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Agricultural Terrorism: Potential Economic Effects on the Poultry Industry in Mississippi

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## Abstract

An input/output model is developed to estimate the potential economic impact of intentional attacks by agricultural terrorists using Exotic Newcastle disease (END) to inflict economic damage on the poultry industry in Mississippi. Also, the model is used to measure how other sectors in the state that are highly dependent upon this industry for incomes, employment, output, and taxes will be impacted by intentional use of the disease on the poultry sector in the state.

## Introduction

Agricultural terrorism is one of the most important problems facing the food sector in the U.S. In this study, the term agricultural terrorism refers to the use of disease by terrorists against agricultural targets, including crops or livestock or poultry, in an effort to cause widespread economic damage to or the total economic destruction of the target. This is a separate issue from the use of agents and toxins to contaminate specific products, in those cases, the target is actually people, and the incidents look like consumer product tampering (Pate and Cameron, 2001). Potential biological agents used by agricultural terrorists to intentionally spread disease could include viruses, bacteria, and toxins.

Although often-cited cases of biological agent agricultural attacks have involved threats or contamination of specific products, causing significant economic losses through diminished consumer confidence, they never threaten the loss of an entire sector of the agricultural economy such as poultry. The diffusion, both geographically and typologically, of agricultural production across the United States makes a catastrophic attack on or the total elimination of a significant portion of the national agricultural economy unlikely, but regional and state economies can be significantly impacted (Pate and Cameron, 2001).

An attack or perceived attack could cause significant economic harm in lost income, employment, taxes, and output to the U.S. economy and key trading partners. Intelligence and law enforcement officials when considering the possibility of agricultural terrorism, no longer question whether such an attack will occur but rather when, where, and how it will occur. U.S. agriculture is vulnerable to such an attack because of its size and importance to the U.S. economy; as well as its accessibility, lack of genetic diversity and susceptibility to foreign diseases (Huff, Meilke, and Turvey, 2003).

It is important to measure the potential economic impact of agricultural terrorism on a state's agricultural economy should such an attack occur. To measure the economic impact of agricultural terrorism on the food sector in the state's economy, the study focused on Mississippi's poultry industry. This sector was selected for economic evaluation of agricultural terrorism primarily due to its importance to the state's agricultural economy and the overall economy in Mississippi. A survey about consumers' opinions of poultry sold in Mississippi found that 90.1 percent of 608 respondents had favorable views on this topic. When asked "Do you think the poultry products purchased are clean, fresh, and free of bacteria and disease?" Almost 77 percent of the respondents said yes to the question (Deeds, 2000).

#### Overview of the Mississippi Poultry Industry

The Mississippi poultry industry began in the 1940s and 1950s. During that time, the Census of Agriculture reported that Mississippi farmers raised 35 million broilers. In 2001, Mississippi farmers produced more than 740 million broilers. This ranked about 4<sup>th</sup> in the nation in production. However, the average broiler produced in the state weighs about 5 pound, and consumes about seven pounds of feed grains a year. Mississippi broilers are smaller than broilers produced in North Carolina, ranking state 5<sup>th</sup> in total pounds of broilers produced (Morgan and

Murray, 2002). The Mississippi poultry industry affects many groups in the state, such as construction workers who build the broiler houses, port workers, transportation firms, utility companies, corn and soybean growers, and others outlined in the various tables in the study.

Because Mississippi's poultry industry is a major player on the world poultry market, events occurring in foreign countries affect the state's industry. In 2000, the U.S. exported 2.5 million metric tons of poultry. Of this, 389,000 tons went to Canada and Mexico, presumably by truck and rail. This left about 2.4 million metric tons for other international destinations. . Major importers of U.S. poultry include China, Russia, Latvia, and Japan. Almost 22 percent of all poultry exported from the U.S moved through Mississippi ports, mainly Gulfport and Pascagoula. This is significant since Mississippi produced only 9.1 percent of U.S. broilers in 2000 (Morgan and Murray, 2002).

#### Understanding Exotic Newcastle Disease

Exotic Newcastle disease (END) is a contagious and fatal viral disease affecting all species of birds. It is one of the most infectious diseases of poultry in the world. END can cause birds to die with few outward symptoms. The death rate can be as high as 100 percent in unvaccinated chickens, yet infecting and causing death in vaccinated poultry.

END affects the respiratory, nervous, and digestive systems in birds. Some symptoms of infected birds include sneezing, gasping for air, coughing, greenish, watery diarrhea, drooping wings, paralysis, thin-shelled eggs, decreased egg production, sudden death and others (Arizona Department of Agriculture, 2002).

There is no easy treatment for Exotic Newcastle Disease, except through quarantine, humanely destroying the infected poultry flock, and disinfecting the area. END can affect humans but not seriously. The symptom is mild swelling of tissues around the eyes, mainly

associated with people working around infected birds in the poultry industry. Meat and egg products from infected birds are safe to eat. However, the public reaction to the news about broilers infected with END usually leads to reduce consumption of these products in the industry (Murthy, 2002).

### Objectives of the Study

The primary objective of this study was to measure the economic effects of an agricultural terrorist attack such as Exotic Newcastle Disease (END) on poultry and related industries in the Mississippi economy. Specific objectives of the study were as follows:

1. To develop an input-output model of the Mississippi economy with emphasis on the poultry sector.
2. To measure the total impact of Exotic Newcastle Disease in the Mississippi poultry industry on output, incomes, employment, and indirect business taxes resulting from specific changes in output caused by an agricultural terrorist's attack on the poultry industry using the IMPLAN input-output model (MIG, 2000).

### Data, Methods, and Procedures

Because linkages between poultry and the rest of Mississippi's economy are complex, analysts often try to measure direct and spillover contributions from one or more industries (Spurlock, 2003). One technique, which can be used to measure economic interdependences of various sectors in an economy, is the input-output model. Based on a study by Williams, 1977, with this technique, the effects of agricultural terrorism on output, income, indirect business taxes, and employment can be measured. Not only can the direct effects of such an attack be measured, but the indirect and induced effects of this attack also can be quantified. The sum of

the effects provides a measure of the total effects caused by agricultural terrorism in one sector of the economy on other sectors and the total economy.

For purposes of this analysis, the input-output model for the poultry sector was developed using 2000 IMPLAN data for Mississippi. The IMPLAN model was used primarily because it contains details on the economic transactions of agriculture and related sectors in the Mississippi economy. The immediate impact of introducing Exotic Newcastle Disease (END) into the poultry sector was modeled by reducing output by 10 %, 20% and 30%. This could cause demand for poultry to decline among consumers in Mississippi, the U.S., and in foreign countries. Since nine percent of Mississippi poultry meat is exported to foreign countries, the study expected all imports of these products would be eliminated. These shocks were applied on top of the reductions in domestic output due to the END attack.

#### Limitations of The Study

This study has one limitation imposed by regional input-output models. Regional input-output models such as IMPLAN provide tremendous detail on the economic impacts of an activity. However, this detail carries with it several assumptions, including: 1) the supply of labor and other intermediate resources is not limited so growth will not increase wages or prices, 2) the percent of supplies purchased outside the region will stay the same as growth occurs, 3) household consumption of each item increases in direct proportion to income, 4) there is no underemployment, 5) there are no economies of scale, and 6) there will be no substitution between inputs due to price changes (Morris, 1996)

#### Analysis of Results

The following discussions center around the economic impact of Exotic Newcastle Disease on the poultry industry in Mississippi due to 30% reductions in output of the poultry and

related sectors. The discussions are limited to the 30% reduction in the output of the poultry sector from the base model and how this reduction affects the top 39 industry sectors and the rest of the Mississippi economy in terms of output, income, employment, and indirect business taxes due to page limitations. However, if readers want information on the impact of the 10% and 20% reductions in output of the poultry and eggs sector, they can contact the authors. This section also focuses on the estimated impact of the ban of poultry and poultry product exports from the state. Finally, it analyzes expenditures for destroying, disposing, cleaning, disinfecting, and monitoring (DDC&DM) resulting from the introduction of the Exotic Newcastle Disease by terrorists in the Mississippi poultry industry and how DDC&DM expenditures on infected poultry farms will impact the top 39 sectors including the poultry sector and the rest of the Mississippi economy.

## Output

Table 1 shows the base model and how the economic impact of a possible bio-terrorist's attack on the poultry sector using END as a weapon of destruction has on all other sectors of the Mississippi economy. The base model shows that gross output totaled about \$124 billion for the Mississippi economy in 2000. The sectors with largest total gross output were: (1) owner-occupied dwellings-\$5.8 billion; (2) wholesale trade-\$4.7 billion; (3) petroleum refining-\$4.5 billion; (4) motor freight transportation and warehouse-\$3.3 billion; and (5) banking-\$3.3 billion. Results also show the top 19 industries in the state accounted for almost \$38 billion or almost 30.3% of total gross output, poultry almost \$1.4 billion or almost 1.1%, and the rest of Mississippi sectors accounted for almost \$85.6 billion or 68.6 % of total output.

The bio-terrorist's attack of END on the poultry sector in the Mississippi economy which causes a 30% decline in gross output from the base model will result in the loss of total gross



output valued at: (1) \$416.9 million in the poultry and eggs sector; (2) \$44.6 million in the agricultural-forestry-fishery services; (3) \$18.3 million in the wholesale trade; (4) \$14.0 million-motor freight transport and warehouse; and (5) \$11.5 million-petroleum refining. Results also suggest that Mississippi's top 19 industries will lose almost \$168 million in gross output while the rest of the state's sectors will lose \$63.2 million in gross output.

The ban on poultry and poultry products from Mississippi indicates the top 19 industries in the state would lose almost \$62.2 million in gross output while the rest of the Mississippi economy would lose almost \$23.4 million in total gross output. As expected, the poultry and eggs sector will lose the largest amount of gross output resulting from the ban on exports from the state because of the END attack. Under this scenario, poultry would lose almost \$154.4 million in gross output. Other sectors that would incur major losses include agricultural-forestry-fishery services-\$16.5 million, wholesale trade-\$6.8 million, motor freight transport and warehouse-\$5.2 million, and petroleum refining-more than \$4.2 million.

DDC&DM expenditures associated with the infected poultry farms under the 30% reduction in gross output scenario would generate \$373.6 million for this sector, \$40 million for the agricultural-forestry-fishery services sector, and \$16.4 million in gross output for wholesale trade. Benefits to the top 19 industries will equal \$150.6.4 million while the rest of Mississippi's economy will generate almost \$56.7 million in gross output because of the bio-terrorist's attack on the poultry sector in the economy as the poultry industry and its stakeholders recovers from the attack. These impacts are positive since they will create jobs for cleaning, disinfecting, and disposing crews and retail sales for suppliers of compounds used to destroy the virus.

## Income

Table 2 presents an understandable and useful method of examining the impact of selected reductions in poultry output on income resulting from the Exotic Newcastle Disease. In this table, the output of the poultry sector is assumed to decrease by 30%. The base model and the effects on income in the Mississippi economy from the selected reductions in the poultry sector's output are shown on the same line. Also, the effects of the loss of foreign exports and the estimated expenditures for destroying, disposing, cleaning, disinfecting, and monitoring (DDC&DM) infected poultry farms are shown on the same line resulting from the bio-terrorists' attack on the poultry sector on the Mississippi economy.

The base model suggests the top 19 industries in the Mississippi economy generated almost \$10.5 billion in income while the rest of the economy generated an estimated \$26.7 billion in household income. Poultry generated more than \$177.1 million in household income. Individually, wholesale trade generated the largest income in the Mississippi economy in 2000. That sector generated more than \$1.8 billion in household income. The second leading generator of income in the Mississippi economy was the doctors and dentists sector. This sector generated almost \$1.4 billion in household income during the study period.

The effects of a 30% reduction in poultry output on income resulting from the bio-terrorist's attack indicate the poultry sector would lose \$53.6 million in household income. The results also show agricultural, forestry, and fishery services, wholesale trade, motor freight transport and warehousing, and maintenance and repairs of other facilities sectors would lose almost \$20.8, \$7.6, \$4.2, and \$3.5 million in household income, respectively. These results suggest that a bio-terrorists' attack on the poultry and eggs sector will not only have major

financial implications for that sector but other leading sectors as well since these sectors generate substantial incomes for the Mississippi economy.

Like many other sectors in the Mississippi economy, the export market is important to the survival and the success of the poultry and eggs sector. Therefore, an attack on the poultry and egg sector using END as the weapon of choice by bio-terrorists could cause our trading partners to impose a ban on imports of these products from the state. To model this situation, it was assumed that our trading partners would impose a total ban (100%) rather than a partial ban (for example, 10%) on imports of poultry and poultry products. An export ban would eliminate shipments of poultry and poultry products from Mississippi to foreign markets.

Results show the poultry and egg sector would lose almost \$20 million in household income because of the banning of exports from Mississippi by the state's trading partners. Besides major declines in household income in the poultry and eggs sector, agricultural, forestry, and fishery services, wholesale trade, and the motor freight transportation and warehousing sectors would lose \$7.7million, \$2.8million, and \$1.5 million, respectively. Results also show the top 19 industries in the Mississippi economy will lose an estimated \$20.5 million in household income and the rest of the Mississippi industries will lose almost \$6.75million in household income if the state's trading partners banned poultry exports to their country.

The results of the 30% expenditures for destroying, disposing, cleaning, disinfecting and monitoring infected poultry farms show the poultry and eggs sector will receive almost \$48.1 million in household income as the state and poultry stakeholders clean up, get rid of infected birds, and monitor the industry until it returns to full production. The other beneficiaries of this process include agricultural, forestry, and fishery services sector-\$18.6 million, wholesale trade sector-\$6.8 million, motor freight transport and warehousing sector-\$3.7 million, and

maintenance and repair other facilities sector-\$3.2 million. These results suggest that even though a bio-terrorist's attack on the poultry and eggs sector will cause major financial losses to the state's economy, several sectors would be major beneficiaries in the recovery process.

## Employment

Employment changes in the Mississippi economy resulting from a 30% change in poultry output are shown in Table 3. The table also contains employment changes in the economy resulting from a ban on exports from the state and a 30% change in expenditures for destroying, disposing, cleaning, disinfecting, and monitoring (DDC&DM) affected poultry operations.

The base model shows the top 19 industries in the state employed 506,707 people while the rest of the economy employed an estimated one-million people. Direct employment in the poultry sector totaled 9,392 people. On a sector basis, eating and drinking establishments employed an estimated 72,185 workers. This sector was by far the largest Mississippi employer in 2000. The second leading employer in the state was the wholesale trade sector. This sector employed 50,930 people in the study year. The third leading employer was a general merchandise store employing 41,431, followed by hotels and lodging places. This sector employed 38,406 people in 2000.

The 30% decrease in poultry output would cause a decline of 946 people employed in this sector. The sector that would lose the second largest amount of employees is agricultural, forestry, and fishery services. This sector would lose 668 employees if a bio-terrorist's attack caused poultry output to decline by 30%. Also, the top 19 industries in the state would lose 1,104 employees while the rest of the industries in the state would lose 254 employees under the 30% reduction in poultry and eggs output scenario.

The effects of a ban on exports of poultry and poultry products from the state would cause the layoff of 1,051 workers in this industry. The ban on poultry and poultry products exports from the state would increase the unemployed in agricultural, forestry, and fishery services by 741 people. The top 19 industries in the state would lose 1,227 employees while the rest of the industries in the state would lose 283 resulting from a ban on poultry and poultry products by Mississippi's trading partners.

Employment changes in the economy resulting from the 30% expenditures for destroying, disposing, cleaning, disinfecting, and monitoring (DDC&DM) infected poultry farms will increase employment in the poultry sector by 2,543. Also these expenditures will increase employment in the agricultural, forestry, and fishery sector by 1,795 workers. Further, employment among the top 19 industries in Mississippi would rise by 2,969 employees during the recovery of the poultry industry.

#### Indirect Business Taxes

Results from the base model and selected changes in the poultry and eggs sector on indirect business taxes resulting from bio-terrorists' attack using END are shown in Table 4 for the Mississippi economy. The base model results indicate the poultry and eggs sector paid more than \$6.0 million in indirect business taxes in 2000. The top 19 sectors in the Mississippi economy paid more than \$3.4 billion in indirect business taxes while the rest of the industries in the state paid more than \$1 billion in indirect business taxes for business-related activities in the state. On a sector basis, the base model shows that owner-occupied dwellings and wholesale trade paid almost \$748.8 million and \$664.4 million in indirect business taxes, respectively.

The effects of the 30% decrease in poultry and eggs output suggest the state will lose more than \$8.7 million in indirect business taxes from the top 19 industries and almost \$1.5

million from the rest of the industries in the state. On a sector basis, wholesale trade will lose \$2.6 million in indirect business taxes, poultry and eggs will lose \$1.8 million and agricultural, forestry, fishery services sector would lose \$1.1 million in indirect business taxes.

The ban on exports of poultry and poultry products from Mississippi will cause the state to lose an estimated \$3.2 million in indirect business taxes from the top 19 industries while the remaining industries would lose \$549,865 thousand in the rest of the state's economy. The ban on exports of poultry and poultry products will have the largest impact on indirect business taxes generated from wholesale trade, poultry and eggs, and agricultural, forestry, and forestry services sectors. The indirect business taxes lost from these three sectors will be almost \$960,149, \$680,709, and \$420,197, respectively.

The 30% spending for destroying, disposing, cleaning, disinfecting and monitoring (DDC&DM) infected poultry farms will generate \$7.8 million in indirect business taxes for local and state governments by the top 19 industries. The rest of the state's industries will generate more than \$1.3 million in indirect business taxes that could help local and state officials provide adequate facilities and services to meet the needs of consumers and taxpayers in the state. The wholesale trade sector would benefit the most from a bio-terrorist's attack on the poultry and eggs sector in terms of indirect business taxes. This sector would generate \$2.3 million in indirect business taxes. The second leading beneficiary is the poultry and eggs sector. This sector would generate more than \$1.6 million in indirect business taxes.

#### Summary of Economic Impact of END on Poultry Industry

Table 5 shows that a 30% decrease in poultry and eggs output due to an Exotic Newcastle Disease outbreak will cause total output, income, employment, and indirect business taxes to decrease by \$648.1 million, \$127.3 million, 6,914 employees, and \$12 million, respectively in

the state' economy. The results from spending 30% on destroying, disposing, cleaning, disinfecting, and monitoring (DDC&DM) infected poultry farms suggests that total output will increase by \$581 million, income by \$114.1 million, employment by 6,197 employees, and indirect business taxes by almost \$10.8 million. Finally, a ban on exports of poultry and poultry products from Mississippi will cause total output to decrease \$240 million, income to decrease by \$47 million, employment to decrease by 2,560 people, and indirect business taxes to decline by almost \$4.5 million.

The net economic impact of a 30% reduction in poultry and eggs output due to an outbreak of the Exotic Newcastle Disease in Mississippi suggests total output, income, employment, and indirect business taxes will decrease \$307.2 million, income \$60.3million, employment 3,277 workers, and indirect business taxes \$5.77 million in the state's economy, respectively.

#### Summary and Conclusions

Results from this analysis suggest the Mississippi poultry industry will be greatly impacted by a bio-terrorists' attack, using the Exotic Newcastle Disease. Results also show that not only the poultry industry will be economically damaged but other sectors the poultry industry depends on for its inputs and firms who purchase its outputs as well. An END attack that reduced poultry output by 30%, coupled with a ban on exports from Mississippi would cause direct output to decline by \$414 million and exports to the state's trading partners to decrease by \$153.3 million. The direct, indirect and induced effects of these changes will be much greater in terms output, income, employment, and indirect business taxes. For example, the direct, indirect and induced effects reveal that total output will decline \$648 million and foreign exports will decrease by \$240 million in the Mississippi economy.

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**Table 1.** Economic Impact of Selected Reductions in Poultry Output and Foreign Exports on Output Values in the Mississippi Economy, 2000

Sector	Industry	Base Model (\$)	Industry Reduction (IR) (\$) 30%	Foreign Export Loss (FEL) (\$) 100%	DDC & DM Costs (State) (\$) 30%
2	Poultry and Eggs	1,379.9	(416,861,952)	(154,375,856)	373,632,480
26	Agricultural- Forestry- Fishery Services	240.0	(44,629,528)	(16,527,587)	40,001,352
447	Wholesale Trade	4,694.4	(18,317,892)	(6,783,638)	16,418,288
435	Motor Freight Transport and Warehousing	3,322.2	(13,978,700)	(5,176,711)	12,529,079
210	Petroleum Refining	4,497.6	(11,469,335)	(4,247,422)	10,279,941
87	Soybean Oil Mills	206.2	(10,207,973)	(3,780,303)	9,149,384
78	Prepared Feeds- N.E.C	239.8	(8,651,863)	(3,204,032)	7,754,647
461	Owner-occupied Dwellings	5,774.6	(7,046,560)	(2,609,542)	6,315,817
443	Electric Services	1,490.7	(6,411,924)	(2,374,518)	5,746,994
56	Maintenance and Repair Other Facilities	1,527.9	(5,801,511)	(2,148,465)	5,199,882
21	Oil Bearing Crops	184.9	(5,220,229)	(1,933,200)	4,678,881
89	Animal and Marine Fats and Oils	67.8	(5,049,185)	(1,869,857)	4,525,573
456	Banking	3,283.4	(4,926,607)	(1,824,463)	4,415,708
490	Doctors and Dentists	2,695.3	(4,725,353)	(1,749,933)	4,235,324
433	Railroads and Related Services	361.1	(4,513,855)	(1,671,609)	4,045,759
454	Eating & Drinking	2,345.4	(4,132,866)	(1,530,518)	3,704,279
462	Real Estate	2,068.7	(3,929,840)	(1,455,332)	3,522,308
441	Communications- Except Radio and TV	2,210.9	(3,586,335)	(1,328,122)	3,214,424
493	Other Medical and Health Services	708.3	(2,920,997)	(1,081,729)	2,618,084
451	Automotive Dealers & Service Stations	1,876.3	(2,462,539)	(911,948)	2,207,169
	Top 19 Industries	56,074.4	(199,060,144)	(73,717,646)	178,417,188
	Rest of Mississippi	67,262.1	(32,208,632)	(11,927,774)	28,868,529

Note: Industry is ranked 1 thru 20. Base model is in Millions of Dollars (\$)

**Table 2.** Economic Impact of END in the Poultry Industry on Incomes in Mississippi 2000

Sector	Industry	Base Model (\$)	Industry Reduction (IR) (\$) 30%	Foreign Export Loss (FEL) (\$) 100%	DDC & DM Costs (State) (\$) 30%
2	Poultry and Eggs	177.1	(53,622,732)	(19,858,026)	48,061,944
26	Agricultural, Forestry, Fishery Services	63.5	(20,784,458)	(7,697,077)	18,629,066
447	Wholesale Trade	1,844.8	(7,612,694)	(2,819,198)	6,823,242
435	Motor Freight Transport and Warehousing	792.9	(4,174,776)	(1,546,038)	3,741,843
56	Maintenance and Repair Other Facilities	672.3	(3,542,572)	(1,311,915)	3,175,200
490	Doctors and Dentists	1,362.0	(2,808,906)	(1,040,218)	2,517,616
433	Railroads and Related Services	148.9	(1,861,735)	(689,453)	1,668,669
21	Oil Bearing Crops	11.7	(1,623,349)	(601,173)	1,455,005
454	Eating & Drinking	764.1	(1,452,552)	(537,922)	1,301,920
492	Hospitals	956.4	(1,396,935)	(517,325)	1,252,070
493	Other Medical and Health Services	275.2	(1,369,075)	(507,007)	1,227,099
443	Electric Services	302.3	(1,340,688)	(496,495)	1,201,656
451	Automotive Dealers & Service Stations	761.5	(1,098,766)	(406,905)	984,822
494	Legal Services	419.3	(1,098,585)	(406,837)	984,660
450	Food Stores	522.4	(1,028,461)	(380,869)	921,808
456	Banking	618.8	(951,104)	(352,221)	852,472
455	Miscellaneous Retail	421.9	(909,125)	(336,675)	814,847
441	Communications, Except Radio and TV	503.7	(851,544)	(315,351)	763,237
78	Prepared Feeds, N.E.C	21.3	(769,942)	(285,131)	690,097
89	Animal and Marine Fats and Oils	10.2	(762,358)	(282,323)	683,300
	Top 19 Industries	15,466.6	(64,401,894)	(23,849,857)	57,723,283
	Rest of Mississippi	21,671.3	(9,253,610)	(3,426,875)	8,293,991

Note: Industry is ranked 1 thru 20. Base model is in Millions of Dollars (\$)

**Table 3.** Economic Impact of END in the Poultry Industry on Employment in Mississippi, 2000

Sector	Industry	Base Model	Industry Reduction (IR) 30%	Foreign Export Loss (FEL) 100%	DDC & DM Costs (State) 30%
2	Poultry and Eggs	9,392	(945.8)	(1,050.8)	2,543.2
26	Agricultural- Forestry- Fishery Services	10,765	(667.4)	(741.4)	1,794.5
447	Wholesale Trade	50,930	(66.2)	(73.6)	178.1
21	Oil Bearing Crops	4,872	(45.9)	(51.0)	123.3
435	Motor Freight Transport and Warehousing	32,567	(45.7)	(50.7)	122.8
454	Eating & Drinking	72,185	(42.4)	(47.1)	114.0
56	Maintenance and Repair Other Facilities	29,876	(37.8)	(42.0)	101.7
13	Hay and Pasture	9,796	(30.4)	(33.8)	81.8
455	Miscellaneous Retail	35,173	(19.5)	(21.7)	52.4
450	Food Stores	33,577	(18.3)	(20.4)	49.3
493	Other Medical and Health Services	13,070	(18.0)	(20.0)	48.3
490	Doctors and Dentists	26,288	(15.4)	(17.1)	41.3
449	General Merchandise Stores	41,431	(15.1)	(16.7)	40.5
451	Automotive Dealers & Service Stations	31,646	(13.8)	(15.4)	37.2
462	Real Estate	20,703	(13.1)	(14.6)	35.3
492	Hospitals	30,986	(12.8)	(14.2)	34.4
474	Personnel Supply Services	24,826	(12.3)	(13.6)	33.0
457	Credit Agencies	13,228	(12.1)	(13.5)	32.6
456	Banking	18,349	(9.2)	(10.2)	24.7
3	Ranch Fed Cattle	6,439	(9.0)	(10.0)	24.2
	Top 19 Industries	724,085	(1,232)	(1,369)	3,313
	Rest of Mississippi	784,575	(127)	(141)	340

Note: Industry is ranked 1 thru 20.

**Table 4.** Economic Impact of END in the Poultry on Mississippi Industry Business Taxes, 2000

Sector	Industry	Base Model (\$)	Industry Reduction (IR) (\$)	Foreign Export Loss (FEL) (\$)	DDC & DM Costs (State) (\$)
			30%	100%	30%
447	Wholesale Trade	664.435	(2,592,695)	(960,149)	2,323,827
2	Poultry and Eggs	6.084	(1,838,121)	(680,709)	1,647,504
26	Agricultural, Forestry, Fishery Services	6.101	(1,134,658)	(420,196)	1,016,992
461	Owner-occupied Dwellings	748.778	(913,713)	(338,374)	818,959
443	Electric Services	190.827	(820,790)	(303,962)	735,673
462	Real Estate	244.702	(464,859)	(172,151)	416,652
451	Automotive Dealers & Service Stations	290.167	(380,819)	(141,028)	341,327
21	Oil Bearing Crops	11.382	(321,433)	(119,036)	288,100
455	Miscellaneous Retail	174.240	(289,842)	(107,337)	259,785
450	Food Stores	168.902	(276,506)	(102,398)	247,832
454	Eating & Drinking	142.627	(251,324)	(93,072)	225,261
449	General Merchandise Stores	217.467	(237,245)	(87,859)	212,643
441	Communications, Except Radio and TV	116.324	(188,687)	(69,876)	169,120
435	Motor Freight Transport and Warehousing	40.970	(172,386)	(63,840)	154,509
433	Railroads and Related Services	10.206	(127,577)	(47,245)	114,347
459	Insurance Carriers	51.960	(118,020)	(43,706)	105,781
463	Hotels and Lodging Places	169.213	(110,389)	(40,880)	98,941
448	Building Materials & Gardening	81.092	(108,451)	(40,162)	97,204
453	Furniture & Home Furnishings Stores	58.969	(98,945)	(36,642)	88,684
456	Banking	53.071	(79,631)	(29,490)	71,373
	Top 19 Industries	3,838	(9,717,485)	(3,598,662)	8,709,761
	Rest of Mississippi	615	(455,288)	(168,606)	408,073

Note: Industry is ranked 1 thru 20. Base model is in Millions of Dollars (\$)

**Table 5.** Summary of Economic Impacts of Exotic Newcastle Disease on the Poultry Industry in Mississippi, 2000

Model Base	Direct Effects	Direct, Indirect & Induced Effects
Output Change	\$1,379.86	\$2,160.44
Income	\$177.50	\$424.26
Employment	9,392.00	23,045.00
Indirect Business Taxes	\$6.08	\$40.04
30% Output Reduction		
Output Level	(\$413.96)	(\$648.13)
Income Level	N/A	(\$127.29)
Employment Level	N/A	(6,914.00)
Indirect Business Taxes Level	N/A	(\$12.01)
30% DDC & DM Costs		
Output Level	\$371.03	\$580.92
Income Level	N/A	\$114.08
Employment Level	N/A	6,197.00
Indirect Business Taxes Level	N/A	\$10.77
100% Foreign Exports		
Output Level	(\$153.30)	(\$240.02)
Income Level	N/A	(\$47.14)
Employment Level	N/A	(2,560.00)
Indirect Business Taxes Level	N/A	\$4.45

Note:

<sup>1</sup> Values for Output, Income, Indirect Business Taxes, and Foreign Exports are in millions of dollars. Employment figures are actual numbers.

<sup>2</sup> Numbers in parenthesis denote negative values.