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# An Estimation of the Potential Impact on Georgia's Economy of Higher Energy Costs Predicted Under the Cap and Trade Provisions of H.R. 2454

**Marcia Jones, Sharon P. Kane, and John McKissick**

Recent "Cap and Trade" legislation, designed to reduce global warming emissions, continues to raise questions about potential impacts on the agricultural sector. Many studies are limited because they consider only impacts on agricultural production costs without examining the total agribusiness sector, though in general most agree that higher energy prices will result. The nature of Georgia's agribusiness economy suggests increases in agricultural production costs will have impacts that differ from the national picture. With higher expenses for energy-dependent inputs, such legislation will likely impose a higher burden on Georgia's farmers than at the national level.

***Key Words:*** cap and trade, economic impact, Georgia agribusiness, greenhouse gas (GHG) emissions

The debate surrounding H.R. 2454, or "Cap and Trade" legislation,[1] continues to raise questions as to its projected impacts on the nation's agricultural sector. According to some estimates, the legislation, intended to reduce greenhouse gas emissions, could have potentially devastating impacts on agriculture and other energy-intensive sectors in the economy through significant anticipated increases in energy prices (e.g., for fuel, irrigation, feed, and fertilizer). Much attention has been drawn to modeling and estimating the economic impacts on the agricultural sector. Responses to requests for information regarding the potential impacts of the Cap and Trade provisions of H.R. 2454 have generally centered on production agriculture and net farm income. Little has been discussed about the impacts on agribusinesses, particularly first line or directly related food and fiber manufacturing. For Georgia, where food and fiber production and processing are key components of the economy, exploring the implications of the legislation on ag-related businesses is as critical as predicting the likely impacts on farm-level production.

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[1] Title III of H.R. 2454, the American Clean Energy and Security Act of 2009, is often referred to as "Cap and Trade" because of its components that include a cap on the level of greenhouse gas emissions and a trading system for emission permits. For further details, see the July 14, 2009 report, "The American Clean Energy and Security Act (H.R. 2454): Section-by-Section," from the Committee on Energy and Commerce, U.S. House of Representatives.

The objective of this report is to explore the potential impacts on Georgia's agribusiness industry given the predicted effects of Cap and Trade on energy prices. Using IMPLAN input-output modeling (Minnesota IMPLAN Group, Inc., 2010), we use projections from previous studies of potential impacts on agricultural production, food processing, and fiber manufacturing to estimate impacts on Georgia's agribusiness economy.

While the number of persons employed in direct farm production has declined in recent years, agriculture and the businesses that process the raw materials used or produced by farmers have long been key parts of both the national and state economies. The agribusiness sector (including crop and livestock production, processing and manufacturing of primary agricultural products, supply of inputs used in agricultural production, and services and distribution) contributes to the state economies both directly and indirectly in terms of the value of output and jobs. Input sectors such as agricultural chemical and farm machinery manufacturers, and agricultural support service providers such as veterinary services and farm financing, are linked to the agricultural production and processing industries. Related industries also include meat slaughtering, food, beverage, leather, textile, and tobacco manufacturing; food warehousing, wholesaling, and retailing; and pulp and paper manufacturing.

During 2008, the agribusiness sector generated almost $2 trillion in output for the U.S. economy and employed more that 12 million people. These numbers represent the direct economic value of the agribusiness sector, excluding the multiplier effects on other sectors. As income increases in the agribusiness sector, expenditures on goods and services produced by other sectors also increase, stimulating the overall level of economic activity. In addition, consumption of agricultural products, either in direct or processed forms, further adds to the economic impact of agribusiness activity. Thus, the potential impacts of higher energy prices on farm production costs would spread beyond the agricultural sector to the rest of the economy through such impacts as the effects on food and fiber processing costs, farm income, and reduced sales from farm-related suppliers.

## The Cap and Trade Provisions—In a Nutshell

The American Clean Energy and Security Act of 2009, H.R. 2454, sponsored by Representatives Henry Waxman (D-CA) and Edward Markey (D-MA), was designed to reduce global warming by gradually reducing covered greenhouse gas (GHG) emissions. The legislation requires that GHG emissions be reduced by 3% below 2005 levels in 2012, 17% below 2005 levels in 2020, 42% below 2005 levels in 2030, and 83% below 2005 levels in 2050. Although the Act contains several titles, most interest and economic modeling have focused on Title III, often referred to simply as "Cap and Trade," which establishes a U.S. national cap on total GHG emissions.

According to the cost estimate (U.S. Congress, 2009), the industries covered by the Act (including electric utilities, oil companies, and large industrial sources) contribute about 85% of U.S. greenhouse gas emissions or approximately 17% of current global emissions. The remaining major parts of H.R. 2454 deal with clean energy and energy efficiency (Titles I and II) and address competitiveness issues and the transition to a clean energy economy (Title IV) and the role of domestic agricultural and forestry-related offsets (Title V).

Under Title III, the Environmental Protection Agency (EPA) would establish two separate regulatory initiatives known as cap-and-trade programs—one covering emissions of most types of GHGs and the other covering hydrofluorocarbons (HFCs). Once regulated entities received rights or allowances from the EPA, they could then emit HFCs under the cap-and-trade programs up to those cap allowances. Some of the allowances would be auctioned by the federal government while the remainder would be distributed at no charge as deemed best by the regulators. Each allowance would entitle companies to emit the equivalent of one metric ton of carbon dioxide equivalent up to the annual limit for total emissions as set by the legislation ("Cap"). After the allowances were distributed, regulated entities would be free to buy and sell allowances at a price to be determined by the market ("Trade") (U.S. Congress, 2009).

At the national level, 1%–3% of allowances in each year will be set aside in a Strategic Allowance Reserve, from which allowances will be auctioned four times each year. The establishment of an offset/trade market would allow companies to comply with the emissions cap either through reductions in their emissions levels or through offset credits from domestic and international trade of allowances. As currently written, the agricultural industry could be issued allowances that could be traded in the offset market. It should be noted that offset options are subject to restrictions which include a maximum cap on the total quantity of emissions of 2 billion metric tons of $CO_2$ equivalent in each year, split evenly between domestic and international offsets (Montgomery et al., 2009). Additional reductions in emission levels could also be obtained from reducing deforestation (particularly in the Third World) or through domestic carbon sinks or sequestration.

Production agriculture could benefit from being exempt from having to "cap" greenhouse gas emissions but allowed to trade emission permits in the offset market. The sector could also benefit from activities associated with carbon sinks or sequestration. It is this potential revenue from carbon offsets that is presented in some reports as a large benefit to agriculture, and, in some cases, estimated to exceed any projected increases in agricultural production costs.

## The Implications for Agriculture

Understandably, the discussions about Cap and Trade have focused largely on determining whether the costs of reducing greenhouse gas emissions outweigh the benefits of such action. The response varies significantly depending on the respondent's perspective as well as the assumptions made about such variables as

the progress achieved in increasing energy efficiency and reducing energy consumption, the efficiency of the projected offset market, and the costs of emissions reductions relative to permit prices. However, there is general consensus on both sides of the debate that implementations of the provisions of H.R. 2454 will result in higher energy prices. Those findings are confirmed in research conducted by the U.S Environmental Protection Agency (U.S. EPA, 2009) and used as the basis for the analysis completed by the U.S. Department of Agriculture (USDA, 2009b). The EPA report (p. 49) stated conclusively that a "cap-and-trade policy increases the price of energy-intensive goods."

There is also little debate that, as an energy-intensive industry, food and agricultural production will be impacted, directly and indirectly, by higher energy prices. The direct impacts are tied to costs for transportation and fuels such as diesel, gasoline, and electricity. The indirect costs are linked to the manufacture of other agricultural inputs such as seed, feed, and agricultural chemicals. The impacts on fertilizer, one of the largest components in farm production costs, are delayed initially due to exemptions granted to the agricultural industry.[2] Nonetheless, it is widely projected that impacts will be felt by companies linked to processing, distribution, and other related agribusinesses. Although production agriculture is currently exempt from the GHG emissions cap, many industries that supply inputs to the sector, including energy suppliers, are subject to the caps. As such, the implications of higher input prices for agricultural production cannot be ignored.

For Georgia, as with other states, the performance of the farm producing and processing subsectors is of tremendous significance to the overall performance of the agribusiness economy because farm production is intricately intertwined with other parts of the economy. Based on the value of output produced in 2008 (Minnesota IMPLAN Group, Inc., 2010), manufacturing related to the processing of agricultural raw materials, including food, beverages, tobacco, leather, and fibers, accounted for almost half (45%) of the value of all manufacturing products produced in Georgia (figure 1) and 44% of all persons employed in manufacturing (table 1).

Moreover, consumption of agricultural products, either in direct or processed forms, further adds to the economic impact of agribusiness activity. Taking into account the linkages among the sectors—including the indirect or multiplier effects—the contributions of the agribusiness sector to the level of economic activity in the State are even more impressive. These additional effects incorporate not only the effects of input purchases by the agribusiness sector, but also the increased household income of the workers employed in both the agribusiness sector and the input supply businesses.

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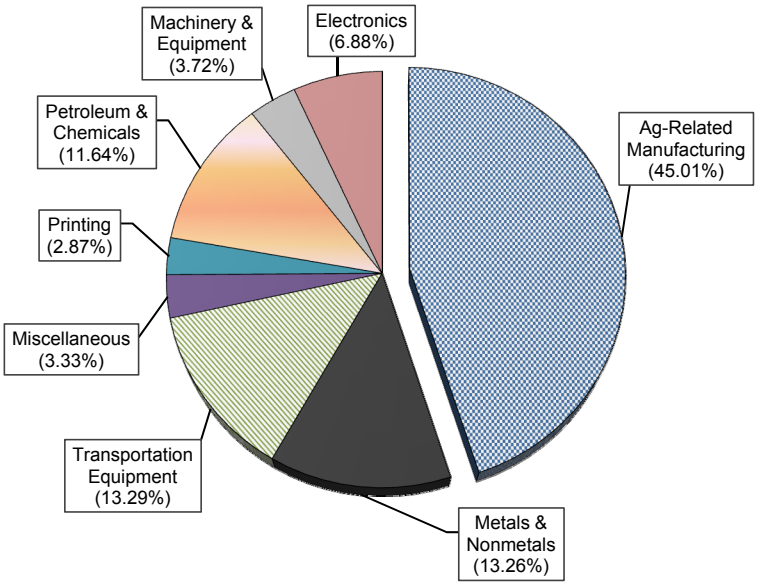
[2] Fertilizer is classified as an energy-intensive trade exposed entity (EITE) Under Title IV, Subtitle B of the Act designed to protect firms in EITE industries from incurring energy-related costs that would disadvantage them as compared to foreign competitors not subject to those costs. The bill sets a maximum amount of allowances that can be rebated to EITE industries from 2012, and are expected to be eliminated by 2035 or subject to action by the President. [See USDA (2009b) for further details.]




*Source:* Authors' calculations using IMPLAN data (Minnesota IMPLAN Group, Inc., 2010).

**Figure 1. Relative output share of Georgia's manufacturing sector**

**Table 1. Relative Employment Share of Georgia's Manufacturing Industry Sectors**

| Manufacturing Industry Sector | Share of Employment | Manufacturing Industry Sector | Share of Employment |
|---|---|---|---|
| Ag-Related Manufacturing | 44.43% | Printing | 5.70% |
| Metals & Nonmetals | 18.43% | Petroleum & Chemicals | 4.85% |
| Transportation Equipment | 8.98% | Machinery & Equipment | 4.01% |
| Miscellaneous | 7.09% | Electronics | 6.51% |

*Source:* Authors' calculations using IMPLAN data (Minnesota IMPLAN Group, Inc., 2010).

Georgia's production agriculture and direct agribusiness industries contributed almost $70 billion in economic activity to the State in 2008, and employed close to 400,000 workers [Center for Agribusiness and Economic Development (CAED), 2010]. With the indirect impacts on all other sectors including manufacturing, construction, retail and wholesale trade, and government, the economic significance of the agricultural production sector cannot be overstated. Despite the expected decline in job growth in those production activities, largely due to increases in labor productivity, the backward and forward linkages associated with other sectors mean that crop and animal production will continue to be

**Table 2. Average per Farm Production Costs for U.S. and Georgia, 2008**

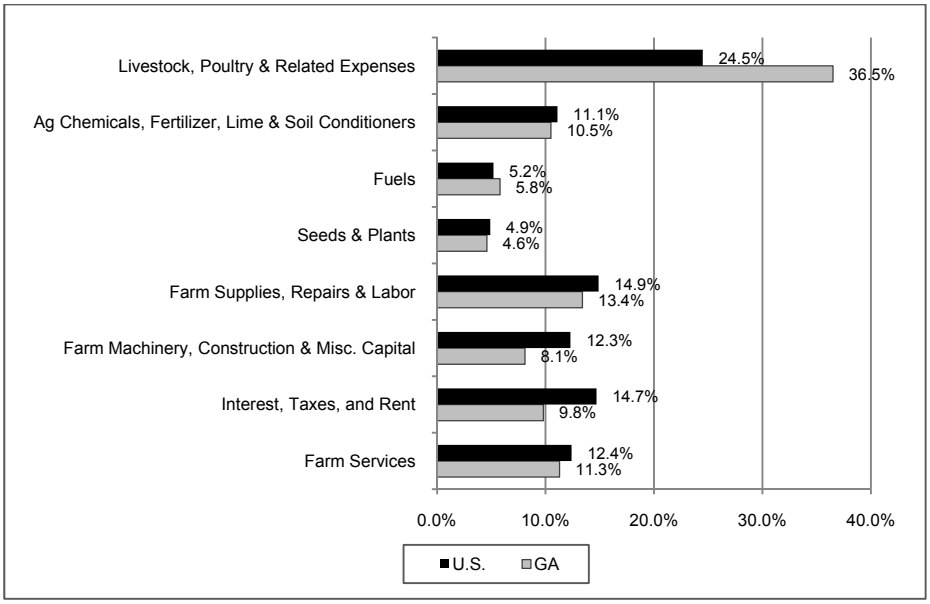
| | UNITED STATES | | GEORGIA | | |
|---|---|---|---|---|---|
| | Average per Farm Expenditures | | Average per Farm Expenditures | | GA Avg. per Farm as % of U.S. |
| 2008 Production Expense Category | $ Value | % | $ Value | % | |
| Total Farm Production Expenditures | 140,075 | 100.0 | 123,642 | 100.0 | 88.3 |
| Livestock, Poultry & Related Expenses | 12,912 | 9.2 | 11,297 | 9.1 | 87.5 |
| Feed | 21,398 | 15.3 | 33,891 | 27.4 | 158.4 |
| Ag Chemicals | 5,338 | 3.8 | 4,812 | 3.9 | 90.1 |
| Fertilizer, Lime & Soil Conditioners | 10,265 | 7.3 | 8,159 | 6.6 | 79.5 |
| Fuels | 7,300 | 5.2 | 7,113 | 5.8 | 97.4 |
| Farm Supplies & Repairs | 7,254 | 5.2 | 5,439 | 4.4 | 75.0 |
| Seeds & Plants | 6,889 | 4.9 | 5,649 | 4.6 | 82.0 |
| All Other Production Expenses | 68,719 | 49.1 | 47,282 | 38.2 | 68.8 |

*Source:* USDA/NASS, "Farm Production Expenditures: 2008 Summary" (August 2009).

significant contributors to Georgia's economic growth. Agribusinesses, including manufacturing firms, use Georgia's farm commodities as inputs in their processing operations. As such, any projected declines in agricultural production due to higher production costs would lead to higher input costs for industries that depend on agricultural output, contributing to a potential decline in domestic and global competitiveness as a result of these linkages.

Based on 2008 estimates from the U.S. Department of Agriculture (USDA, 2009c), farm expenditures on fuel, feed, fertilizer, and chemicals amount to an average of $44,301 across the country, representing almost one-third of farm production expenses (31.6%). In Georgia, the corresponding numbers are $53,975 per farm, or almost half (43.7%) of total expenses (table 2). Further, for Georgia farmers, expenditures for feed, agricultural chemicals, and fuels represent a larger share of total farm expenditures as compared to farmers in other parts of the nation. This is particularly true for feed expenses related to Georgia's large poultry and animal industry for which those expenses represent almost 30% of the average Georgian farm expenses. The corresponding number for the average U.S. farmer is only 15%. Consequently, livestock-related expenses represent more than one-third of the average farm expenses for Georgia farmers and only one-fourth for the average U.S. farmer (figure 2).

As a result of the questions raised concerning the uncertainties of the impacts on agriculture, several studies have attempted to assess the potential economic impacts to farmers at the regional and state levels. In addition, the 25 × ′25 Carbon Work Group (the Group) published a 2009 report summarizing the significant findings of both macroeconomic and sector-specific studies, including some that focused primarily on the agriculture and forestry sectors of the economy. The Group found that results from "objective independent studies" suggest only "modest" increases in the costs to agriculture and forestry. However, the Group's




*Source:* USDA/NASS, "Farm Production Expenditures: 2008 Summary" (August 2009).

**Figure 2. Share of total farm expenses: Georgia as compared to U.S.**

report cautions that the costs and benefits will not be distributed uniformly across all sector members and that much about the ultimate outcomes remains unknown (p. 1).

The uncertainty in agricultural production is of particular interest in our study as to the potential impacts not only on agricultural production in Georgia, but equally important, the impact on agricultural-based manufacturing, including food processing and fiber manufacturing. Summaries of published studies most relevant to Georgia's agricultural sector are provided below, but it should be noted that these investigations are primarily focused on the effects that Cap and Trade would have on U.S. production agriculture and farm income.

In one report, the USDA (2009b) completed an analysis of the potential effects of higher energy costs on agricultural supply, demand, prices, and net farm income as compared to the baseline values for 2012–18. Among the many assumptions made, the authors assumed there would not be any technological changes in production, no alteration of inputs in agriculture (no changes in production functions or input substitutions), and no increase in demand for bio-energy as a result of higher energy prices. The analysis used the energy price effects estimated by the EPA in its study of the effects of H.R. 2454 and reported in table 3 (U.S. EPA, 2009).

Using these projected increases in energy prices, the USDA concluded, "… the agricultural sector will have modest costs in the short-term and net benefits—perhaps significant net benefits—over the long-term" (USDA, 2009b, p. 1). This

**Table 3. Estimated Impacts of H.R. 2454 on Energy Prices, Using EPA Estimates**

| Description | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|
| **$/Ton $CO_2$e (2005 $):** | | | | | | | | |
| Allowance Price | $12.6 | $16.3 | $20.8 | $26.5 | $33.9 | $43.4 | $55.3 | $70.4 |
| **Percent Change from Baseline (%):** | | | | | | | | |
| Electricity Price | 10.7 | 12.7 | 14.0 | 13.3 | 16.9 | 24.0 | 29.1 | 35.2 |
| Natural Gas Price | 7.4 | 8.5 | 8.6 | 10.4 | 14.3 | 18.9 | 24.1 | 30.9 |
| Petroleum Price | 3.2 | 4.0 | 4.7 | 5.6 | 7.2 | 9.0 | 11.4 | 14.6 |

*Source:* USDA (2009b).

conclusion relied heavily on the assumption that farmers will earn significant revenues from the establishment of a market for offsets.[3]

Although the study acknowledged that the cost of energy inputs such as electricity, natural gas, and petroleum will increase as a result of the capping of emissions on these industries, it excludes the impact on fertilizer (because of the protections included in the Act) and included projected revenues from the offset market. However, as the authors of the EPA study acknowledge, "There are many uncertainties that affect the economic impacts of H.R. 2454 including such factors as the degree to which new nuclear power is technically and politically feasible, the availability and cost of domestic offset projects, and the availability and cost of carbon capture and storage technology" (U.S. EPA, 2009, p. 8). Thus, although the conclusion is reached that passage of the legislation will impact agricultural production costs, the extent of those impacts remains unclear for the nation as a whole. The implications for Georgia are even more difficult to draw from this study, given that the State's commodity mix and production functions are different from the national average picture drawn where the focus is on crop production.

While the reality is that producers will likely change production practices as input costs change and that commodity prices will rise to reflect higher production costs, the full scope of the economic impacts on agricultural production and the agribusiness industry remain unclear. This uncertainty is even more marked when national and regional differences in such factors as commodity mixes, production practices, and types and levels of agricultural-related processing are taken into account. To address some of these national and regional variations, several regional impact studies have been completed with varying results and implications at the national level and for Georgia.

The Agricultural and Food Policy Center (AFPC) at Texas A&M University released a study in 2009 which, like the USDA study discussed above, relied on the EPA estimated energy price changes. However, the study went further by including estimated carbon and agricultural commodity prices to evaluate the

[3] The proposed legislation would allow production agriculture to sell carbon offsets to other industries subject to the caps and to use land for carbon sequestration. The USDA analysis includes these potential sources of revenue but excludes the potential effects of the offsets.

**Table 4. Ending Cash Reserves in 2016 for the Cap and Trade Modeling for Representative Farms, by Commodity**

| Commodity/Farm Type | Ending Cash Reserves in 2016 | | | |
|---|---|---|---|---|
| | Higher | Lower | Total | Lower Ending Reserves as % of Total |
| Feedgrain/Oilseed | 17 | 8 | 25 | 32.0 |
| Wheat | 8 | 3 | 11 | 27.3 |
| Cotton | 1 | 13 | 14 | 92.9 |
| Rice | 0 | 14 | 14 | 100.0 |
| Dairy | 1 | 21 | 22 | 95.5 |
| Cattle Ranches | 0 | 12 | 12 | 100.0 |
| Total | 27 | 71 | 98 | 72.4 |

*Source:* Agricultural and Food Policy Center (2009, table 11), with additional calculations.

farm-level impacts of H.R. 2454. The model included data for 98 representative crop farms and dairy and livestock operations from across the United States, including Georgia (a cotton operation) to simulate economic activity using such characteristics as location, size, crop mix, and average receipts. Based on the data collected from these representative farms and the model developed by AFPC, projections were made as to the impacts on farm income characteristics from the baseline date of 2009 to 2016. The authors determined that the best evaluator of the farm-level results was average ending cash reserves in 2016 (table 4). Accordingly, our report will focus only on the results issued for that income measure. In summary, the AFPC study indicated that almost three out of every four representative farms would be worse off at the end of the model period on the basis of cash on hand at the end of 2016. For commodities of particular interest to Georgia (cotton, dairy, and cattle), more than 90% of producers would be worse off.

In a Food and Agricultural Policy Research Institute (FAPRI) report, Brown and Westhoff (2009) estimated the effects of projected energy price increases on specific Missouri crop production costs using assumptions similar to those used in the USDA (2009b) study but with energy price increases as computed by CRA International (Montgomery et al., 2009). Except for motor fuel prices, the estimates for both carbon allowance prices and the projected increases in energy prices (using 2008 prices) are higher than those projected in the USDA study, based on 2005 prices (table 5).

Brown and Westhoff's (2009) findings suggested production cost increases for dryland corn of 3.2% per acre by 2020 and 8.1% by 2050. Soybean operating costs are expected to rise by 1.6% by 2020 and 4.4% by 2050 (table 6). According to a report in the *Missouri News Scene*, for selected farmers, "[t]he legislation would cost … an additional $11,000 a year in 2020 and more than $30,000 a year by 2050" (Johnson, 2009, p. 13). It should be noted that, unlike the USDA (2009b) study, this analysis did not include the potential revenues from the offset market.

**Table 5. Estimated Impacts of H.R. 2454 on Energy Prices, Using CRA Estimates**

| Description | 2015 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| **$/Metric Ton $CO_2$ (2008 $):** | | | | | |
| Allowance Price | $22 | $28 | $46 | $74 | $124 |
| **Percent Change from Baseline (%):** | | | | | |
| Electricity Price | 7.3 | 16.0 | 22.0 | 34.0 | 45.0 |
| Natural Gas Price | 10.0 | 14.0 | 16.0 | 25.0 | 34.0 |
| Motor Fuel Price | 3.0 | 4.0 | 5.0 | 7.0 | 11.0 |

*Source:* Montgomery et al. (2009, p. 7, table 1.1).

**Table 6. Projected Impacts on Missouri Crop Production Costs**

| Description | 2009 Baseline Prices | Percent Change from Baseline (%) | | | |
|---|---|---|---|---|---|
| | | 2020 | 2030 | 2040 | 2050 |
| Dryland Corn | $313.96 | 3.2 | 3.8 | 5.7 | 8.1 |
| Irrigated Corn | $385.94 | 3.5 | 4.1 | 6.2 | 8.8 |
| Soybeans | $183.43 | 1.6 | 2.0 | 2.8 | 4.4 |
| Soft Red Wheat | $181.21 | 4.1 | 2.8 | 7.4 | 10.4 |

*Source:* Brown and Westhoff (2009, p. 9, table 6).

Assuming agricultural emissions are left uncapped, research at the Center for Agricultural and Rural Development at Iowa State University (Babcock, 2009) found that H.R. 2454 will likely have a small impact on corn and soybean farms. Diesel fuel costs were estimated to rise by $0.80/acre while overall production costs would rise by about 1%–2% by 2020. However, Babcock's analysis showed that despite increased production costs, there would be an overall net benefit to farmers based on the revenues derived from selling soil carbon sequestration offsets.

Although the results of various studies confirm that agricultural production will be impacted as energy prices increase, few estimates exist of the precise effects of higher carbon prices on agricultural production. A 2001 study by Peters et al. estimated the likely effects of several different levels of carbon prices on agricultural production.[4] Across crop and livestock commodities, price increases and production declines were projected to be less than 1% by 2010. On the other hand, using a projected carbon price of $10 per ton (below the USDA estimated minimum expected price of $14), a more recent study conducted by Resources for the Future (RFF) found that short-run projected decreases in agricultural output would be about 0.56%, rising to 0.68% in the long run, when capital and technology can

[4] The charges considered in the Peters et al. study ($14, $100, and $200 per metric ton of carbon) were derived from estimates to reduce GHG emissions to a 1990 minus 7% level by 2010 under different levels of carbon trading and global participation.

change (Ho, Morgenstern, and Shih, 2008). From these estimates, it is reasonable to predict that the declines would be larger at a carbon price of $14 (the minimum projected by USDA), and significantly higher at the $200 per ton estimate (the maximum price expected by the USDA experts).

Overall, results of the effects of H.R. 2454 are as different as the assumptions used in the various models. Regardless of the source of the analysis or the authors' perspectives, it is widely accepted that the impacts from H.R. 2454 would differ depending on how energy costs change. According to the CRA report, "the cost of bringing emissions down to levels required by the caps cannot be avoided" (Montgomery et al., 2009, p. 2). The report estimated that in 2030, the U.S. manufacturing sector will lose 260,000 jobs and the agricultural sector will lose 59,000. A Heritage Foundation study conducted by Kreutzer et al. (2009) looked specifically at the impacts on industrial production and concluded H.R. 2454 will affect some industries more than others, but farmers will be among the groups hardest hit by emissions controls. Their results suggested that America's manufacturing base would lose an average of 389,000 jobs per year between 2012 and 2035, with a high over this period of 1.38 million in 2035 (1.17 million in durable manufacturing and 210,000 jobs in nondurable manufacturing). Kreutzer et al. also predicted that farm profits will decline by 28% in 2012, and further decline by an average of 57% through 2035. At the state level, they estimated average nonfarm job losses of 38,389 in Georgia from 2012–2035. Despite these predictions, supporters of the legislation continue to point out that the economic costs, and hence the economic impacts, are overstated because of the assumption of unchanged production functions and commodity prices.

## The Impacts on Georgia's Economy

Despite the numerous studies on the subject, none have conclusively determined the likely impacts of H.R. 2454 on the agricultural community either at the state or national level. Further, while the existing studies are diverse in both their focus and projections, none have focused on the animal and crop production mix of significance to Georgia, being more applicable to row crop agriculture. Yet, the nature of Georgia's agribusiness economy means increases in agricultural production costs will have impacts on other sectors in its economy that may be different from the national picture. For example, Georgia's large livestock industry, particularly poultry, will not have the option of generating revenues from carbon offsets. In addition, because fuel represents a larger share of farm expenses for Georgia's farmers when compared to the average U.S. farmer, H.R. 2454 will clearly have different impacts on Georgia's agribusinesses. This reality is confirmed by a recent USDA (2009d) study that noted agricultural producers are not affected uniformly by the rise in energy prices. Energy-related inputs and the ability to generate and provide offsets have a different importance across the sector and impacts reflect those different roles, both by commodity and region of the country.

The increases in corn and soybean production costs predicted by both the Missouri study (Brown and Westhoff, 2009) and the USDA (2009d) report would be reflected in higher feed costs for Georgia's livestock farmers. As the nation's top poultry producer (with broiler production of 1.4 billion head of birds and table egg output of 4.8 billion eggs in 2007),[5] Georgia's poultry industry will be impacted at both the production and processing levels. Another recent USDA report highlighted the impact of energy prices on livestock production due to the fact that feed and energy costs are large components of meat and dairy production expenses (USDA, 2009a). The authors noted that higher energy prices will also raise the costs of animal slaughtering, processing, refrigeration, and retailing. With higher expenses for these and energy-dependent inputs such as irrigation and electricity, H.R. 2454 is likely to impose a higher burden on Georgia's farmers than at the national level.

Commissioned by the National Association of Manufacturers (NAM), and one of the few studies examining the impacts of the legislation on Georgia's economy, the Science Applications International Corp. (2009) predicted that high energy prices, fewer jobs, and loss of industrial output are estimated to reduce Georgia's gross state product (GSP) by between $1.1 and $1.9 billion per year by 2020, and $11.4 and $15.6 billion by 2030. Such declines in Georgia's manufacturing sector would impact the agribusiness sector through forward and backward linkages between the two sectors. For instance, declines in the processing of agricultural raw materials in the food and beverage industry or in textile and apparel manufacturing would be felt in the agricultural production sector. As a result, the NAM study further predicted that, by 2030, Georgia's agribusiness sector will be significantly impacted due to declines in its food processing and paper manufacturing industries. For these two key agribusiness industries, output declines of 1.9% to 2.1% and 6.6% to 7.2%, respectively, are projected by NAM.

Using IMPLAN economic impact analysis modeling,[6] those ranges of production declines in the agribusiness sectors from NAM were used in this study to estimate the likely impacts on the remainder of Georgia's economy. The effect on the rest of the economy, or indirect effects, occurs as a result of food manufacturing industries (or any directly affected industry) purchasing inputs from other sectors to produce output in their own industry. Further impacts occur when their employees make purchases from their earned income. These combined effects are the direct and indirect effects on the rest of the economy, often referred to as multiplier effects.

For the food processing industry, we estimated that the direct and indirect impacts on the economy would be between $1.21 and $1.33 billion. The corresponding impacts computed by CAED for the declines projected by NAM in the

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[5] These data are provided by the USDA/NASS Georgia Field Office.

[6] Impact Analysis for Planning (IMPLAN) is an economic impact assessment software system used in determining the economic impact of economic sectors and events. The data used were extracted using the 2008 model. [See Minnesota IMPLAN Group, Inc. (2010) for more detail.]

paper manufacturing industry range from $1.15 to $1.28 billion per year. Based on the NAM projections, we estimate that the employment base for Georgia's agribusiness sector will shrink annually by 4,000–5,000 jobs due to the decline in the food processing industry, and a similar number from declines in the paper manufacturing sector. Tables 7 and 8 demonstrate the range of total impacts (direct and indirect) across the diverse sectors of Georgia's economy resulting from the outlined scenarios from NAM on the food processing and paper manufacturing industries, respectively.

Thus, although production agriculture is not currently subject to the cap in GHG emissions, linkages with industries subject to the caps, such as input supply industries and processors of agricultural products, would mean that passage of the legislation will impact agricultural production costs at the national and state levels. The nature of Georgia's agribusiness economy suggests increases in agricultural production costs will have impacts that differ from the national picture. For instance, with higher expenses for energy-dependent inputs, H.R. 2454 is likely to impose a higher burden on Georgia's farmers than at the national level. Hence, the results reported in tables 7 and 8 may not be typical for all states, and would certainly be different for those states whose agribusiness economies are less dependent on animal slaughtering and other agricultural-based processing than is Georgia. While the reality is that producers will likely change production practices as input costs change, and commodity prices will rise to reflect higher production costs, direct and indirect economic impacts on Georgia's agricultural production sector and its agribusiness industry should be expected.

With such varying estimates and projections at the national level, we sought to estimate the likely impacts of changes in agricultural production on Georgia's economy. Using IMPLAN and farm gate production values, the impacts of each 1% change[7] in agricultural production were computed.

Since the IMPLAN model is linear, computing additional changes would be a multiple effect of the 1% change, allowing for a range of estimates to be developed. The results indicated that for every 1% decline in farm production, Georgia's economy would contract by roughly $215 million and 1,700 jobs (table 9). When combined with first-line agricultural-related processing, the economic impact of a 1% decline in food and fiber production would mean a $650 million decline from the 2008 level of economic activity. The corresponding impacts on employment would be a loss of slightly more than 3,500 jobs (table 10).

[7] In their revised report of December 2009 (USDA, 2009d, tables 17 and 20), USDA economists predicted that, of the commodities significant to Georgia's agribusiness economy, national production declines in the magnitude of 0.4% to 22.7% in broiler, eggs, milk, and hog production, and as much as 14.1% for cotton can be expected from 2015 to 2050.

**Table 7. Potential Impact of Estimated Food Processing Industry Declines on Georgia's Economy**

| Sector | Output Base ($ mil.) | Total Output Impact ($ mil.) Low Estimate (1.9% decline) | High Estimate (2.1% decline) |
|---|---|---|---|
| Agricultural Production | 11,023 | 60.1 | 66.4 |
| Mining | 2,058 | 0.1 | 0.1 |
| Construction | 45,338 | 3.9 | 4.3 |
| Food Processing | 40,643 | 772.2 | 853.5 |
| Other Manufacturing | 141,888 | 24.4 | 27.0 |
| Transportation, Utilities & Information | 46,426 | 48.2 | 53.3 |
| Wholesale & Retail Trade | 82,890 | 69.1 | 76.4 |
| Service | 351,713 | 223.9 | 247.5 |
| Government | 61,799 | 5.8 | 6.4 |
| Total | 783,777 | 1,207.7 | 1,334.8 |

*Source:* Authors' calculations using IMPLAN data (Minnesota IMPLAN Group, Inc., 2010).

( extended . . . → )

**Table 8. Potential Impact of Estimated Paper Manufacturing Industry Declines on Georgia's Economy**

| Sector | Output Base ($ mil.) | Total Output Impact ($ mil.) Low Estimate (6.6% decline) | High Estimate (7.2% decline) |
|---|---|---|---|
| Agricultural Production | 11,023 | 63.5 | 69.3 |
| Mining | 2,058 | 1.1 | 1.1 |
| Construction | 45,338 | 6.4 | 7.0 |
| Food Processing | 40,643 | 634.2 | 691.9 |
| Other Manufacturing | 141,888 | 44.1 | 78.8 |
| Transportation, Utilities & Information | 46,426 | 74.8 | 81.6 |
| Wholesale & Retail Trade | 82,890 | 81.3 | 88.7 |
| Service | 351,713 | 234.9 | 256.2 |
| Government | 61,799 | 8.7 | 9.5 |
| Total | 783,777 | 1,149.0 | 1,284.1 |

*Source:* Authors' calculations using IMPLAN data (Minnesota IMPLAN Group, Inc., 2010).

( extended . . . → )

**Table 7. Extended**

| Sector | Employment Base (No.) | Total Employment Impact (No.) | |
|---|---|---|---|
| | | Low Estimate (1.9% decline) | High Estimate (2.1% decline) |
| Agricultural Production | 80,735 | 398 | 440 |
| Mining | 7,252 | 0 | 0 |
| Construction | 368,833 | 42 | 46 |
| Food Processing | 67,078 | 1,274 | 1,409 |
| Other Manufacturing | 359,156 | 64 | 70 |
| Transportation, Utilities & Information | 229,424 | 255 | 281 |
| Wholesale & Retail Trade | 792,024 | 535 | 591 |
| Service | 2,680,491 | 1,611 | 1,780 |
| Government | 810,399 | 33 | 37 |
| Total | 5,395,391 | 4,212 | 4,656 |

**Table 8. Extended**

| Sector | Employment Base (No.) | Total Employment Impact (No.) | |
|---|---|---|---|
| | | Low Estimate (6.6% decline) | High Estimate (7.2% decline) |
| Agricultural Production | 80,735 | 339 | 370 |
| Mining | 7,252 | 5 | 5 |
| Construction | 368,833 | 70 | 76 |
| Food Processing | 67,078 | 1,172 | 1,279 |
| Other Manufacturing | 359,156 | 152 | 165 |
| Transportation, Utilities & Information | 229,424 | 276 | 302 |
| Wholesale & Retail Trade | 792,024 | 632 | 690 |
| Service | 2,680,491 | 1,812 | 1,976 |
| Government | 810,399 | 45 | 50 |
| Total | 5,395,391 | 4,503 | 4,912 |

**Table 9. Impact of a 1% Decline in Agricultural Production on Georgia's Economy**

| | Output Impact ($) | | Employment Impact (No.) | |
|---|---|---|---|---|
| Sector | Direct | Indirect | Direct | Indirect |
| Agricultural Production (Farm Gate + Landscape) | 139,745,202 | 0 | 1,247 | 0 |
| Mining | 0 | 65,569 | 0 | 0 |
| Construction | 0 | 802,752 | 0 | 9 |
| Manufacturing | 0 | 17,945,784 | 0 | 21 |
| Transportation, Utilities & Information (TUI) | 0 | 11,918,295 | 0 | 47 |
| Wholesale & Retail Trade (Trade) | 0 | 10,009,071 | 0 | 83 |
| Finance, Insurance & Real Estate (FIRE) | 0 | 17,435,903 | 0 | 78 |
| Services | 0 | 15,737,504 | 0 | 194 |
| Government & Other | 0 | 996,108 | 0 | 4 |
| Total | 139,745,202 | 74,910,986 | 1,247 | 438 |

*Source:* Authors' calculations using IMPLAN data (Minnesota IMPLAN Group, Inc., 2010).

*Notes:* Total impact of 1% decline in farm production = $214.7 million drop in economic activity and ~1,700 jobs lost; agricultural production as percent of economy = 2.82%.

**Table 10. Impact of a 1% Decline in Agricultural Production and Directly Related Agribusiness/Processing (food and fiber) on Georgia's Economy**

| | Output Impact ($) | | Employment Impact (No.) | |
|---|---|---|---|---|
| Sector | Direct | Indirect | Direct | Indirect |
| Agricultural Production (Farm Gate + Landscape) | 419,197,252 | 0 | 2,017 | 0 |
| Mining | 0 | 270,504 | 0 | 1 |
| Construction | 0 | 2,644,282 | 0 | 29 |
| Manufacturing | 0 | 25,516,744 | 0 | 51 |
| Transportation, Utilities & Information (TUI) | 0 | 45,872,699 | 0 | 178 |
| Wholesale & Retail Trade (Trade) | 0 | 37,472,936 | 0 | 304 |
| Finance, Insurance & Real Estate (FIRE) | 0 | 48,436,953 | 0 | 193 |
| Services | 0 | 64,555,496 | 0 | 727 |
| Government & Other | 0 | 3,205,011 | 0 | 14 |
| Total | 419,197,252 | 230,974,625 | 2,017 | 1,496 |

*Source:* Authors' calculations using IMPLAN data (Minnesota IMPLAN Group, Inc., 2010).

*Notes:* Total impact of 1% decline in farm production and directly related agribusiness/processing = $650.2 million drop in economic activity and ~3,500 jobs lost; agricultural production and directly related agribusiness as percent of economy = 8.2%.

## Conclusions and Implications

Overall, results of the projected effects of H.R. 2454 are as different as the assumptions used in the various models. However, regardless of the source of the analysis or the author's perspective, it is widely accepted that the impacts from H.R. 2454 would differ depending on how and the extent to which energy costs change in both the short and long runs.

With agricultural production so heavily dependent on energy-intensive inputs, GHG emissions control will impact the agricultural production sector and those industries that depend on this sector for inputs. If, as it is projected, the final version of the legislation includes a combination of abatement and sequestration initiatives, the precise implications for agribusinesses will depend on such factors as the extent to which farm land is converted to forest land for carbon sequestration and the efficiency with which the offset market functions. While it is widely acknowledged that the legislation will create both benefits and costs to various groups and sectors, precisely who will benefit most is still subject to debate.

Understandably, the discussions about Cap and Trade have focused largely on determining whether the costs of reducing GHG emissions outweigh the benefits of such action. The response varies significantly depending on the respondent's perspective as well as the assumptions made. However, there is general consensus on both sides of the debate that implementation of the provisions of H.R. 2454 will result in higher energy prices. There is also little debate that, as an energy-intensive industry, food and agricultural production will be impacted, directly and indirectly, by higher energy prices. The direct impacts are tied to costs for transportation and fuels such as diesel, gasoline, and electricity. The indirect costs are linked to the manufacture of other agricultural inputs such as seed, feed, and agricultural chemicals. It is widely projected that impacts will be felt by companies linked to processing, distribution, and other related agribusinesses. At present, although production agriculture is not subject to the cap in greenhouse gas emissions, many of the industries that supply inputs to the agricultural production sector, including the energy sectors, are subject to the caps. Consequently, the implications of higher input prices for agricultural production cannot be ignored. In the long run, the impacts on the agribusiness sector are likely to include changes in commodity mixes as production functions adjust to changes in relative input costs.

Despite numerous studies on the subject, no studies have conclusively determined the likely impacts of H.R. 2454 on the agricultural community either at the state or national level. Further, while the existing studies are diverse in both their focus and projections, none have focused on the animal and crop production mix of significance to Georgia, being more applicable to row crop agriculture. Yet, the nature of Georgia's agribusiness economy means that increases in agricultural production costs will have impacts on other sectors in its economy that may be different from the national picture. For example, Georgia's large livestock

industry, particularly poultry, will not have the option of generating revenues from carbon offsets. In addition, because fuel represents a larger share of farm expenses for Georgia's farmers when compared to the average U.S. farmer, H.R. 2454 will have different impacts on Georgia's agribusinesses. What is clear at this point is that any 1% reduction in agricultural production, regardless of commodity mix, will result in a $650 million ripple effect on Georgia's economy and a loss of over 3,500 jobs.

While it is widely acknowledged that the legislation will create both benefits and costs to various groups and sectors, unlike the scenario presented for the average national farmer, Georgia's agribusiness sector, especially its large poultry industry, will not be able to reap some of the benefits from H.R. 2454, and therefore will show different net effects from the legislation. The potential impacts of higher energy prices on farm production costs would spread beyond the agricultural sector to the rest of the economy through such impacts as the effects on food and fiber processing costs, farm income, and reduced sales from farm-related suppliers. These impacts would result in reductions in output and lost jobs based on current economic impact models of Georgia's economy.

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