 <sup>b</sup> | -0.06 <sup>b</sup> |               |
| Pakistan                      | -0.10 |       | -1.00              | -0.12 <sup>b</sup> | -0.15              |               |
| Philippines                   | -0.09 |       | -1.40              | -0.12 <sup>b</sup> | -0.19              |               |
| Peru                          | -0.12 |       | -0.60 <sup>b</sup> | -0.48 <sup>b</sup> | -0.15 <sup>b</sup> |               |
| Russia and Ukraine            | -0.18 | -0.06 | -0.10              | -0.02 <sup>b</sup> | -0.05              |               |
| South Africa                  | -0.15 | -0.19 | -0.60              | -0.01              | -0.01              |               |
| Thailand                      | -0.15 | -0.10 | -0.70              | -0.02              | -0.24              |               |
| Turkey                        | -0.16 |       | -1.00 <sup>b</sup> |                    | -0.04              |               |
| United States                 | -0.29 | -0.82 | -0.20              | -0.04              | -0.11              | -0.29         |
| Venezuela                     | -0.10 |       | -0.60 <sup>b</sup> | -0.48 <sup>b</sup> | -0.15 <sup>b</sup> |               |
| ROW                           | -0.11 | -0.05 | -0.64              |                    |                    | -0.17         |

**Table C.3: (Continued)**

| Demand (Income Elasticity) | Model | OECD | Devadoss & Kropf | Wohlgemant        | Stocks (Own Price Elasticity) | Model | Devadoss & Kropf |
|----------------------------|-------|------|------------------|-------------------|-------------------------------|-------|------------------|
| Algeria                    | 0.19  |      |                  | 0.44              | Algeria                       | -0.16 |                  |
| Argentina                  | 0.24  | 0.21 |                  | 0.29              | Argentina                     | -0.08 |                  |
| Australia                  | 0.14  | 0.46 | 0.04             | 0.04              | Australia                     | -0.09 | -0.23            |
| Brazil                     | 0.15  | 0.21 | 0.81             | 0.25              | Brazil                        | -0.09 | -0.30            |
| Canada                     | 0.12  | 0.15 | -0.92            | 0.13              | Canada                        | -0.09 | -0.28            |
| China                      | 0.11  | 0.29 |                  | 0.95              | China                         | -0.13 |                  |
| Colombia                   | 0.39  |      |                  | 0.3 <sup>b</sup>  | Colombia                      | -0.09 |                  |
| Cuba                       |       | 0.58 |                  |                   | Cuba                          | -0.15 |                  |
| Egypt                      | 0.20  |      |                  | 0.40              | Egypt                         | -0.09 |                  |
| European Union-15          | 0.13  | 0.46 | 0.30             | 0.30              | European Union                | -0.21 | -0.01            |
| EU NMS                     | 0.19  |      |                  | 0.20              | EU NMS                        | -0.10 |                  |
| Guatemala                  | 0.16  |      |                  | 0.51              | Guatemala                     | -0.11 |                  |
| India                      | 0.12  | 0.18 | 0.12             | 0.54              | India                         | -0.10 | -0.22            |
| Indonesia                  | 0.14  | 0.29 | 1.25             | 0.11              | Indonesia                     | -0.14 | -0.12            |
| Iran                       | 0.09  |      |                  |                   | Iran                          | -0.10 |                  |
| Japan                      | 0.08  | 0.73 |                  | 0.08              | Japan                         | -0.09 |                  |
| Korea                      | 0.11  | 0.32 |                  | 0.53              | Korea                         | -0.10 |                  |
| Malaysia                   | 0.19  |      |                  | 0.17              | Malaysia                      | -0.09 |                  |
| Mexico                     | 0.19  | 0.19 | 0.25             | 0.30              | Mexico                        | -0.10 | -0.02            |
| Morocco                    | 0.30  |      |                  | 0.3 <sup>b</sup>  | Morocco                       | -0.11 |                  |
| Pakistan                   | 0.21  |      |                  | 1.30              | Pakistan                      | -0.11 |                  |
| Philippines                | 0.20  |      |                  | 0.11              | Philippines                   | -0.12 |                  |
| Peru                       | 0.15  |      |                  | 0.30 <sup>b</sup> | Peru                          | -0.11 |                  |
| Russia and Ukraine         |       | 0.50 |                  | 0.20              | Russia and Ukraine            | -0.21 |                  |
| South Africa               | 0.22  | 1.42 | 0.42             | 0.16              | South Africa                  | -0.13 |                  |
| Thailand                   | 0.19  | 0.96 | 0.01             | 0.71              | Thailand                      | -0.14 | -0.04            |
| Turkey                     | 0.19  |      |                  | 0.36              | Turkey                        | -0.10 |                  |
| United States              |       | 0.13 | 0.25             | 0.10              | United States                 | -1.13 | -0.16            |
| Venezuela                  | 0.25  |      |                  | 0.30 <sup>b</sup> | Venezuela                     | -0.12 |                  |
| ROW                        |       | 0.20 |                  |                   | ROW                           | -0.11 |                  |

a Elasticities are estimated at the sample average for 2000 through 2004.

b Regional averages.

c The first value is the own price elasticity with respect to sugarcane; the second value with respect to sugar beet.

d Simple average of quotas A, B and C elasticities.

e U.S. sugarcane and sugar beet areas are modeled at the state level. The range is provided in parenthesis.

Note: NMS is New Member States; SR refers to short run, MR is medium run, and LR is long run.

Table C.3 provides the supply and demand elasticities for the international sugar model by country and a comparison to the literature. The various studies use a wide range of model structures with differing definitions in terms of variables and regions. Although this results in a variation in elasticities, the model elasticities are within the range found in the literature. The international sugar model has been used in a number of studies including Abler et al. (2007), Elobeid and Beghin (2006), and Beghin et al. (2003).

## Appendix D: Sensitivity Analyses

**Table D.1: Removal of U.S. Trade Barriers on U.S and Brazilian Ethanol Markets with Elasticities Doubled**

|  | 2005   | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    |
|--|--------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>World</b>   |        |         |         |         |         |         |         |         |         |         |         |
| <b>Anhydrous ethanol price</b>                       |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Gallon)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.29   | 1.34    | 1.24    | 1.21    | 1.19    | 1.22    | 1.25    | 1.28    | 1.30    | 1.32    | 1.35    |
| Scenario 1   | 1.29   | 1.70    | 1.59    | 1.55    | 1.51    | 1.51    | 1.57    | 1.60    | 1.62    | 1.64    | 1.65    |
| Percentage Change                                    | 0.00%  | 27.40%  | 28.14%  | 27.45%  | 27.31%  | 24.52%  | 25.78%  | 25.01%  | 24.49%  | 23.97%  | 22.15%  |
| <b>Net Exports</b>                                   |        |         |         |         |         |         |         |         |         |         |         |
| (Million Gallons)                                    |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 645.11 | 795.71  | 1006.10 | 1059.49 | 1101.50 | 1174.01 | 1229.27 | 1267.01 | 1286.57 | 1295.64 | 1299.49 |
| Scenario 1   | 645.11 | 1751.78 | 2137.85 | 2282.57 | 2376.78 | 2568.42 | 2545.56 | 2605.28 | 2642.64 | 2667.34 | 2637.71 |
| Percentage Change                                    | 0.00%  | 120.15% | 112.49% | 115.44% | 115.78% | 118.77% | 107.08% | 105.62% | 105.40% | 105.87% | 102.98% |
| <b>Raw Sugar Price</b>                               |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Cents per Pound)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 12.20  | 13.94   | 13.43   | 13.70   | 13.85   | 14.02   | 14.31   | 14.60   | 14.89   | 15.18   | 15.49   |
| Scenario 1   | 12.20  | 14.97   | 14.20   | 14.36   | 14.51   | 14.60   | 15.04   | 15.34   | 15.65   | 15.97   | 16.25   |
| Percentage Change                                    | 0.00%  | 7.42%   | 5.74%   | 4.82%   | 4.77%   | 4.18%   | 5.12%   | 5.05%   | 5.14%   | 5.25%   | 4.88%   |
| <b>Crude Oil Price</b>                               |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Gallon)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.17   | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Scenario 1   | 1.17   | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Percentage Change                                    | 0.00%  | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   |
| <b>United States</b>                                 |        |         |         |         |         |         |         |         |         |         |         |
| <b>Production</b>                                    |        |         |         |         |         |         |         |         |         |         |         |
| (Million Gallons)                                    |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 3886   | 4729    | 5196    | 5786    | 6396    | 6948    | 7479    | 7917    | 8333    | 8732    | 9123    |
| Scenario 1   | 3886   | 4089    | 4435    | 4973    | 5542    | 5998    | 6588    | 7010    | 7410    | 7794    | 8200    |
| Percentage Change                                    | 0.00%  | -13.55% | -14.65% | -14.04% | -13.35% | -13.67% | -11.92% | -11.45% | -11.07% | -10.74% | -10.12% |
| <b>Consumption</b>                                   |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 4007   | 4950    | 5563    | 6168    | 6786    | 7381    | 7935    | 8375    | 8775    | 9147    | 9507    |
| Scenario 1   | 4007   | 5337    | 6028    | 6665    | 7300    | 7951    | 8452    | 8894    | 9292    | 9662    | 9997    |
| Percentage Change                                    | 0.00%  | 7.80%   | 8.35%   | 8.06%   | 7.57%   | 7.73%   | 6.51%   | 6.19%   | 5.89%   | 5.63%   | 5.15%   |
| <b>Net Imports</b>                                   |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 127    | 217     | 370     | 385     | 393     | 434     | 456     | 459     | 443     | 417     | 386     |
| Scenario 1   | 127    | 1256    | 1601    | 1697    | 1761    | 1955    | 1863    | 1884    | 1883    | 1869    | 1798    |
| Percentage Change                                    | 0.00%  | 479.37% | 332.51% | 340.55% | 348.03% | 350.86% | 308.10% | 310.24% | 324.88% | 348.54% | 365.72% |
| <b>Gasoline Consumption</b>                          |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 139894 | 140974  | 143476  | 146739  | 149905  | 152843  | 154767  | 156718  | 158738  | 160850  | 162955  |
| Scenario 1   | 139894 | 141231  | 143779  | 147055  | 150225  | 153191  | 155078  | 157027  | 159041  | 161148  | 163235  |
| Percentage Change                                    | 0.00%  | 0.18%   | 0.21%   | 0.22%   | 0.21%   | 0.20%   | 0.20%   | 0.19%   | 0.19%   | 0.19%   | 0.17%   |
| <b>Share of Fuel Ethanol in Gasoline Consumption</b> |        |         |         |         |         |         |         |         |         |         |         |
| (Ratio)  |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 0.03   | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Scenario 1   | 0.03   | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    | 0.06    | 0.06    |
| Percentage Change                                    | 0.00%  | 7.98%   | 8.46%   | 8.11%   | 7.57%   | 7.69%   | 6.45%   | 6.12%   | 5.81%   | 5.54%   | 5.06%   |
| <b>Domestic Ethanol Price</b>                        |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Gallon)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.80   | 2.00    | 1.92    | 1.89    | 1.87    | 1.90    | 1.93    | 1.96    | 1.98    | 2.01    | 2.01    |
| Scenario 1   | 1.80   | 1.81    | 1.70    | 1.66    | 1.62    | 1.62    | 1.68    | 1.71    | 1.73    | 1.75    | 1.76    |
| Percentage Change                                    | 0.00%  | -9.26%  | -11.59% | -12.54% | -13.10% | -14.35% | -12.88% | -12.88% | -12.82% | -12.75% | -12.26% |
| <b>Corn Farm Price</b>                               |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Bushel)                            |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.86   | 2.05    | 2.15    | 2.27    | 2.36    | 2.41    | 2.46    | 2.49    | 2.51    | 2.54    | 2.56    |
| Scenario 1   | 1.86   | 1.99    | 2.08    | 2.19    | 2.29    | 2.34    | 2.41    | 2.43    | 2.46    | 2.48    | 2.50    |
| Percentage Change                                    | 0.00%  | -2.69%  | -3.31%  | -3.29%  | -2.81%  | -2.89%  | -2.23%  | -2.33%  | -2.30%  | -2.34%  | -2.24%  |
| <b>DDG Price</b>                                     |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Dollars per Ton)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 77.66  | 76.59   | 78.98   | 79.74   | 79.75   | 79.70   | 79.64   | 78.98   | 78.18   | 77.10   | 75.99   |
| Scenario 1   | 77.66  | 77.66   | 80.00   | 80.68   | 80.64   | 80.74   | 80.57   | 79.93   | 79.08   | 77.97   | 76.82   |
| Percentage Change                                    | 0.00%  | 1.39%   | 1.29%   | 1.18%   | 1.12%   | 1.30%   | 1.17%   | 1.20%   | 1.15%   | 1.14%   | 1.09%   |
| <b>Gluten Feed Price</b>                             |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 50.68  | 52.97   | 55.63   | 57.64   | 58.97   | 59.90   | 60.60   | 60.69   | 60.73   | 60.52   | 60.31   |
| Scenario 1   | 50.68  | 52.58   | 55.01   | 56.95   | 58.37   | 59.32   | 60.18   | 60.26   | 60.29   | 60.08   | 59.87   |
| Percentage Change                                    | 0.00%  | -0.75%  | -1.12%  | -1.19%  | -1.01%  | -0.97%  | -0.69%  | -0.71%  | -0.72%  | -0.74%  | -0.72%  |
| <b>Gluten Meal Price</b>                             |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 278.20 | 259.78  | 266.70  | 266.95  | 265.16  | 264.64  | 263.72  | 261.19  | 257.51  | 252.94  | 248.07  |
| Scenario 1   | 278.20 | 263.70  | 271.06  | 271.37  | 269.12  | 269.29  | 267.60  | 265.47  | 261.71  | 257.27  | 252.26  |
| Percentage Change                                    | 0.00%  | 1.51%   | 1.63%   | 1.66%   | 1.49%   | 1.76%   | 1.47%   | 1.64%   | 1.63%   | 1.71%   | 1.69%   |
| <b>Corn Oil Price</b>                                |        |         |         |         |         |         |         |         |         |         |         |
| (U.S. Cents per Pound)                               |        |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 25.46  | 24.25   | 25.62   | 26.56   | 27.07   | 27.53   | 28.07   | 28.56   | 29.01   | 29.51   | 30.07   |
| Scenario 1   | 25.46  | 24.29   | 25.62   | 26.52   | 26.96   | 27.42   | 27.91   | 28.42   | 28.85   | 29.36   | 29.91   |
| Percentage Change                                    | 0.00%  | 0.17%   | 0.00%   | -0.14%  | -0.43%  | -0.41%  | -0.60%  | -0.49%  | -0.54%  | -0.52%  | -0.54%  |

**Table D.1: (continued)**

|   | 2005  | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    |
|---|-------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>Brazil</b>                                   |       |         |         |         |         |         |         |         |         |         |         |
| <b>Production</b>                               |       |         |         |         |         |         |         |         |         |         |         |
| (Million Gallons)                               |       |         |         |         |         |         |         |         |         |         |         |
| Baseline  | 4768  | 5087    | 5496    | 5700    | 5889    | 6092    | 6287    | 6479    | 6670    | 6867    | 7079    |
| Scenario 1                                      | 4768  | 5571    | 6228    | 6543    | 6799    | 7005    | 7254    | 7479    | 7695    | 7915    | 8118    |
| Percentage Change                               | 0.00% | 9.50%   | 13.32%  | 14.80%  | 15.46%  | 14.99%  | 15.38%  | 15.43%  | 15.37%  | 15.27%  | 14.68%  |
| <b>Total Consumption</b>                        |       |         |         |         |         |         |         |         |         |         |         |
| Baseline  | 4196  | 4326    | 4503    | 4643    | 4786    | 4918    | 5058    | 5212    | 5383    | 5571    | 5779    |
| Scenario 1                                      | 4196  | 3916    | 4112    | 4269    | 4421    | 4589    | 4709    | 4873    | 5052    | 5248    | 5479    |
| Percentage Change                               | 0.00% | -9.46%  | -8.68%  | -8.06%  | -7.63%  | -6.69%  | -6.90%  | -6.50%  | -6.15%  | -5.81%  | -5.20%  |
| <b>Anhydrous Ethanol Consumption</b>            |       |         |         |         |         |         |         |         |         |         |         |
| Baseline  | 1398  | 1376    | 1394    | 1414    | 1439    | 1461    | 1464    | 1467    | 1470    | 1474    | 1478    |
| Scenario 1                                      | 1398  | 1292    | 1314    | 1338    | 1364    | 1393    | 1393    | 1398    | 1402    | 1407    | 1416    |
| Percentage Change                               | 0.00% | -6.08%  | -5.73%  | -5.40%  | -5.19%  | -4.60%  | -4.87%  | -4.72%  | -4.60%  | -4.49%  | -4.15%  |
| <b>Hydrous Ethanol Consumption</b>              |       |         |         |         |         |         |         |         |         |         |         |
| Baseline  | 2798  | 2950    | 3109    | 3229    | 3348    | 3458    | 3594    | 3745    | 3913    | 4098    | 4302    |
| Scenario 1                                      | 2798  | 2624    | 2798    | 2931    | 3057    | 3196    | 3316    | 3476    | 3650    | 3840    | 4062    |
| Percentage Change                               | 0.00% | -11.04% | -10.00% | -9.22%  | -8.68%  | -7.58%  | -7.72%  | -7.20%  | -6.73%  | -6.29%  | -5.56%  |
| <b>Net Exports</b>                              |       |         |         |         |         |         |         |         |         |         |         |
| Baseline  | 607   | 769     | 991     | 1056    | 1102    | 1174    | 1229    | 1267    | 1287    | 1296    | 1299    |
| Scenario 1                                      | 607   | 1684    | 2116    | 2273    | 2377    | 2414    | 2546    | 2605    | 2643    | 2667    | 2638    |
| Percentage Change                               | 0.00% | 119.09% | 113.52% | 115.29% | 115.78% | 105.64% | 107.08% | 105.62% | 105.40% | 105.87% | 102.98% |
| <b>Share of Sugarcane in Ethanol Production</b> |       |         |         |         |         |         |         |         |         |         |         |
| (Ratio)   |       |         |         |         |         |         |         |         |         |         |         |
| Baseline  | 0.51  | 0.51    | 0.52    | 0.52    | 0.53    | 0.53    | 0.54    | 0.54    | 0.55    | 0.55    | 0.56    |
| Scenario 1                                      | 0.51  | 0.55    | 0.56    | 0.57    | 0.57    | 0.58    | 0.58    | 0.59    | 0.59    | 0.60    | 0.60    |
| Percentage Change                               | 0.00% | 7.52%   | 8.62%   | 8.94%   | 9.12%   | 8.60%   | 8.97%   | 8.93%   | 8.88%   | 8.82%   | 8.40%   |

**Table D.2: Removal of U.S. Trade Barriers and Tax Credit on U.S and Brazilian Ethanol Markets with Elasticities Doubled**

|  | 2005                      | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    |
|--|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>World</b>   | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| <b>Anhydrous ethanol price</b>                       |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.29                      | 1.34    | 1.24    | 1.21    | 1.19    | 1.22    | 1.25    | 1.28    | 1.30    | 1.32    | 1.35    |
| Scenario 2   | 1.29                      | 1.58    | 1.47    | 1.44    | 1.41    | 1.41    | 1.47    | 1.50    | 1.52    | 1.54    | 1.56    |
| Percentage Change                                    | 0.00%                     | 18.13%  | 18.83%  | 18.33%  | 18.34%  | 15.89%  | 17.53%  | 17.07%  | 16.77%  | 16.48%  | 14.92%  |
| <b>Net Exports</b>                                   | (Million Gallons)         |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 645.11                    | 795.71  | 1006.10 | 1059.49 | 1101.50 | 1174.01 | 1229.27 | 1267.01 | 1286.57 | 1295.64 | 1299.49 |
| Scenario 2   | 645.11                    | 1412.97 | 1763.68 | 1876.08 | 1955.79 | 2117.38 | 2114.59 | 2174.26 | 2210.72 | 2234.98 | 2204.87 |
| Percentage Change                                    | 0.00%                     | 77.57%  | 75.30%  | 77.07%  | 77.56%  | 80.35%  | 72.02%  | 71.61%  | 71.83%  | 72.50%  | 69.67%  |
| <b>Raw Sugar Price</b>                               | (U.S. Cents per Pound)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 12.20                     | 13.94   | 13.43   | 13.70   | 13.85   | 14.02   | 14.31   | 14.60   | 14.89   | 15.18   | 15.49   |
| Scenario 2   | 12.20                     | 14.63   | 13.95   | 14.14   | 14.30   | 14.38   | 14.82   | 15.11   | 15.41   | 15.73   | 15.99   |
| Percentage Change                                    | 0.00%                     | 4.98%   | 3.87%   | 3.20%   | 3.20%   | 2.60%   | 3.57%   | 3.48%   | 3.53%   | 3.62%   | 3.23%   |
| <b>Crude Oil Price</b>                               | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.17                      | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Scenario 2   | 1.17                      | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Percentage Change                                    | 0.00%                     | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   |
| <b>United States</b>                                 |                           |         |         |         |         |         |         |         |         |         |         |
| <b>Production</b>                                    | (Million Gallons)         |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 3886                      | 4729    | 5196    | 5786    | 6396    | 6948    | 7479    | 7917    | 8333    | 8732    | 9123    |
| Scenario 2   | 3886                      | 3660    | 4040    | 4593    | 5167    | 5628    | 6222    | 6647    | 7053    | 7442    | 7854    |
| Percentage Change                                    | 0.00%                     | -22.61% | -22.25% | -20.61% | -19.21% | -19.00% | -16.80% | -16.03% | -15.36% | -14.77% | -13.91% |
| <b>Consumption</b>                                   |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 4007                      | 4950    | 5563    | 6168    | 6786    | 7381    | 7935    | 8375    | 8775    | 9147    | 9507    |
| Scenario 2   | 4007                      | 4551    | 5225    | 5849    | 6474    | 7122    | 7627    | 8073    | 8477    | 8853    | 9195    |
| Percentage Change                                    | 0.00%                     | -8.06%  | -6.09%  | -5.17%  | -4.60%  | -3.51%  | -3.89%  | -3.61%  | -3.40%  | -3.22%  | -3.29%  |
| <b>Net Imports</b>                                   |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 127                       | 217     | 370     | 385     | 393     | 434     | 456     | 459     | 443     | 417     | 386     |
| Scenario 2   | 127                       | 908     | 1194    | 1261    | 1310    | 1496    | 1403    | 1425    | 1424    | 1411    | 1341    |
| Percentage Change                                    | 0.00%                     | 318.73% | 222.58% | 227.37% | 233.18% | 244.91% | 207.37% | 210.41% | 221.46% | 238.73% | 247.38% |
| <b>Gasoline Consumption</b>                          |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 139894                    | 140974  | 143476  | 146739  | 149905  | 152843  | 154767  | 156718  | 158738  | 160850  | 162955  |
| Scenario 2   | 139894                    | 140694  | 143241  | 146522  | 149698  | 152673  | 154570  | 156528  | 158553  | 160669  | 162767  |
| Percentage Change                                    | 0.00%                     | -0.20%  | -0.16%  | -0.15%  | -0.14%  | -0.11%  | -0.13%  | -0.12%  | -0.12%  | -0.11%  | -0.12%  |
| <b>Share of Fuel Ethanol in Gasoline Consumption</b> | (Ratio)                   |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 0.03                      | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Scenario 2   | 0.03                      | 0.03    | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    |
| Percentage Change                                    | 0.00%                     | -8.69%  | -6.55%  | -5.53%  | -4.90%  | -3.75%  | -4.09%  | -3.79%  | -3.55%  | -3.36%  | -3.41%  |
| <b>Domestic Ethanol Price</b>                        | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.80                      | 2.00    | 1.92    | 1.89    | 1.87    | 1.90    | 1.93    | 1.96    | 1.98    | 2.01    | 2.01    |
| Scenario 2   | 1.80                      | 1.69    | 1.58    | 1.55    | 1.52    | 1.52    | 1.58    | 1.61    | 1.63    | 1.65    | 1.67    |
| Percentage Change                                    | 0.00%                     | -15.46% | -17.60% | -18.38% | -18.81% | -19.88% | -18.23% | -18.06% | -17.89% | -17.69% | -17.13% |
| <b>Corn Farm Price</b>                               |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.86                      | 2.05    | 2.15    | 2.27    | 2.36    | 2.41    | 2.46    | 2.49    | 2.51    | 2.54    | 2.56    |
| Scenario 2   | 1.86                      | 1.96    | 2.04    | 2.16    | 2.26    | 2.31    | 2.38    | 2.41    | 2.43    | 2.46    | 2.48    |
| Percentage Change                                    | 0.00%                     | -4.45%  | -5.05%  | -4.87%  | -4.06%  | -4.05%  | -3.29%  | -3.23%  | -3.20%  | -3.20%  | -3.08%  |
| <b>DDG Price</b>                                     | (U.S. Dollars per Ton)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 77.66                     | 76.59   | 78.98   | 79.74   | 79.75   | 79.70   | 79.64   | 78.98   | 78.18   | 77.10   | 75.99   |
| Scenario 2   | 77.66                     | 78.48   | 80.61   | 81.18   | 81.07   | 81.17   | 80.98   | 80.33   | 79.46   | 78.33   | 77.15   |
| Percentage Change                                    | 0.00%                     | 2.47%   | 2.06%   | 1.80%   | 1.66%   | 1.85%   | 1.68%   | 1.70%   | 1.64%   | 1.60%   | 1.53%   |
| <b>Gluten Feed Price</b>                             |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 50.68                     | 52.97   | 55.63   | 57.64   | 58.97   | 59.90   | 60.60   | 60.69   | 60.73   | 60.52   | 60.31   |
| Scenario 2   | 50.68                     | 52.33   | 54.68   | 56.62   | 58.10   | 59.08   | 59.96   | 60.09   | 60.12   | 59.91   | 59.71   |
| Percentage Change                                    | 0.00%                     | -1.21%  | -1.71%  | -1.76%  | -1.47%  | -1.37%  | -1.05%  | -0.98%  | -1.00%  | -1.01%  | -0.99%  |
| <b>Gluten Meal Price</b>                             |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 278.20                    | 259.78  | 266.70  | 266.95  | 265.16  | 264.64  | 263.72  | 261.19  | 257.51  | 252.94  | 248.07  |
| Scenario 2   | 278.20                    | 266.32  | 273.34  | 273.45  | 270.83  | 271.08  | 269.34  | 267.08  | 263.37  | 258.88  | 253.85  |
| Percentage Change                                    | 0.00%                     | 2.52%   | 2.49%   | 2.44%   | 2.14%   | 2.44%   | 2.13%   | 2.25%   | 2.28%   | 2.35%   | 2.33%   |
| <b>Corn Oil Price</b>                                | (U.S. Cents per Pound)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 25.46                     | 24.25   | 25.62   | 26.56   | 27.07   | 27.53   | 28.07   | 28.56   | 29.01   | 29.51   | 30.07   |
| Scenario 2   | 25.46                     | 24.32   | 25.61   | 26.51   | 26.90   | 27.37   | 27.85   | 28.36   | 28.80   | 29.30   | 29.85   |
| Percentage Change                                    | 0.00%                     | 0.29%   | -0.01%  | -0.20%  | -0.63%  | -0.59%  | -0.78%  | -0.72%  | -0.74%  | -0.73%  | -0.73%  |

**Table D.2: (continued)**

|   | 2005  | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Brazil</b>                                   |       |        |        |        |        |        |        |        |        |        |        |
| <b>Production</b>                               |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4768  | 5087   | 5496   | 5700   | 5889   | 6092   | 6287   | 6479   | 6670   | 6867   | 7079   |
| Scenario 2                                      | 4768  | 5410   | 5986   | 6263   | 6498   | 6692   | 6934   | 7155   | 7368   | 7584   | 7783   |
| Percentage Change                               | 0.00% | 6.35%  | 8.92%  | 9.88%  | 10.35% | 9.83%  | 10.29% | 10.44% | 10.46% | 10.44% | 9.95%  |
| <b>Total Consumption</b>                        |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4196  | 4326   | 4503   | 4643   | 4786   | 4918   | 5058   | 5212   | 5383   | 5571   | 5779   |
| Scenario 2                                      | 4196  | 4055   | 4241   | 4393   | 4541   | 4705   | 4821   | 4981   | 5157   | 5349   | 5577   |
| Percentage Change                               | 0.00% | -6.26% | -5.81% | -5.38% | -5.13% | -4.34% | -4.69% | -4.44% | -4.21% | -4.00% | -3.50% |
| <b>Anhydrous Ethanol Consumption</b>            |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 1398  | 1376   | 1394   | 1414   | 1439   | 1461   | 1464   | 1467   | 1470   | 1474   | 1478   |
| Scenario 2                                      | 1398  | 1321   | 1340   | 1363   | 1389   | 1417   | 1416   | 1420   | 1424   | 1428   | 1436   |
| Percentage Change                               | 0.00% | -4.02% | -3.83% | -3.61% | -3.48% | -2.98% | -3.31% | -3.22% | -3.15% | -3.09% | -2.80% |
| <b>Hydrous Ethanol Consumption</b>              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 2798  | 2950   | 3109   | 3229   | 3348   | 3458   | 3594   | 3745   | 3913   | 4098   | 4302   |
| Scenario 2                                      | 2798  | 2734   | 2901   | 3030   | 3152   | 3288   | 3405   | 3561   | 3733   | 3921   | 4141   |
| Percentage Change                               | 0.00% | -7.31% | -6.69% | -6.16% | -5.83% | -4.91% | -5.25% | -4.91% | -4.61% | -4.32% | -3.74% |
| <b>Net Exports</b>                              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 607   | 769    | 991    | 1056   | 1102   | 1174   | 1229   | 1267   | 1287   | 1296   | 1299   |
| Scenario 2                                      | 607   | 1378   | 1744   | 1869   | 1956   | 1985   | 2115   | 2174   | 2211   | 2235   | 2205   |
| Percentage Change                               | 0.00% | 79.23% | 75.99% | 76.98% | 77.56% | 69.05% | 72.02% | 71.61% | 71.83% | 72.50% | 69.67% |
| <b>Share of Sugarcane in Ethanol Production</b> |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 0.51  | 0.51   | 0.52   | 0.52   | 0.53   | 0.53   | 0.54   | 0.54   | 0.55   | 0.55   | 0.56   |
| Scenario 2                                      | 0.51  | 0.53   | 0.55   | 0.55   | 0.56   | 0.56   | 0.57   | 0.57   | 0.58   | 0.58   | 0.59   |
| Percentage Change                               | 0.00% | 5.07%  | 5.86%  | 6.07%  | 6.22%  | 5.71%  | 6.15%  | 6.17%  | 6.17%  | 6.15%  | 5.78%  |

**Table D.3: Removal of U.S. Trade Barriers on U.S and Brazilian Ethanol Markets with Elasticities Halved**

|  | 2005                      | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    |
|--|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>World</b>   | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| <b>Anhydrous ethanol price</b>                       | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.29                      | 1.34    | 1.24    | 1.21    | 1.19    | 1.22    | 1.25    | 1.28    | 1.30    | 1.32    | 1.35    |
| Scenario 1   | 1.29                      | 1.67    | 1.54    | 1.49    | 1.46    | 1.40    | 1.52    | 1.54    | 1.56    | 1.58    | 1.60    |
| Percentage Change                                    | 0.00%                     | 25.41%  | 24.04%  | 22.82%  | 22.40%  | 15.14%  | 21.79%  | 20.54%  | 20.00%  | 19.57%  | 18.07%  |
| <b>Net Exports</b>                                   | (Million Gallons)         |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 645.11                    | 795.71  | 1006.10 | 1059.49 | 1101.50 | 1174.01 | 1229.27 | 1267.01 | 1286.57 | 1295.64 | 1299.49 |
| Scenario 1   | 645.11                    | 1084.45 | 1387.59 | 1472.31 | 1529.88 | 1634.93 | 1658.18 | 1715.21 | 1745.04 | 1762.65 | 1759.40 |
| Percentage Change                                    | 0.00%                     | 36.29%  | 37.92%  | 38.96%  | 38.89%  | 39.26%  | 34.89%  | 35.37%  | 35.64%  | 36.05%  | 35.39%  |
| <b>Raw Sugar Price</b>                               | (U.S. Cents per Pound)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 12.20                     | 13.94   | 13.43   | 13.70   | 13.85   | 14.02   | 14.31   | 14.60   | 14.89   | 15.18   | 15.49   |
| Scenario 1   | 12.20                     | 14.15   | 13.38   | 13.59   | 13.75   | 13.84   | 14.33   | 14.56   | 14.85   | 15.15   | 15.46   |
| Percentage Change                                    | 0.00%                     | 1.50%   | -0.35%  | -0.78%  | -0.72%  | -1.21%  | 0.14%   | -0.28%  | -0.25%  | -0.15%  | -0.18%  |
| <b>Crude Oil Price</b>                               | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.17                      | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Scenario 1   | 1.17                      | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Percentage Change                                    | 0.00%                     | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   |
| <b>United States</b>                                 |                           |         |         |         |         |         |         |         |         |         |         |
| <b>Production</b>                                    | (Million Gallons)         |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 3886                      | 4729    | 5196    | 5786    | 6396    | 6948    | 7479    | 7917    | 8333    | 8732    | 9123    |
| Scenario 1   | 3886                      | 4528    | 4938    | 5509    | 6108    | 6584    | 7185    | 7609    | 8016    | 8406    | 8797    |
| Percentage Change                                    | 0.00%                     | -4.27%  | -4.97%  | -4.79%  | -4.51%  | -5.25%  | -3.93%  | -3.88%  | -3.80%  | -3.73%  | -3.57%  |
| <b>Consumption</b>                                   |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 4007                      | 4950    | 5563    | 6168    | 6786    | 7381    | 7935    | 8375    | 8775    | 9147    | 9507    |
| Scenario 1   | 4007                      | 5061    | 5706    | 6321    | 6945    | 7583    | 8090    | 8534    | 8934    | 9305    | 9657    |
| Percentage Change                                    | 0.00%                     | 2.23%   | 2.56%   | 2.49%   | 2.34%   | 2.74%   | 1.95%   | 1.90%   | 1.81%   | 1.73%   | 1.58%   |
| <b>Net Imports</b>                                   |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 127                       | 217     | 370     | 385     | 393     | 434     | 456     | 459     | 443     | 417     | 386     |
| Scenario 1   | 127                       | 533     | 773     | 816     | 841     | 1001    | 904     | 925     | 919     | 900     | 861     |
| Percentage Change                                    | 0.00%                     | 145.64% | 108.77% | 111.97% | 113.81% | 130.93% | 98.13%  | 101.46% | 107.32% | 116.03% | 123.02% |
| <b>Gasoline Consumption</b>                          |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 139894                    | 140974  | 143476  | 146739  | 149905  | 152843  | 154767  | 156718  | 158738  | 160850  | 162955  |
| Scenario 1   | 139894                    | 141048  | 143569  | 146836  | 150004  | 152966  | 154861  | 156813  | 158831  | 160942  | 163041  |
| Percentage Change                                    | 0.00%                     | 0.05%   | 0.06%   | 0.07%   | 0.07%   | 0.08%   | 0.06%   | 0.06%   | 0.06%   | 0.06%   | 0.05%   |
| <b>Share of Fuel Ethanol in Gasoline Consumption</b> | (Ratio)                   |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 0.03                      | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Scenario 1   | 0.03                      | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    | 0.06    |
| Percentage Change                                    | 0.00%                     | 2.28%   | 2.60%   | 2.51%   | 2.34%   | 2.73%   | 1.94%   | 1.88%   | 1.79%   | 1.70%   | 1.55%   |
| <b>Domestic Ethanol Price</b>                        |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.80                      | 2.00    | 1.92    | 1.89    | 1.87    | 1.90    | 1.93    | 1.96    | 1.98    | 2.01    | 2.01    |
| Scenario 1   | 1.80                      | 1.78    | 1.65    | 1.60    | 1.57    | 1.51    | 1.63    | 1.65    | 1.67    | 1.69    | 1.71    |
| Percentage Change                                    | 0.00%                     | -10.60% | -14.24% | -15.51% | -16.23% | -20.36% | -15.47% | -15.80% | -15.77% | -15.65% | -15.01% |
| <b>Corn Farm Price</b>                               |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.86                      | 2.05    | 2.15    | 2.27    | 2.36    | 2.41    | 2.46    | 2.49    | 2.51    | 2.54    | 2.56    |
| Scenario 1   | 1.86                      | 2.03    | 2.13    | 2.24    | 2.33    | 2.39    | 2.44    | 2.47    | 2.50    | 2.52    | 2.54    |
| Percentage Change                                    | 0.00%                     | -0.85%  | -1.12%  | -1.10%  | -0.94%  | -1.11%  | -0.66%  | -0.82%  | -0.78%  | -0.82%  | -0.79%  |
| <b>DDG Price</b>                                     |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 77.66                     | 76.59   | 78.98   | 79.74   | 79.75   | 79.70   | 79.64   | 78.98   | 78.18   | 77.10   | 75.99   |
| Scenario 1   | 77.66                     | 76.91   | 79.31   | 80.04   | 80.04   | 80.08   | 79.94   | 79.29   | 78.47   | 77.39   | 76.27   |
| Percentage Change                                    | 0.00%                     | 0.41%   | 0.41%   | 0.38%   | 0.36%   | 0.48%   | 0.38%   | 0.40%   | 0.37%   | 0.38%   | 0.37%   |
| <b>Gluten Feed Price</b>                             |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 50.68                     | 52.97   | 55.63   | 57.64   | 58.97   | 59.90   | 60.60   | 60.69   | 60.73   | 60.52   | 60.31   |
| Scenario 1   | 50.68                     | 52.85   | 55.42   | 57.41   | 58.77   | 59.68   | 60.48   | 60.54   | 60.57   | 60.37   | 60.15   |
| Percentage Change                                    | 0.00%                     | -0.24%  | -0.38%  | -0.40%  | -0.33%  | -0.37%  | -0.19%  | -0.25%  | -0.25%  | -0.26%  | -0.26%  |
| <b>Gluten Meal Price</b>                             |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 278.20                    | 259.78  | 266.70  | 266.95  | 265.16  | 264.64  | 263.72  | 261.19  | 257.51  | 252.94  | 248.07  |
| Scenario 1   | 278.20                    | 261.01  | 268.17  | 268.43  | 266.50  | 266.44  | 264.92  | 262.70  | 258.92  | 254.45  | 249.54  |
| Percentage Change                                    | 0.00%                     | 0.47%   | 0.55%   | 0.56%   | 0.51%   | 0.68%   | 0.45%   | 0.58%   | 0.55%   | 0.60%   | 0.59%   |
| <b>Corn Oil Price</b>                                | (U.S. Cents per Pound)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 25.46                     | 24.25   | 25.62   | 26.56   | 27.07   | 27.53   | 28.07   | 28.56   | 29.01   | 29.51   | 30.07   |
| Scenario 1   | 25.46                     | 24.26   | 25.62   | 26.55   | 27.04   | 27.49   | 28.01   | 28.52   | 28.96   | 29.46   | 30.01   |
| Percentage Change                                    | 0.00%                     | 0.05%   | 0.00%   | -0.05%  | -0.14%  | -0.15%  | -0.24%  | -0.15%  | -0.19%  | -0.18%  | -0.19%  |

**Table D.3: (continued)**

|   | 2005  | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Brazil</b>                                   |       |        |        |        |        |        |        |        |        |        |        |
| <b>Production</b>                               |       |        |        |        |        |        |        |        |        |        |        |
| (Million Gallons)                               |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4768  | 5087   | 5496   | 5700   | 5889   | 6092   | 6287   | 6479   | 6670   | 6867   | 7079   |
| Scenario 1                                      | 4768  | 5274   | 5792   | 6034   | 6242   | 6401   | 6641   | 6858   | 7061   | 7268   | 7477   |
| Percentage Change                               | 0.00% | 3.67%  | 5.40%  | 5.86%  | 6.01%  | 5.07%  | 5.63%  | 5.85%  | 5.86%  | 5.84%  | 5.64%  |
| <b>Total Consumption</b>                        |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4196  | 4326   | 4503   | 4643   | 4786   | 4918   | 5058   | 5212   | 5383   | 5571   | 5779   |
| Scenario 1                                      | 4196  | 4231   | 4419   | 4565   | 4711   | 4868   | 4984   | 5143   | 5316   | 5505   | 5718   |
| Percentage Change                               | 0.00% | -2.19% | -1.85% | -1.67% | -1.57% | -1.03% | -1.46% | -1.33% | -1.26% | -1.19% | -1.06% |
| <b>Anhydrous Ethanol Consumption</b>            |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 1398  | 1376   | 1394   | 1414   | 1439   | 1461   | 1464   | 1467   | 1470   | 1474   | 1478   |
| Scenario 1                                      | 1398  | 1357   | 1377   | 1398   | 1423   | 1450   | 1449   | 1453   | 1456   | 1460   | 1465   |
| Percentage Change                               | 0.00% | -1.41% | -1.22% | -1.12% | -1.06% | -0.71% | -1.03% | -0.97% | -0.94% | -0.92% | -0.85% |
| <b>Hydrous Ethanol Consumption</b>              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 2798  | 2950   | 3109   | 3229   | 3348   | 3458   | 3594   | 3745   | 3913   | 4098   | 4302   |
| Scenario 1                                      | 2798  | 2874   | 3043   | 3167   | 3288   | 3417   | 3535   | 3690   | 3860   | 4045   | 4253   |
| Percentage Change                               | 0.00% | -2.56% | -2.13% | -1.92% | -1.78% | -1.17% | -1.63% | -1.48% | -1.37% | -1.28% | -1.13% |
| <b>Net Exports</b>                              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 607   | 769    | 991    | 1056   | 1102   | 1174   | 1229   | 1267   | 1287   | 1296   | 1299   |
| Scenario 1                                      | 607   | 1056   | 1371   | 1467   | 1530   | 1532   | 1658   | 1715   | 1745   | 1763   | 1759   |
| Percentage Change                               | 0.00% | 37.34% | 38.35% | 38.99% | 38.89% | 30.54% | 34.89% | 35.37% | 35.64% | 36.05% | 35.39% |
| <b>Share of Sugarcane in Ethanol Production</b> |       |        |        |        |        |        |        |        |        |        |        |
| (Ratio)   |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 0.51  | 0.51   | 0.52   | 0.52   | 0.53   | 0.53   | 0.54   | 0.54   | 0.55   | 0.55   | 0.56   |
| Scenario 1                                      | 0.51  | 0.52   | 0.53   | 0.54   | 0.54   | 0.54   | 0.55   | 0.55   | 0.56   | 0.56   | 0.57   |
| Percentage Change                               | 0.00% | 2.38%  | 2.49%  | 2.46%  | 2.47%  | 1.83%  | 2.47%  | 2.45%  | 2.45%  | 2.45%  | 2.33%  |

**Table D.4: Removal of U.S. Trade Barriers and Tax Credit on U.S and Brazilian Ethanol Markets with Elasticities Halved**

|  | 2005                      | 2006    | 2007    | 2008    | 2009    | 2010    | 2011    | 2012    | 2013    | 2014    | 2015    |
|--|---------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| <b>World</b>   | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| <b>Anhydrous ethanol price</b>                       | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.29                      | 1.34    | 1.24    | 1.21    | 1.19    | 1.22    | 1.25    | 1.28    | 1.30    | 1.32    | 1.35    |
| Scenario 2   | 1.29                      | 1.57    | 1.44    | 1.40    | 1.37    | 1.32    | 1.45    | 1.46    | 1.49    | 1.51    | 1.53    |
| Percentage Change                                    | 0.00%                     | 17.34%  | 16.64%  | 15.76%  | 15.51%  | 8.58%   | 15.59%  | 14.63%  | 14.35%  | 14.18%  | 12.96%  |
| <b>Net Exports</b>                                   | (Million Gallons)         |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 645.11                    | 795.71  | 1006.10 | 1059.49 | 1101.50 | 1174.01 | 1229.27 | 1267.01 | 1286.57 | 1295.64 | 1299.49 |
| Scenario 2   | 645.11                    | 992.83  | 1268.28 | 1343.03 | 1396.21 | 1495.27 | 1522.75 | 1580.13 | 1610.83 | 1629.66 | 1627.95 |
| Percentage Change                                    | 0.00%                     | 24.77%  | 26.06%  | 26.76%  | 26.75%  | 27.36%  | 23.87%  | 24.71%  | 25.20%  | 25.78%  | 25.28%  |
| <b>Raw Sugar Price</b>                               | (U.S. Cents per Pound)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 12.20                     | 13.94   | 13.43   | 13.70   | 13.85   | 14.02   | 14.31   | 14.60   | 14.89   | 15.18   | 15.49   |
| Scenario 2   | 12.20                     | 14.08   | 13.39   | 13.62   | 13.78   | 13.87   | 14.35   | 14.58   | 14.86   | 15.16   | 15.47   |
| Percentage Change                                    | 0.00%                     | 1.03%   | -0.24%  | -0.56%  | -0.51%  | -1.03%  | 0.30%   | -0.16%  | -0.16%  | -0.10%  | -0.15%  |
| <b>Crude Oil Price</b>                               | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.17                      | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Scenario 2   | 1.17                      | 1.43    | 1.44    | 1.40    | 1.35    | 1.31    | 1.33    | 1.37    | 1.40    | 1.43    | 1.46    |
| Percentage Change                                    | 0.00%                     | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   | 0.00%   |
| <b>United States</b>                                 |                           |         |         |         |         |         |         |         |         |         |         |
| <b>Production</b>                                    | (Million Gallons)         |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 3886                      | 4729    | 5196    | 5786    | 6396    | 6948    | 7479    | 7917    | 8333    | 8732    | 9123    |
| Scenario 2   | 3886                      | 4425    | 4850    | 5427    | 6028    | 6504    | 7106    | 7531    | 7937    | 8327    | 8718    |
| Percentage Change                                    | 0.00%                     | -6.44%  | -6.65%  | -6.21%  | -5.76%  | -6.39%  | -4.99%  | -4.87%  | -4.74%  | -4.63%  | -4.44%  |
| <b>Consumption</b>                                   |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 4007                      | 4950    | 5563    | 6168    | 6786    | 7381    | 7935    | 8375    | 8775    | 9147    | 9507    |
| Scenario 2   | 4007                      | 4856    | 5493    | 6104    | 6726    | 7362    | 7871    | 8316    | 8716    | 9089    | 9442    |
| Percentage Change                                    | 0.00%                     | -1.91%  | -1.27%  | -1.03%  | -0.89%  | -0.25%  | -0.82%  | -0.71%  | -0.67%  | -0.64%  | -0.68%  |
| <b>Net Imports</b>                                   |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 127                       | 217     | 370     | 385     | 393     | 434     | 456     | 459     | 443     | 417     | 386     |
| Scenario 2   | 127                       | 432     | 647     | 681     | 701     | 860     | 764     | 785     | 780     | 763     | 725     |
| Percentage Change                                    | 0.00%                     | 99.42%  | 74.78%  | 76.92%  | 78.32%  | 98.35%  | 67.28%  | 70.94%  | 75.94%  | 83.03%  | 87.87%  |
| <b>Gasoline Consumption</b>                          |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 139894                    | 140974  | 143476  | 146739  | 149905  | 152843  | 154767  | 156718  | 158738  | 160850  | 162955  |
| Scenario 2   | 139894                    | 140908  | 143426  | 146695  | 149864  | 152829  | 154726  | 156680  | 158701  | 160814  | 162916  |
| Percentage Change                                    | 0.00%                     | -0.05%  | -0.03%  | -0.03%  | -0.03%  | -0.01%  | -0.03%  | -0.02%  | -0.02%  | -0.02%  | -0.02%  |
| <b>Share of Fuel Ethanol in Gasoline Consumption</b> | (Ratio)                   |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 0.03                      | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Scenario 2   | 0.03                      | 0.03    | 0.04    | 0.04    | 0.04    | 0.05    | 0.05    | 0.05    | 0.05    | 0.05    | 0.06    |
| Percentage Change                                    | 0.00%                     | -2.06%  | -1.38%  | -1.12%  | -0.96%  | -0.31%  | -0.87%  | -0.76%  | -0.71%  | -0.67%  | -0.72%  |
| <b>Domestic Ethanol Price</b>                        | (U.S. Dollars per Gallon) |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.80                      | 2.00    | 1.92    | 1.89    | 1.87    | 1.90    | 1.93    | 1.96    | 1.98    | 2.01    | 2.01    |
| Scenario 2   | 1.80                      | 1.68    | 1.55    | 1.51    | 1.48    | 1.43    | 1.56    | 1.57    | 1.60    | 1.62    | 1.64    |
| Percentage Change                                    | 0.00%                     | -15.99% | -19.01% | -20.03% | -20.61% | -24.56% | -19.48% | -19.65% | -19.48% | -19.21% | -18.45% |
| <b>Corn Farm Price</b>                               |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 1.86                      | 2.05    | 2.15    | 2.27    | 2.36    | 2.41    | 2.46    | 2.49    | 2.51    | 2.54    | 2.56    |
| Scenario 2   | 1.86                      | 2.02    | 2.12    | 2.23    | 2.33    | 2.38    | 2.44    | 2.46    | 2.49    | 2.51    | 2.54    |
| Percentage Change                                    | 0.00%                     | -1.29%  | -1.51%  | -1.45%  | -1.20%  | -1.35%  | -0.86%  | -1.02%  | -0.98%  | -1.01%  | -0.98%  |
| <b>DDG Price</b>                                     | (U.S. Dollars per Ton)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 77.66                     | 76.59   | 78.98   | 79.74   | 79.75   | 79.70   | 79.64   | 78.98   | 78.18   | 77.10   | 75.99   |
| Scenario 2   | 77.66                     | 77.07   | 79.42   | 80.13   | 80.11   | 80.17   | 80.02   | 79.37   | 78.55   | 77.46   | 76.34   |
| Percentage Change                                    | 0.00%                     | 0.63%   | 0.55%   | 0.49%   | 0.46%   | 0.59%   | 0.48%   | 0.50%   | 0.47%   | 0.48%   | 0.46%   |
| <b>Gluten Feed Price</b>                             |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 50.68                     | 52.97   | 55.63   | 57.64   | 58.97   | 59.90   | 60.60   | 60.69   | 60.73   | 60.52   | 60.31   |
| Scenario 2   | 50.68                     | 52.78   | 55.34   | 57.33   | 58.71   | 59.63   | 60.44   | 60.50   | 60.54   | 60.33   | 60.11   |
| Percentage Change                                    | 0.00%                     | -0.36%  | -0.52%  | -0.53%  | -0.43%  | -0.45%  | -0.25%  | -0.31%  | -0.31%  | -0.32%  | -0.32%  |
| <b>Gluten Meal Price</b>                             |                           |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 278.20                    | 259.78  | 266.70  | 266.95  | 265.16  | 264.64  | 263.72  | 261.19  | 257.51  | 252.94  | 248.07  |
| Scenario 2   | 278.20                    | 261.64  | 268.66  | 268.88  | 266.86  | 266.82  | 265.26  | 263.06  | 259.28  | 254.81  | 249.90  |
| Percentage Change                                    | 0.00%                     | 0.72%   | 0.74%   | 0.72%   | 0.64%   | 0.82%   | 0.58%   | 0.72%   | 0.69%   | 0.74%   | 0.74%   |
| <b>Corn Oil Price</b>                                | (U.S. Cents per Pound)    |         |         |         |         |         |         |         |         |         |         |
| Baseline   | 25.46                     | 24.25   | 25.62   | 26.56   | 27.07   | 27.53   | 28.07   | 28.56   | 29.01   | 29.51   | 30.07   |
| Scenario 2   | 25.46                     | 24.27   | 25.62   | 26.54   | 27.02   | 27.48   | 27.99   | 28.51   | 28.94   | 29.45   | 30.00   |
| Percentage Change                                    | 0.00%                     | 0.08%   | -0.01%  | -0.07%  | -0.19%  | -0.18%  | -0.29%  | -0.19%  | -0.24%  | -0.22%  | -0.24%  |

**Table D.4: (continued)**

|   | 2005  | 2006   | 2007   | 2008   | 2009   | 2010   | 2011   | 2012   | 2013   | 2014   | 2015   |
|---|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| <b>Brazil</b>                                   |       |        |        |        |        |        |        |        |        |        |        |
| <b>Production</b>                               |       |        |        |        |        |        |        |        |        |        |        |
| (Million Gallons)                               |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4768  | 5087   | 5496   | 5700   | 5889   | 6092   | 6287   | 6479   | 6670   | 6867   | 7079   |
| Scenario 2                                      | 4768  | 5215   | 5699   | 5929   | 6132   | 6288   | 6526   | 6743   | 6946   | 7153   | 7363   |
| Percentage Change                               | 0.00% | 2.51%  | 3.70%  | 4.02%  | 4.13%  | 3.21%  | 3.81%  | 4.07%  | 4.14%  | 4.17%  | 4.02%  |
| <b>Total Consumption</b>                        |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 4196  | 4326   | 4503   | 4643   | 4786   | 4918   | 5058   | 5212   | 5383   | 5571   | 5779   |
| Scenario 2                                      | 4196  | 4261   | 4445   | 4589   | 4735   | 4890   | 5005   | 5163   | 5335   | 5524   | 5735   |
| Percentage Change                               | 0.00% | -1.50% | -1.28% | -1.16% | -1.08% | -0.59% | -1.04% | -0.95% | -0.90% | -0.86% | -0.76% |
| <b>Anhydrous Ethanol Consumption</b>            |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 1398  | 1376   | 1394   | 1414   | 1439   | 1461   | 1464   | 1467   | 1470   | 1474   | 1478   |
| Scenario 2                                      | 1398  | 1363   | 1382   | 1403   | 1428   | 1455   | 1453   | 1457   | 1460   | 1464   | 1469   |
| Percentage Change                               | 0.00% | -0.96% | -0.85% | -0.78% | -0.74% | -0.40% | -0.74% | -0.69% | -0.67% | -0.66% | -0.61% |
| <b>Hydrous Ethanol Consumption</b>              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 2798  | 2950   | 3109   | 3229   | 3348   | 3458   | 3594   | 3745   | 3913   | 4098   | 4302   |
| Scenario 2                                      | 2798  | 2898   | 3063   | 3186   | 3306   | 3435   | 3552   | 3706   | 3875   | 4060   | 4267   |
| Percentage Change                               | 0.00% | -1.75% | -1.48% | -1.32% | -1.23% | -0.66% | -1.17% | -1.05% | -0.99% | -0.93% | -0.81% |
| <b>Net Exports</b>                              |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 607   | 769    | 991    | 1056   | 1102   | 1174   | 1229   | 1267   | 1287   | 1296   | 1299   |
| Scenario 2                                      | 607   | 965    | 1252   | 1338   | 1396   | 1397   | 1523   | 1580   | 1611   | 1630   | 1628   |
| Percentage Change                               | 0.00% | 25.49% | 26.35% | 26.78% | 26.75% | 18.99% | 23.87% | 24.71% | 25.20% | 25.78% | 25.28% |
| <b>Share of Sugarcane in Ethanol Production</b> |       |        |        |        |        |        |        |        |        |        |        |
| (Ratio)   |       |        |        |        |        |        |        |        |        |        |        |
| Baseline  | 0.51  | 0.51   | 0.52   | 0.52   | 0.53   | 0.53   | 0.54   | 0.54   | 0.55   | 0.55   | 0.56   |
| Scenario 2                                      | 0.51  | 0.52   | 0.53   | 0.53   | 0.53   | 0.54   | 0.55   | 0.55   | 0.56   | 0.56   | 0.57   |
| Percentage Change                               | 0.00% | 1.63%  | 1.72%  | 1.70%  | 1.71%  | 1.07%  | 1.74%  | 1.74%  | 1.75%  | 1.77%  | 1.67%  |

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