ECONOMIC VIEWPOINTS

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This issue of Economic Viewpoints focuses on timely policy issues in our state. We begin with a discussion of the economic impact of a potential Avian influenza outbreak in the Delmarva poultry region. Wesley Musser and Edward Mallinson demonstrate that such an epidemic could have serious economic consequences for one of our region's most vital industries.

In the second article, Erik Lichtenberg examines how Maryland agricultural practices have changed in the past 15 years. Through surveys of Maryland farmers over this time period, Professor Lichtenberg provides estimates for the adoption of farm management practices designed to reduce nutrient emissions. Given the interest in reducing nutrient emissions into the Chesapeake Bay, this research provides an important insight to how agriculture is progressing in restoring the Bay to its former health.

Bruce Gardner and I examine the importance of ethanol and high fructose corn syrup for U.S. corn farmers in the final article. Both ethanol and high fructose corn syrup have benefited from government policy intervention but the future of these policies is questionable. Our article explores the significance of these policies for corn farmers as well as for industrial manufacturers.

As always, the Department of Agricultural and Resource Economics (AREC) continues to provide answers to important economic questions in our state. We hope you find this and future issues both informative and educational.

Economically Yours,

Kevin McNew, *Editor*

Economic Impact of Potential Avian Influenza Outbreak in the Delmarva Region

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The broiler industry is one of the most important in the Delmarva Region, which includes Delaware, the Eastern Shore of Maryland, and the Eastern Shore of Virginia. Avian influenza (AI) is a persistent threat to this industry because of

the large number of migrating waterfowl and shore birds, the AI contaminated Northeastern livebird auction markets, and the extraordinary density of poultry on the Delmarva. Previous outbreaks in Pennsylvania and other states and the current epidemic in Mexico demonstrate the loss of birds and production that accompanies AI. Information on the economic consequences of a Delmarva outbreak is important for industry and public decision-makers to evaluate disease prevention practices and establish operational and financial priorities.

This paper presents estimates of the economic costs from an AI outbreak. Using production losses in Pennsylvania, the potential effects of an AI outbreak in Delmarva are estimated in terms of regional economic output, aggregate income, and employment. While it is recognized that other economic and social impacts are important, the estimates presented here are useful benchmarks for further discussion and analysis on this issue.

Economic Multipliers

The Delmarva broiler industry stimulates economic activity on several different levels. Backward business linkages represent purchases by the industry for production, including feed ingredients, veterinary supplies, processing equipment, packaging and labor. This backward stimulation of economic activity results in *indirect economic impacts* of poultry processing. The gross margins of input industries, including broiler growers, plus their payments to labor and other resource owners also stimulate additional economic activity. The household income from poultry production is spent on consumer goods, which is known as the *induced economic impact* of broiler processing.

The economic impacts are calculated with multipliers from an input-output model. This model considers relationships between the purchases and sales of industries to each other; sales to final consumers and governments; and purchases of labor and other resources from households. Input-output analysis is a standard method for calculating economic impacts. The model does have limitations. For example, purchased feed ingredients and labor per unit of meat are constant for all levels of production. The model used in this analysis is IMPLAN, which was developed by the U.S. Forest Service and widely used by government and university analysts. Multipliers for this paper were available from prior research in the University of Maryland's AREC Department.

Multipliers indicate changes in various aggregate economic variables for a one dollar change in the value of industry output. Four multipliers for three economic variables affected by Maryland poultry production are listed in Table 1. Output multipliers refer to dollars of sales or aggregate output while total income multipliers concern total household income generated by production, including wages and gross margins of businesses. Employment concerns full-time equivalent employment. Direct multipliers show the effect of broiler processing within that particular industry. A million dollars of processed broiler sales generates one million dollars in direct output, provides $240,000 in gross margins to processors, and results in 8.22 full-time workers annually.

Indirect multipliers measure the effects of broiler production on input industries. A million dollars of poultry sales generates a total output of $750,000 in input industries, which results in $280,000 in household income and 8.66 full-time equivalent employees. Induced multipliers attribute additional economic activity from the increase in household income to be the result of the direct and indirect increase in sales. These impacts are $770,000 of output, $460,000 of total income, and 12.48 employees for each million dollars of processed broiler sales. Finally, the total multipliers are the sum of the direct, indirect, and induced multipliers for the respective variables and have a similar interpretation as each of the components.

These multipliers can be multiplied by incremental changes in processed broiler sales to generate estimates of economic impacts. The multipliers likely underestimate the economic impacts of poultry production in the Delmarva region. The estimate does not include the impact of input and labor purchases in Delaware and Virginia. However, a regional Delmarva model was not available for this analysis so Maryland multipliers are used to estimate losses.

Estimated Losses in Production Due to Avian Influenza

Unpublished data on broiler losses in the 1983-1984 Pennsylvania avian influenza outbreak were used to estimate potential losses in Delmarva. In the quarantine area, annual production was about 75 million birds per year for the 1983-1984 period. Sixty-one flocks were depopulated and were out of production for an average of 93 days. During this time period, 1.6 flocks could have been raised per house so a total of 97.6 flocks were not raised. With the average number of birds per flock being 61,630, a total of 6,015,088 birds were not produced. Given the annual production, this loss represented 8.02 percent of annual production.

The greater broiler density on Delmarva compared to Pennsylvania suggests that more flocks would be infected and destroyed. An upper limit on this loss is 100 percent of the flocks on the ground. Using the average number of days of lost production in Pennsylvania (93), divided by 365 days yields 25.5 percent of annual production if all Delmarva flocks were infected. These two percentages of lost production (8.02 and 25.5) are used to calculate economic impacts in this paper.

Economic Impacts

Delmarva Poultry Industry, Inc. estimates that the annual value of processed broilers on Delmarva is $1.413 billion. An 8.02 percent loss of production is therefore $113.3 million in sales, and a 25.5 percent loss is $360.3 million. These are the direct output losses in Table 2; the other losses in Table 2 are calculated by multiplying the direct output losses by the multipliers in Table 1. An assumed 8.02 percent decline in poultry output results in an $85 million drop in the indirect output of input industries and an $87.2 million drop in the induced output in consumer industries. The total loss in output sales would be $285.5 million. The 25.6 percent reduction in output has a larger indirect and induced loss with a total output loss of $908 million.

The income effect—which is the difference between sales and input purchases—is lower than output losses. For the poultry processing industry, these losses are $27.2 and $86.5 million for the two scenarios. The indirect and induced income losses are higher than the direct losses—indirect income losses are $31.7 and $100.9 million and induced losses are $52.1 and $165.7 million. Total income losses are $111 and $353.1 million, which are spread throughout the poultry processing, poultry growers and other input industries, and the overall consumer economy.

Direct employment losses in the pro-

Table 1. Economic Multipliers for Maryland Poultry Processing Industry, 1991

Economic Variable	Multiplier			
	Direct	Indirect	Induced	Total
Output	1.00	0.75	.77	2.52
Income	0.24	0.28	.46	0.98
Employment[a]	8.22	8.66	12.48	29.97

[a] Employment per $1.0 million sales

Table 2. Economic Impact of Potential Avian Influenza Outbreak in Delmarva

Economic Variable	Losses			
	Direct	Indirect	Induced	Total
8.02% Annual Production Loss				
Output[a]	113.3	85.0	87.2	285.5
Income[a]	27.2	31.7	52.1	111.0
Employment	999	981	1,413	3,396
25.6% Annual Production Loss				
Output[a]	360.3	270.2	277.4	908.0
Income[a]	86.5	100.9	165.7	353.1
Employment	3,178	3,120	4,497	10,798

[a] Million dollars

cessing industry are 999 and 3,178 jobs, respectively, for the two scenarios. Indirect employment losses are almost as much as direct losses, and induced losses are even more than direct losses. Total employment losses are 3,396 and 10,798, respectively.

Conclusions

An AI outbreak in the Delmarva poultry sector could have significant economic consequences. Using production loss relationships from the Pennsylvania experience, total output or sales drops $285.5 million, total income falls $111 million, and employment is reduced 3,396 in the Delmarva region. With a higher, but plausible, loss of about 25 percent of annual production, total output, total income, and total employment losses are $908 million, $353.1 million, and 10,798, respectively. These losses, especially in the areas of income and employment, are spread throughout the poultry input and consumer industries in Delmarva.

While this analysis did not include the public sectors, state and local governments will collect less income and sales taxes as income and sales drop. In addition, property tax delinquencies would likely rise. Declines in poultry output would lead to increased indemnity payments to processors and growers; and unemployment and welfare payments to unemployed workers. However, the current government budget situation suggests that State and Federal indemnities and social welfare payments may be lower than in the past. Nonetheless, the less definable social impacts of even small reductions in sales, income and employment would be significant. Private and public decision-makers need to carefully weigh these projected impacts in considering future resource allocations for prevention, immediate detection, and rapid containment of AI.

Using Soil and Water Conservation Practices to Reduce Bay Nutrients: How Has Agriculture Done?

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Agriculture and Nutrient Pollution in the Chesapeake Bay

The Chesapeake Bay Agreements of 1983, 1987, and 1992 commit the state of Maryland to restoring the Bay to its former health and productivity by (1) reducing controllable loadings of major pollutants into the Bay and each of its major tributaries to 40 percent below 1985 baseline levels by the year 2000 and (2) capping controllable loadings at 40 percent of the 1985 baseline thereafter.

Agriculture plays an important role in current plans for meeting the nitrogen and phosphorous commitments. At present, agricultural sources account for about one-third of total nitrogen loadings and two-fifths of total phosphorus loadings into the Bay (for details, see the Technical Appendix for Maryland's Tributary Strategies, Maryland Department of Natural Resources, March 12, 1996). Agriculture is the biggest nonpoint source of both nutrients, accounting for over half of nonpoint source nitrogen loadings, and almost two-thirds of nonpoint source phosphorus loadings.

In 1995, the State adopted a set of strategies for meeting its nutrient reduction commitments. Those strategies emphasize reductions in point source emissions; they call for upgrades in sewage treatment plants that will limit nitrogen emissions to a little over one-third of the 1985 baseline and phosphorus emissions to only one-tenth of the 1985 baseline. Cutting agricultural emissions is also an important part of the strategies, as Figure 1 indicates. Overall, the Tributary Strategies call for cuts in agricultural emissions of nitrogen and phosphorus of 24 percent and 21 percent relative to estimated 1992 levels.

The Tributary Strategies assume that the agricultural emissions cuts can be achieved by persuading larger numbers of farmers to:

- use conservation tillage to reduce erosion and preserve soil moisture, thereby reducing nitrogen runoff;
- plant cover crops to absorb excess nitrogen after crop harvest and to prevent erosion during the winter months;
- implement nutrient management plans such as testing for soil nitrogen that will result in lower fertilizer application rates; and
- implement soil conservation and water quality plans that use a variety of site-specific practices to reduce runoff and erosion on steeply-sloped land.

Farmers will not be required to implement any of these measures. Instead, the strategies rely on voluntary compliance with State and Federal agencies providing technical and financial assistance.

How has Maryland fared in reducing nutrient pollution in the Bay? Progress has been made, particularly in curbing point source emissions. By 1994, point source emissions of phosphorus had been cut by 56 percent from the 1985 baseline, while point source emissions of nitrogen had been cut by 35 percent. Some improvement has been observed in Bay water quality as well: total phosphorus in the mainstream Bay appears to have fallen 19 percent by 1990. Unfortunately, nitrogen was estimated to have increased by 2 percent over the same period; and analysis of stream quality monitoring data for the period 1978-1993 conducted by the Maryland Department of Environment suggests upward trends in nitrate and nitrite concentrations in the Susquehanna, Potomac, and Choptank Rivers.

The effects of implementing nutrient emissions reduction measures in agriculture may not become evident for some time, particularly for nitrogen which, transported in shallow groundwater can take as little as a few days, or as much as several decades to travel into the Bay and its tributaries. Thus, it would be helpful to have other ways of gauging progress in implementing the measures called for in the Tributary Strategies. A set of surveys from the University of Maryland's Department of AREC allows estimation of trends in farmers' use of many of these runoff reduction practices over the past decade.

University of Maryland Soil and Water Conservation Practice Usage Surveys

The Department of AREC has conducted three surveys to measure the use of a variety of soil and water conservation practices, including:

- conservation tillage;
- cover crops;
- runoff and erosion reduction practices for land with steep slopes, such as contour farming, strip-cropping, maintaining grass- and rock-lined waterways, installing terraces, diversions, and sediment troughs;
- vegetative buffer strips such as filter strips, critical area seeding, permanent vegetative cover, and wildlife habitat; and
- nutrient management practices such as installing animal waste storage structures, incorporating manure and chemical fertilizers, and splitting chemical fertilizer applications.

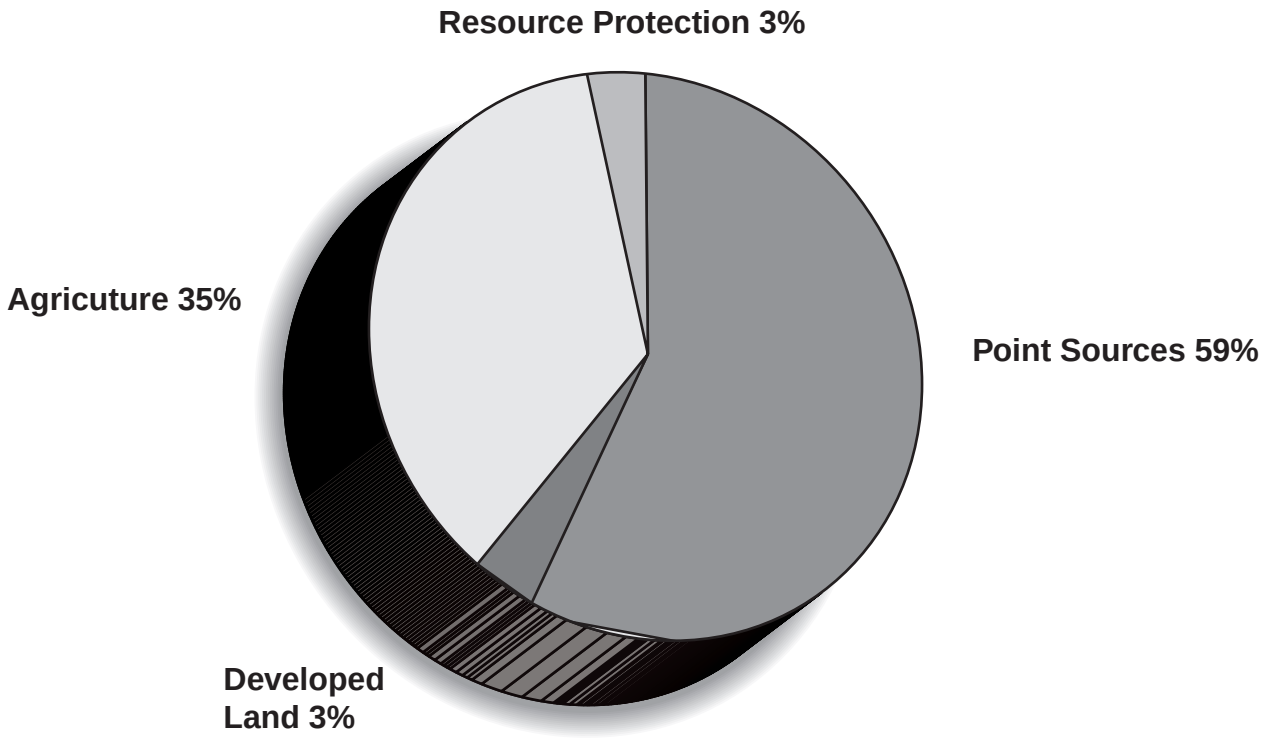
The late Professor Billy V. Lessley conducted the first of these surveys, which covered practices used by 280 farmers in 1986. Professors Erik Lichtenberg and Ivar E. Strand, Jr. conducted follow-up surveys of 520 and 592 farmers in 1991 and 1995, respectively.

All three surveys oversampled farmers with larger operations and undersampled those with smaller ones in order to ensure adequate numbers of responses from commercial enterprises. In making estimates, weights based on annual sales were used to correct for this stratified sampling. The characteristics of the survey samples matched those of the State's farm population—to varying degrees—as reflected in the Census of Agriculture of 1987 and 1992. Generally, farms in all three survey samples had more acreage than the average Maryland farm, but fewer broilers and chickens. Relationships between average number of acres planted to different crops and average numbers of dairy cows, other cattle, and hogs in the sample and the State's farm population as a whole varied from survey to survey.

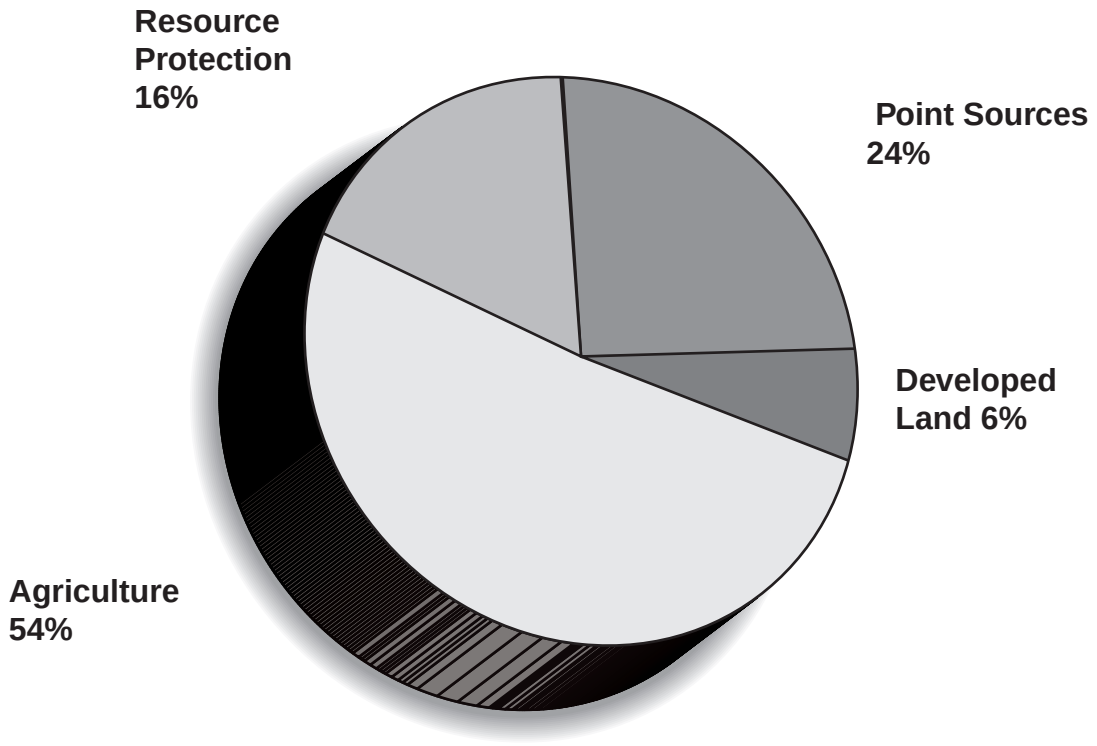
Use of Soil and Water Conservation Practices by Maryland Farmers

The suitability of soil and water conservation practices depends on the type of land being farmed. For example, contour farming and terraces are used on steeply-sloped land, while conservation tillage is used in flat areas. Manure incorporation and animal waste storage facilities are used only by farmers with livestock. Ignoring suitability will lead to underestimates of the extent to which different soil and water conservation practices are used. All three surveys contained information on the percentages of moderately and highly-sloped land operated by each farmer, in addition to infor-

Figure 1. Cuts in Emissions Projected by Maryland's Tributary Strategies

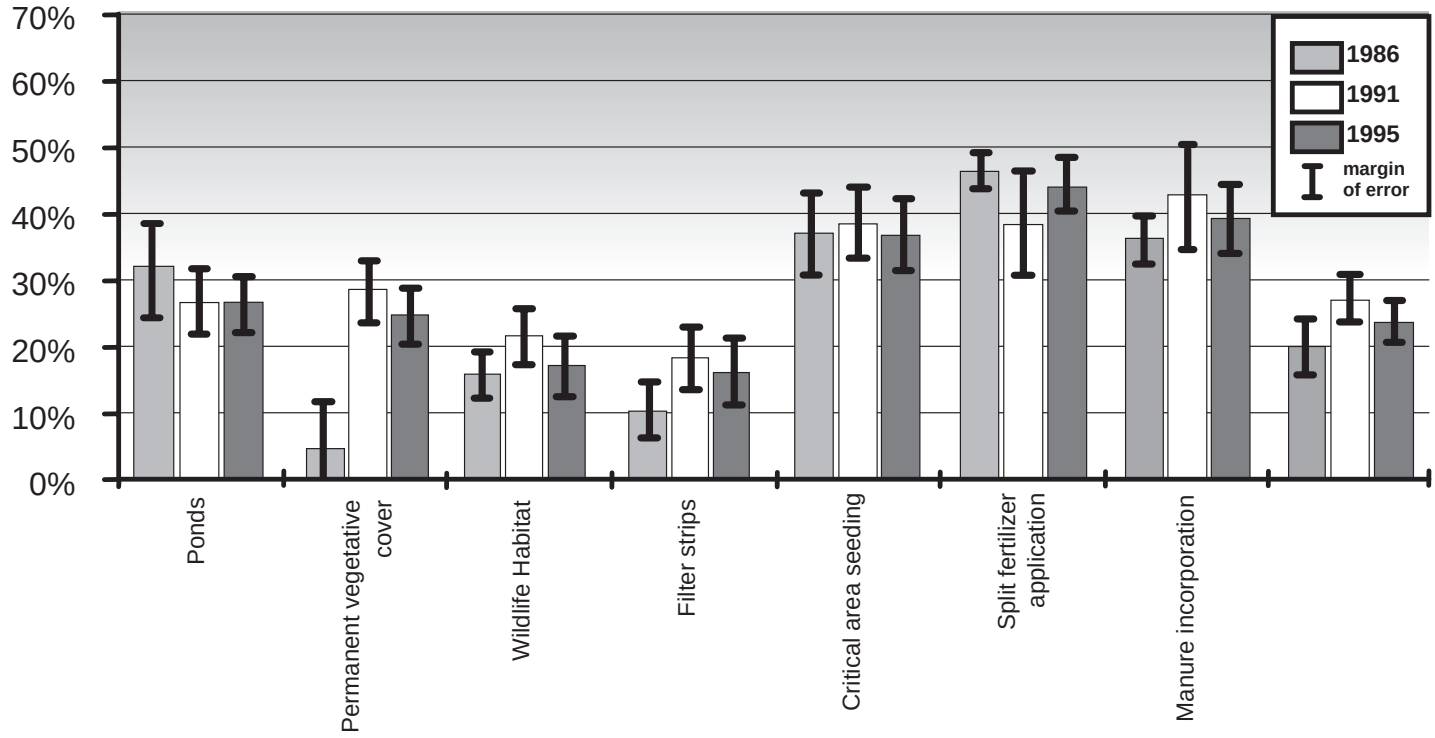


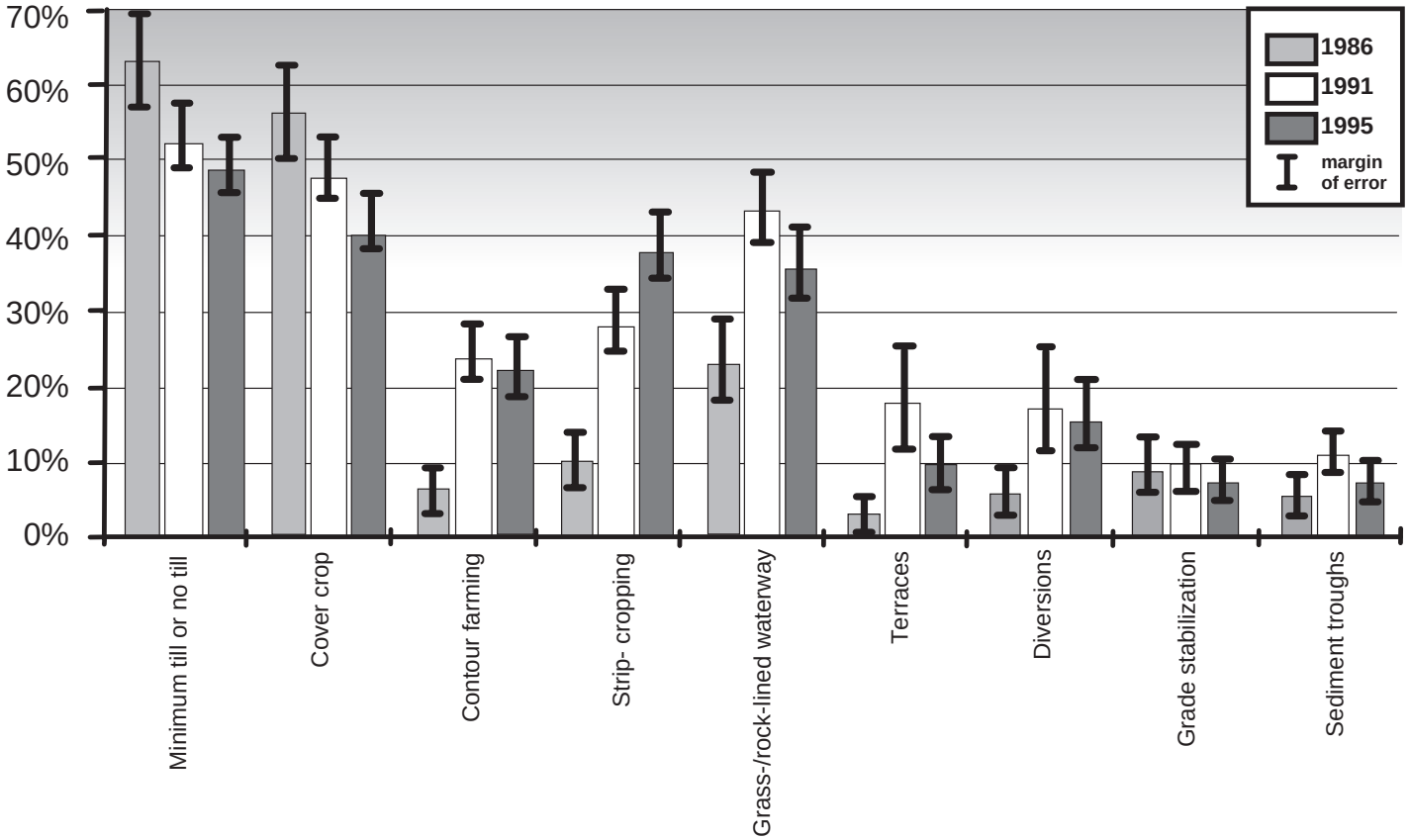
Nitrogen



Phosphorus

Figure 2. Percentage of Farmers with Suitable Land Using Soil and Water Conservation Practices





mation on crops and livestock raised. The following adjustments were made to estimate the suitability of the practices for each farm operation:

• Runoff and erosion controls such as contour farming, strip-cropping, maintaining grass- and rock-lined waterways, and grade stabilization were assumed to be suitable only for crop farmers operating some land with at least a 3 percent slope. Practices such as installing terraces and diversions were assumed to be suitable only for farmers operating some land with at least an 8 percent slope. Diversions were assumed to be suitable for farmers operating some land with at least a 3 percent slope.

• Conservation tillage, cover crops, split application of chemical fertilizers, and incorporation of chemical fertilizers were assumed to be suitable only for farmers growing crops.

• Manure incorporation was assumed to be suitable only for farmers with both crops and livestock.

• Animal waste storage facilities were assumed to be suitable only for farmers with livestock.

No restrictions on suitability were assumed for any of the vegetative buffer strip practices (filter strips, critical area seeding, permanent vegetative cover, maintaining wildlife habitat).

Figure 2 shows the estimated percentage of farmers with suitable land using each soil conservation/runoff reduction practice obtained from the three surveys. It includes error bars giving the upper and lower bounds of a 95 percent confidence interval for each estimate.

The good news is that use of these soil and water conservation practices is quite widespread among Maryland farmers. The bad news is that progress in expanding their use appears to have stalled.

The current usage of these practices on suitable land can be derived from the 1995 survey estimates. These estimates show that many of the soil and water conservation practices are used extensively. Most notably, the data suggest:

• Almost half of Maryland farmers with crops use conservation tillage.

• About 40 percent of Maryland farmers with suitable operations plant cover crops, use strip-cropping, have grass- or rock-lined waterways, split applications of fertilizers, and incorporate both chemical fertilizers and manure.

• Between 25 percent and 30 percent of Maryland farmers with livestock have animal waste storage facilities and use some sort of vegetative buffer strips.

Trends in the use of each of these practices can be estimated by comparing the percentage of farmers using each one over time. Error bars that overlap substantially indicate that two estimates do not differ in a statistically significant manner, i.e., that there has been no change in the percentage of farmers using a practice. (Formal t-tests were also conducted to determine whether apparent changes were statistically significant.) Overall, these estimates suggest the following trends:

• The percentage of farmers using conservation tillage has declined since 1986. In 1986, 63 percent of all farmers with suitable land used minimum or no tillage; by 1995, only 49 percent reported doing so. Most of the decrease occurred between 1986 and 1991. There was no statistically significant difference in the percentage of farmers using conservation tillage in 1991 and 1995.

• The percentage of crop farmers planting winter cover crops has declined since 1986, from 56 percent to 41 percent.

• The percentage of farmers with some steeply-sloped land using runoff and erosion reduction practices for land with steep slopes increased between 1986 and 1995 and especially between 1986 and 1991. The percentages of farmers with some steeply-sloped land using contour farming, strip-cropping, grass- and rock-lined waterways, terraces, and diversions were statistically higher in 1991 and in 1995 than in 1986. (There was no statistically significant difference in the percentages of farmers with steeply-sloped land using grade stabilization or sediment troughs in all three years.) Again, the bulk of the increase appears to have occurred between 1986 and 1991. Differences in the percentages of farmers using contour farming, grass- and rock-lined waterways, diversions, and terraces in 1991 and 1995 were not significant statistically. The percentage of farmers using strip-cropping actually increased between 1991 and 1995.

• The percentage of farmers using vegetative buffer strips also generally increased between 1986 and 1991 and remained higher in 1995 than in 1986. The percentage of farmers seeding critical areas and maintaining wildlife habitat were significantly larger in 1991 than 1986 and the same in 1995 and 1991. There were no changes in the percentages of farmers using filter strips or permanent vegetative cover.

• There were no statistically significant changes in the use of nutrient management practices. The percentage of farmers with livestock using animal waste storage facilities and manure incorporation was the same in 1986 and 1995. The percentages of farmers incorporating chemical fertilizers and splitting chemical fertilizers were the same all three years. Unfortunately, none of the surveys included soil testing, which has since become a key component of the Tributary Strategies.

Implications for the Bay

These estimates suggest a mixed prognosis for the cuts in agricultural emissions of nitrogen and phosphorus envisioned in the Tributary Strategies.

• On the positive side, the results indicate more widespread use of contour farming, strip-cropping, grass- and rock-lined waterways, and diversions, which should reduce erosion and thus loadings of phosphorus into the Bay. Greater use of vegetative buffer strips, strip-cropping, and grass-lined waterways should help limit runoff of nitrogen as well as of phosphorus.

• On the negative side, declines in the use of conservation tillage and cover crops may offset some of these reductions in nitrogen and phosphorus emissions from agriculture. Moreover, the expansion of the use of other soil and water conservation practices appears to have ceased, so that further reductions in emissions are unlikely.

The state of Maryland and the Cooperative Extension Service began a major initiative aimed at improving nutrient management in 1989. By 1995, nutrient management plans had been written for about 670,00 acres. The omission of this program leaves the picture of current efforts incomplete.

Because it takes a long time for nutrients to travel from farms into the Bay and its tributaries, it is impossible to determine at present whether the runoff and erosion controls farmers have already implemented will be sufficient to meet the cuts in nutrient loadings projected by the Tributary Strategies. Monitoring shallow groundwater quality is likely the only way to forecast nutrient conditions in the Bay, and a network of monitoring wells has not been established.

If further reductions in agricultural nutrient emissions are needed, new policy measures may be required. Generally, the surveys indicate that the principal changes in the percentage of farmers using soil and water conservation practices (with the notable exception of nutrient management) occurred between 1986 and 1991. These changes coincided with significant policy developments, including:

• the introduction of conservation compliance in the 1985 Farm Bill, which required farmers operating highly erodible land to follow an acceptable conservation plan by 1991;

• the expansion of cost-sharing through the Maryland Agricultural Cost-Sharing Program, which began in 1986; and

• increased emphasis on providing technical assistance for soil and water conservation.

At the same time, practices like conservation tillage and cover crops became ineligible for cost-sharing in most cases. There were no significant policy changes between 1991 and 1995. A subsequent article will more closely examine the impact of cost-sharing and technical assistance on the use of soil and water conservation practices.

Industrial Corn Uses: A Sweet Deal or Just Gas for Corn Farmers?

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Professor

Farm and commodity interest groups have devoted considerable effort to expanding the demand base for their products. Recognizing that demand for agricultural products as food is limited by population and income factors—both of which are slow to change—these groups have looked to new uses of their products to increase demand.

Corn has been one of the most successful agricultural commodities for industrial uses. In the last twenty years, a number of new industrial products manufactured from corn have been developed. None are more significant, however, than ethanol and high fructose corn syrup.

High fructose corn syrup (HFCS)—a liquid sweetener substitute for sugar—has encountered monolithic growth since industrial production began nearly 25 years ago. Between 1975 and 1994, per capita consumption in the United States grew from 7 pounds to 57 pounds. Over that same period, sugar consumption per capita fell from 93 pounds to 65 pounds. In terms of corn used for HFCS, the volume has grown from 45 million bushels in 1975 to projections of over 500 million bushels for the 1996 crop year (see Figure 1).

Ethanol has experienced similar growth. In 1975, corn used for ethanol purposes was a paltry 10 million bushels but had risen to 533 million bushels by 1994. High corn prices in the last two years have slowed ethanol production but projections for 1996 peg corn use for ethanol at 425 million bushels (Figure 1). When combined, ethanol and HFCS account for over 10 percent of all corn uses including exports.

Some of the HFCS growth can be attributed to U.S. sugar import quotas. U.S. import quotas restrict the amount of overseas sugar that can be used domestically. As a result, the U.S. sugar price is usually double the foreign sugar price, allowing HFCS to compete as a cheaper substitute.

Like HFCS, ethanol has also benefited from public policies. Two Federal programs exist which promote ethanol's use: EPA programs to improve air quality in urban areas by reducing pollution from gasoline used in cars, and tax credits and exemptions that reduce the cost of ethanol as a motor fuel.

Because ethanol and HFCS are important products derived from corn and both products benefit from government policies, an interesting issue is how important these policies are for industry profitability. How would ethanol and HFCS manufacturers (e.g., Archer Daniels Midland) be harmed by changes in existing policies? Closer to home, how would corn farmers fair from the elimination of these various supportive policies? In this article we explore these issues, turning first to the issue of sugar quotas and their impact on the HFCS market and then to a discussion of the impact of government policies on the ethanol market.

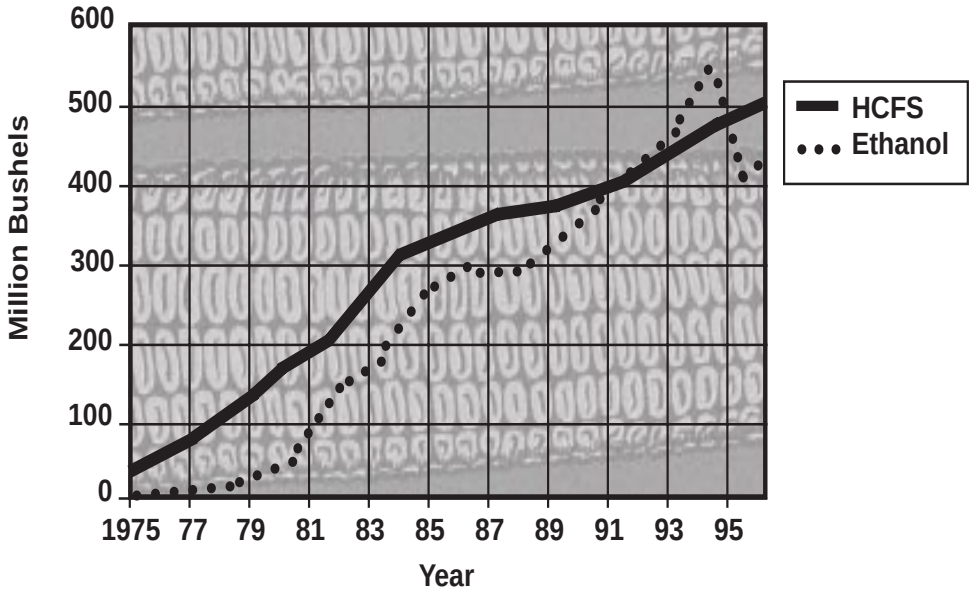
Sugar Quotas and Impacts on the HFCS Market

Since 1982 the United States has restricted the amount of international sugar crossing its borders through the use of import quotas. As a result, U.S. sugar prices are substantially higher than world prices. For example, in September 1996 spot prices for U.S. sugar were 22 cents a pound while world spot prices traded at 11 cents per pound. This type of disparity between world and U.S. sugar prices has been the norm since the introduction of U.S. sugar quotas.

Because of high domestic sugar prices, HFCS has been an inexpensive substitute for U.S. manufacturers. Without U.S. sugar quotas in place, U.S. prices would fall to the world price levels. How would this impact the HFCS market and U.S. corn producers? Lower domestic sugar prices would result in less use of HFCS and, therefore, lower demand for corn as an input to HFCS production. The result is lower prices and less production of HFCS which erodes the returns of HFCS processors. Furthermore, diminished use of corn lowers its price and ultimately leads to lower net returns for corn producers.

How much would U.S. corn farmers and HFCS processors lose from the removal of the sugar quota? To answer this, we utilize elasticities for supply and demand in the sugar, corn and HFCS markets based on previous research by McNew. To calibrate the model for supply and demand in each market, we use long run values for prices and quantities with a sugar import quota in place. Notably, we assume a $2.50 per bushel corn price and 8.5 billion bushels of corn production with an import quota of 1.5 million short tons in place. Although

Figure 1. U.S. Corn Used for Ethanol and Manufacturing: 1975-1996[1]



[1]1996 corn use is forecasted .

corn prices are currently higher, the $2.50 price is a more suitable long-term price level. Other key values are 525 million bushels of corn for HFCS production and a HFCS price of 19 cents per pound.

Table 1 presents the estimates of key economic variables resulting from the removal of the U.S. sugar quota and allowing free access to U.S. markets for world sugar. Without restrictions, the U.S. sugar price would fall to the much lower world price level. The impact on the HFCS market would be lower HFCS prices (due to reduced sugar prices) and the industry would produce less. Our estimates indicate that the demand for corn to produce HFCS would fall by roughly 200 million bushels leading to lower corn prices. However, aggregate use of corn demand (including feed, exports and other industrial uses) would only decline by roughly 76 million bushels as other components of corn demand would strengthen in the face of lower corn prices. The net result is a corn price of $2.42 per bushel or 8 cents less as a result of removing the sugar quota.

Elimination of the quota program appears to create substantial net losses to corn producers and HFCS processors. When combined for the two sectors, the net-losses approach $1 billion. Of this amount, U.S. corn producers would lose $635 million and HFCS processors would lose $290 million. On a dollar basis, corn farmers lose the most from the elimination of the sugar quota program. However, this doesn't account for the different investments and costs between the HFCS and corn production sectors (e.g., a $1 loss for someone with $10 invested is much more substantial than a $1 loss for a $1,000 investment). Using the economic surplus of the two sectors prior to removing the quota, we conclude that the elimination of the sugar quota would cause an economic loss of 24 percent to the HFCS processing sector but only a 3.5 percent loss to corn producers. Thus, even though corn farmers in the aggregate would lose more from freetrade in sugar, HFCS manufacturers bear the largest percentage loss to their returns.

Ethanol Policy Impacts on the Corn Market

The Clean Air Act Amendments of 1990 require cleaner motor fuels to be used seasonally in geographic areas which do not meet EPA's clean air standards. The two major pollution problems are: carbon monoxide (CO) and ozone. CO emissions can be remedied by adding oxygen to gasoline, and ethanol is recognized by EPA as an oxygenate for this purpose. The ozone problem is the more complicated, requiring reformulated gasoline. Ethanol as an oxygenate, can be used in making reformulated gasoline. However, the environmental benefits of ethanol in these blends is not so clear cut. The problem is the greater volatility (tendency to evaporate) of ethanol as compared to methanol blends. For implementation of the Clean Air Act Amendments, EPA mandated that 30 percent of reformulated fuel must be ethanol based. The oil industry challenged this mandate in the courts as going beyond EPA's authority under terms of the Clean Air Act, and won. So ethanol must compete, chiefly with substantially cheaper methanol-based blends, for the oxygenate market. Moreover, because of the volatility problem, EPA has mandated that ethanol not be used in reformulated gasoline for summer use in high-temperature areas.

The second policy is exemption of ethanol blends from the Federal excise tax on gasoline, or an equivalent tax

Table 1. Impact of Removing U.S. Sugar Quota on Corn and HFCS Market Participants.

	With Sugar Quota	With No Sugar Quota	Net Change from Quota Removal
Price of Corn ($/Bu.)	2.50	2.42	-0.08
Aggregate Corn Use (Million Bu.)	8,500	8,424	-76
Corn Used for HFCS (Million Bu.)	525	328	-197
Price of HFCS (Cents/lb)	19.0	15.5	-3.5
Production of HFCS (Million lb.)	8,750	7,864	-886
Cost to HFCS Processors (Million $)			$290
Cost to U.S. Corn Producers (Million $)			$635
Loss in net returns to HFCS Processors (%)			24.0
Loss in net returns to U.S. Corn Producers (%)			3.5

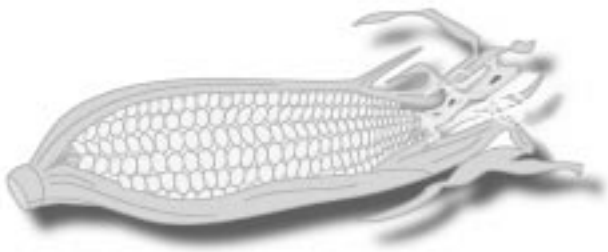
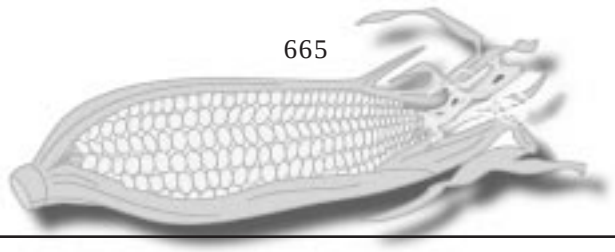


Table 2. Effects of Eliminating Federal Tax Benefits for Ethanol Production

	Current Policy	Subsidy Eliminated	Net Change
Price of Corn ($/Bu.)	2.50	2.46	-0.04
Corn Production (Million Bu.)	8,500	8,460	-40
Ethanol Production (Million Gallons)	1,000	665	-335
Cost to Ethanol Producers (Million $)			165
Cost to Corn Producers (Million $)			258



credit for industrial users of ethanol (blenders) who cannot make use of the excise tax exemption. This policy makes ethanol-based fuels competitive in both the oxygenate and standard fuel markets. Under current law which expires in the year 2000, the exemption is worth 54 cents per gallon of ethanol used. This subsidy, without the Clean Air Act mandate, is sufficient to keep ethanol competitive at current levels of use, but not to generate the further expansion of ethanol fuel use that the 30 percent mandate was expected to provide. In the absence of the mandate, and with the possible expiration of the excise tax exemption in 4 years, the incentive to undertake the substantial investment in ethanol production plant capacity that had been anticipated under the 30 percent mandate no longer exists.

Under these circumstances, the only significant support for the corn market is from the current 54 cent tax benefit. The National Corn Growers have adopted a policy recommendation for legislation to extend the tax provisions beyond 2000. How much would U.S. farmers and ethanol manufacturers lose if the excise tax exemption and blender tax credit were eliminated? Using the same corn supply and demand parameters as for the sugar quota analysis, along with a projection that if the current ethanol tax policies are continued, ethanol production will remain at 1 billion gallons annually, about its current level—requiring 400 million bushels of corn.

The main effects of eliminating the tax preferences are shown in table 2. Use of ethanol would decline about 335 million gallons, losing a third of its current market. This is estimated to cause a net cost to ethanol manufacturers of $165 million annually. The reduced ethanol production would cause the demand for corn to fall by 130 million bushels. However, because of lower corn prices for feed and less production of corn gluten and other feed byproducts of ethanol production, aggregate use of corn falls only 40 million bushels. The result is a fall in the price of corn by 4 cents per bushel. This is much smaller on a percentage basis than the fall in the price of ethanol because the great bulk of corn use is not in ethanol production. However, because the corn price decline applies to the entire 8.5 billion bushels of corn for production, and not just to the 400 million bushels used to make ethanol, the corn growers net loss of $258 million is even larger than the ethanol producers' losses. Nonetheless, as in the sugar quota case, the percentage loss to ethanol manufacturers is substantially greater than the percentage loss to corn growers.

To be included on the mailing list for Economic Viewpoints or to speak with an Extension Specialist on any of the following topics, call (301) 405-1293:

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