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TO: Consumers Union
FROM: Dr. Andrew Dyke and Robert Whelan, ECONorthwest
SUBJECT: GE FOODS LABELING COST STUDY FINDINGS

Executive Summary

Consumers Union is the public policy and advocacy arm of Consumer Reports, a nonprofit organization. Consumers Union supports laws mandating labeling of genetically engineered (GE) food. Oregon Ballot Measure 92, if passed, would require GE labeling. Consumers Union engaged ECONorthwest for a review of published research on the cost of labeling foods containing genetically engineered ingredients.

Opponents of GE labeling laws cite high labeling costs from some published studies. Consumers Union and other labeling proponents cite studies that conclude labeling requirements impose low costs on consumers. Consumers Union asked ECONorthwest to help resolve the apparent disagreement by independently reviewing, comparing, and summarizing published research regarding labeling costs.

We used our expertise in economics to compile existing research presented in academic and other publications relevant to the question of GE labeling costs. Collected studies include assessments of the cost impact of state ballot initiatives similar to Oregon's Ballot Measure 92, and the European Union's GE labeling regime, as well as the United States Food and Drug Administration labeling cost model, and academic studies of the global impacts of GE agricultural products. We found some studies on the economics of GE agricultural products but relatively few that address costs directly related to developing and applying GE labels. We reviewed the studies with models relevant to the requirements of Oregon Ballot Measure 92. Our findings from our review of this body of published research are summarized in Table 1.

Many studies consider possible market impacts (*e.g.*, speculation regarding consumer behavioral changes), and other matters not directly related to the cost of designing and labeling a product as containing a GE ingredients. A number of these studies report estimates of food price impacts from scenarios in which companies subject to GE labeling requirements are assumed to reformulate their products to contain only organic ingredients. We did not consider such scenarios. Rather we approached the question as FDA did in its study of the cost impact of nutritional labeling. FDA states that its model does not consider reformulation costs as "they depend on marketing decisions and are impossible to predict. Moreover, they do not result directly from these proposed rules."

We concluded that the median cost of labeling in the studies that provided relevant models was \$2.30 per person per year. Relevant cost estimates presented in the studies we reviewed ranged from \$.32 to \$15.01.

Our review focuses on GE labeling costs incurred by the producers and retailers. These costs do not necessarily translate directly into increases in the prices consumers pay for food products, as competitive forces may prohibit retailers from fully passing on some or all incremental GE labeling costs to consumers.

1 Findings

This literature review first provides an overview of the economics of food labeling and then a summary of original research on the cost of labeling initiatives. We follow this section with summaries of reports that cite the findings of other labeling cost analyses, but do not conduct their own cost analysis. We conclude our findings section with summaries of additional research we reviewed that did not directly address labeling costs.

Table 1 summarizes the labeling cost findings presented in the research. For those studies that did not provide a per capita expense, ECONorthwest used population data to determine the per capita expense. ECONorthwest then used the U.S. Bureau of Labor Statistics inflation calculator to convert current dollars into to 2014 \$. For studies reporting relevant low and high costs of implementation, we have calculated midpoint costs in the summary table below. In 2014 \$, the studies presented in this report provide a per capita expenses as low as \$0.32 per up to \$15.01. The median value is \$2.30. While some studies projected that costs would continue for up to 20 years, others projected only one-time costs. The values in the table below reflect costs during the first year of implementation or, in some cases total one-time costs potentially spread across the relevant compliance period.

Table 1: Summary of Labeling Cost Findings

Study (author last name, year)	\$ per State or Country	Unit	Population (study year)	Per capita cost (study year \$)	Per capita cost (2014 \$)
Lesser and Lynch, 2014	\$6,300,000	2014 \$, New York State, annual cost	19,600,000	\$0.32	\$0.32
Sheperd-Bailey, 2012	4,831,300*	2012 \$, California, one-time implementation cost	38,041,430**	1.27	1.32
Sheperd-Bailey, 2013	15,337,000*	2013 \$, Washington, one-time implementation cost	6,971,406**	2.20	2.25
Northridge, 2012	550,000,000	2012 \$, California, one-time implementation cost, midpoint	38,041,430**	14.46	15.01
Federal Register, 1991	950,000,000	1991 \$, U.S., one-time implementation cost, midpoint	252,030,000**	3.77	6.59
Jaeger, 2002 (NERA, 2001)	168,000,000	2002 \$, U.K., annualized 20-year cost, Option C	59,500,000*	1.77	2.34

*ECONorthwest estimate based on data reported from studies and U.S. Census Bureau data.

**U.S. Census Bureau population estimate for study year.

1.1 Ballot Measure 92

The primary issues relevant to GE labeling, as mandated by Ballot Measure 92, include the following:

Label and placard design. Ballot Measure 92 requires new labels for packaged food containing GE ingredients and in-store labeling of GE-containing raw foods. Food producers would be responsible for the cost of packaged food labels, while food retailers would be responsible for placard costs. The cost of label design is

largely a product of the compliance period, a factor we describe in greater detail in 1.2.

GE content threshold. Ballot Measure 92 requires labeling for products containing at least 0.9 percent GE ingredients by weight, similar to the threshold currently enforced in the European Union.

Number of stock-keeping units (SKUs) affected. A stock-keeping unit is a product defined by its brand, size, and other attributes for which it has a unique identifying number or bar code used by scanners in supermarkets, for example. Organic foods and foods for which GE ingredients account for less than 0.9 percent of the product's weight would not require new labels under Ballot Measure 92. Also, there would be no new labels on categories of foods (SKUs) for which there are no GE ingredients on the market, such as wheat products, rice products and almost all whole fruits and vegetables.

1.2 The Economics of Food Labeling

Much of the relevant published research cites the food labeling cost model developed by the Food and Drug Administration (FDA) and the Research Triangle Institute. We begin our literature review with a summary of that model, as reported in the following document, which also provides an overview of the economics of food labeling more generally.

- *Muth, M.K., Ball, M.J., Coglaiti, M.C., & Karns, S.A. 2012. Model to estimate costs of using labeling as a risk reduction strategy for consumer products regulated by the Food and Drug Administration. Contract No. GS-10F-0097L, Task Order 5. Revised final report: Prepared for U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition. Research Triangle Park, NC: RTI International.*

Research Triangle Institute (RTI) worked with the FDA to develop the FDA labeling cost model. The model provides estimates of the cost of regulatory labeling changes that impact retail consumer products. Most studies examining GE labeling use the model. The most recent model update occurred in 2012, and is the subject of the RTI report by Muth, Ball, Coglaiti, and Karns.

The 2012 model takes into account labeling costs at three levels: the universal product code ("UPC" barcode), the product, and the sales unit. These costs occur one-time and will not increase the ongoing production cost, unless a package insert or other product addition is required by the regulation.

The first cost defined is the “**per UPC (or SKU) cost**” for labor and materials associated with administrative activities, graphic design, prepress and printing, and recordkeeping. Not all products impacted by a regulatory change incur 100 percent of these costs. Manufacturers often update labels for non-regulatory reasons. Therefore, with a sufficiently long compliance period, food producers can incorporate label changes required by regulation at “minimal additional cost.”¹ The model reports an average UPC/SKU cost for all products, as opposed to just relabeled products.

The second cost segment is the “**per product cost**” for analytical testing and market testing costs. This segment does not take into account product reformulation, which is not a direct cost of labeling regulation. The FDA states, “in many cases, reformulation would not be a likely response to the regulatory requirements.”²

The final cost segment is the “**per sales unit cost**” of discarded inventory (*e.g.*, disposing of products with old labels), as well as the production and application of stickers to existing labeled products. The authors from RTI found that this cost depends almost entirely on the length of the compliance period; if a producer has enough time to make label changes, then it can do so as inventory turns over.³

The compliance period can impact labeling costs at the UPC and product level. For compliance periods of one-year or less, producers will not be able to coordinate regulated label changes with previously scheduled label changes, and will incur 100 percent of the per UPC cost described here. As modeled, the cost decreases incrementally until 42 months, at which point, the Model assumes that food producers could coordinate label changes required by regulation with regularly scheduled labeling activities.⁴

For compliance periods of 15 months or less, the Model assumes a 40 percent increase for both the UPC- and product-related labeling costs. This factor reflects the overtime and rush charges for completing labeling activities on a faster schedule, as well as the cost of applying stickers to existing labels when there is insufficient time to print new labels.⁵

1.3 Original Research

The sources reviewed in this section provide an analysis of labeling costs. All of these analyses estimate the potential GE product labeling costs. The first is from the University of Québec:

¹ Muth, Ball, Coglaiti, and Karns, 2012, 3-1.

² *Ibid*, 3-2.

³ *Ibid*, 3-2.

⁴ *Ibid*, 3-8.

⁵ *Ibid*, 4-38.

- *Cloutier, M. 2006. Etude Economique sur les Coûts Relatifs à l'Etiquetage Obligatoire des Filières Génétiquement Modifiées (GM) versus non-GM au Niveau Québécois. Economic survey on the costs relating to mandatory labelling of the genetically modified (GM) versus non-GM at the Quebec level. Prepared for the Ministère de l'Agriculture des Pêcheries et de l'Alimentation du Québec. University of Québec in Montréal, Department of Management and Technology.*

This study considers the potential costs associated with the introduction of a mandatory labeling policy for GE foods in Quebec. The labeling policy stipulated a GE labeling threshold of 0.05 percent, lower than the 0.9 percent threshold mandated by Ballot Measure 92. The policy did not pertain to animal feed, animal products, or to food sold at restaurants, similar to Ballot Measure 92.

The analysis estimates both the implementation (one-time) and ongoing (annual) costs for each sector involved in the production of corn and soy products. In addition to labeling costs, the study also assesses potential costs associated with reformulation and identity preservation.⁶ Since reformulation and identity preservation are not direct costs of labeling, we do not include those costs in this review.

The study reported total costs by production cost segment, but with limited supporting detail. The authors interviewed food producers and determined that the average cost of relabeling is between \$10,000 and \$15,000 (2006 Canadian dollars) per relabeled product.⁷

- *Lesser, W. and Lynch, S. 2014. Costs of Labeling Genetically Modified Food Products in N.Y. State. Dyson School of Applied Economics and Management, Cornell University.*

This study analyzes the potential total cost to households of the proposed GE labeling initiative in New York State. The analysis considers the costs associated with compliance, including a separate estimate for the cost of relabeling all affected products. Other costs considered include costs associated with reformulation of products using non-GMO or organic ingredients and regulatory costs. The authors assume that producers and retailers would pass 100 percent of these expenses onto consumers. Since product reformulation (ingredient substitution) is not a cost of labeling, this review only reports on the estimate of labeling costs.

⁶ Identity preservation refers to the process or system of maintaining the segregation and tracking the identities of products.

⁷ It is important to note that this metric differs from the FDA model and studies based on that model, such as two by Shepherd-Bailey (2012 and no date), which look at the cost per product over *all* products.

The authors include three factors in estimating the cost of labeling GE products: the label design and the physical act of labeling, the cost of warehousing additional items, and the cost to supermarkets of stocking and tracking new products. Since the cost of warehousing and tracking new products is not part of the cost of labeling (as defined by the FDA⁸), this review considers the cost of the labeling segment alone.

Lesser and Lynch concluded that the direct cost of labeling would be \$6.3 million statewide.⁹ Their research uses a Census population estimate of 19.6 million for New York State, equal to a per capita labeling cost of 32 cents a year.¹⁰

- *Shepherd-Bailey, J. Ph.D., Emory University School of Law. 2012. Economic Assessment: Proposed California Right to Know Genetically Engineered Food Act. Prepared for the Alliance for Natural Health USA.*

Shepherd-Bailey, J. Ph.D., Emory University School of Law. 2013. Economic Assessment of Washington Initiative 522. Prepared for the Alliance for Natural Health USA.

In both economic assessments, Shepherd-Bailey analyzed the potential labeling costs associated with GE labeling initiatives in California and Washington. Both studies use the same methodology to analyze:

1. The relabeling costs to food producers arising from the redesign of package labels,
2. The relabeling costs to food retailers attributable to the redesign of price display cards in grocery stores for non-packed items (*e.g.*, GE produce), and
3. The extent to which producers pass these costs to the consumer.

Labeling costs to food producers

Both Shepherd-Bailey studies use the FDA labeling cost model, described previously, to estimate the one-time cost of changing a package label to comply with regulatory changes. The author concludes that relabeling expense to producers would be “trivial.”¹¹

⁸ Muth, Ball, Coglaiti, and Karns, 2012.

⁹ Lesser and Lynch, 2014, no page.

¹⁰ ECONorthwest divided Lesser and Lynch’s \$6.3 total statewide labeling cost by Lesser and Lynch’s state population figure of 19.6 million.

¹¹ Shepherd-Bailey, 2012, 10.

Shepherd-Bailey emphasizes the fact that the length of the compliance period is a significant factor in the cost to producers. Citing the FDA model, she notes that 75 percent of food products undergo at least one routine label change every 30 months.¹² Therefore, Shepherd-Bailey concludes food producers may incorporate mandated label changes into regularly scheduled label changes at “little additional cost.”¹³

Shepherd-Bailey, relying on the FDA model, concludes that, for a 20-month compliance period (as stipulated under both the Washington and California initiatives), the one-time cost per product is \$1,104.43 (2012 \$) (the mid-point between the one- and two-year estimates provided by the FDA model).¹⁴ This figure is for *all* products, not only those that are relabeled.

Labeling expenses to food retailers

Shepherd Bailey also calculates the cost to food retailers of placard redesign for GE products not separately packaged. Using a model developed by the FDA in 1998 to determine the placard costs associated with disclosing warnings for minimally-processed juices, Dr. Shepherd-Bailey estimates that produce item placards would cost up to \$2,820 (2012 \$) per store for all products.

Total labeling expense and the impact on consumer expenditures

Using Consumer Expenditure Survey (CES) data from the U.S. Bureau of Labor Statistics, the author determined the potential impact on consumers of the GE labeling initiative, *if producers and retailers passed on 100 percent of the cost*. Applying the cost ratios discussed previously to CES data for California, the author finds that the California initiative would cause a one-time increase in annual per capita food expenditures of \$1.27 (2012 \$).¹⁵ Using this same methodology, the author finds that the Washington initiative would cause a one-time per capita increase of \$2.20 (2013 \$) in annual food expenditures.¹⁶

Although the analyses determine that there are one-time compliance costs to producers and retailers, the author sets forth reasons, with supporting empirical evidence, that these producers and retailers *would not* pass on this cost to consumers:

- The management and physical costs of making price adjustments are high relative to compliance costs,¹⁷
- Relabeling costs are one-time expenses,¹⁸

¹² *Ibid*, 13.

¹³ *Ibid*, 13.

¹⁴ *Ibid*, 13.

¹⁵ Shepherd-Bailey, 2012, 4.

¹⁶ Shepherd-Bailey, no date, 4.

¹⁷ *Ibid*, 3.

¹⁸ *Ibid*, 4.

- The competitive nature of the food industry is a deterrent for firms to increase prices above those of their competitors'.¹⁹

Under these conditions, Dr. Shepherd-Bailey concludes that the proposed initiatives would not have an impact on consumer prices.

- *Northbridge Environmental Management Consultants. 2013. "Washington State Initiative Measure No. 522: Overview of Estimated Costs to Consumers." Northbridge Environmental Management Consultants. September 16.*

This study summarizes estimates of the cost to consumers of implementing Washington's 2013 GE labeling initiative (I-522). The study speculates that the labeling initiative would cause producers to substitute organic or certified non-GE ingredients for GE ingredients, to avoid labeling products. Therefore, it presumes that the cost of the initiative includes the cost of ingredient substitutions, in addition to the cost of recordkeeping (to ensure compliance with non-GE ingredients).

The study does not consider the cost of labeling. It considers the cost of ingredient substitution and identity preservation, which are not labeling expenses. The cost of labeling may be embedded in the analysis of ingredient substitution and recordkeeping costs, but the authors do not report this.

Northbridge conducted a similar study in 2012 for California:

- *Northbridge Environmental Management Consultants. 2012. "The Genetically Engineered Foods Mandatory Labeling Initiative: Overview of Anticipated Impacts and Estimated Costs to Consumers." Northbridge Environmental Management Consultants. July 25.*

This study contains analysis specific to the potential costs of California's 2012 GE labeling ballot initiative to California consumers. Unlike the 2013 Washington study, which focused solely on the cost of scenarios related to ingredient substitution, this report also considers a scenario in which producers of products that contain GE ingredients comply by labeling them such. According to the study, "the direct cost of [the labeling] scenario is much lower than the substitution scenarios . . . the industry cost would range from \$300 million to \$800 million (2012 \$) statewide."²⁰ The authors do not specify if this cost is for a single year or ongoing, nor do they provide any explanation of the methodology used.

¹⁹ *Ibid*, 4.

²⁰ Northbridge Environmental Management Consultants, 2012, p. 47.

- *Federal Register*. 1991. "Regulatory Impact Analysis of the Proposed Rules to Amend the Food Labeling Regulations." 56 FR 229. pp. 60856-60878.

This regulatory impact analysis by the FDA considers the costs and benefits of modifying nutritional food labeling regulations. Although not about GE labeling, the analysis does report costs directly related to relabeling.

The FDA used an earlier version of the labeling cost model described previously. The model considers the following cost segments: (1) administrative costs, (2) testing costs to determine nutrient content, (3) printing costs related to changing printing plates and other mechanism, and (4) inventory costs arising from the discard of products with outdated labels.²¹ The model does not consider reformulation costs, as "they depend on marketing decisions and are impossible to predict. Moreover, they do not result directly from these proposed rules."²²

The analysis interviewed food manufacturers to obtain the data inputs for the model. The FDA determined that the nutritional labeling initiative would impact 17,000 domestic food manufacturers and 257,000 labels. And, although the majority of costs would occur in the first year, the model considers costs over a 20-year period and discounts recurring costs back to the present using a discount rate of five percent.²³

The total cost to food manufacturers would be \$600 million (1991 \$), with a sufficient compliance period. This estimate may include the costs associated with food service establishment menu reprinting costs. Under a short compliance period, the cost could climb as high as \$1.3 billion (1991 \$). The FDA reported that this equates to a labeling cost per product (in 1991 \$) of \$2,023 to \$5,058.²⁴

1.4 Other Literature Reviews

This section provides a review of papers that contain within them reviews of other research. These literature reviews cite estimates of labeling costs, but do not provide original analysis of labeling costs.

²¹ Federal Register, 1991, 60856.

²² *Ibid*, 60856.

²³ *Ibid*, 60856.

²⁴ *Ibid*, 60857.

- *Golan, E., Kuchler, F., and Mitchell, L. 2000. Economics of Food Labeling. Economic Research Service, U.S. Department of Agriculture. Agricultural Economic Report No. 793. December.*

This report provides a primer on the economics of food labeling. The authors begin with an explanation of the economic theory behind food labeling initiatives, and conclude with five case studies on the costs and benefits of labeling initiatives. Three of the studies are about cases in which the government has intervened in labeling; the other two cases are about proposed interventions.

The report focuses on a range of economic effects related to a government's decision to regulate food labeling, including both monetary and non-monetary benefits and costs. The financial cost of relabeling is thus only one of many considerations discussed in the report.

The authors discuss the cost of labeling incurred by firms in the context of a proposed amendment to nutrition labeling regulations, which this report describes (see page 9).²⁵ They simply report on the conclusions described in this source and do not provide any new analysis.

- *Gruere, G. and Rao, S. 2007. "A Review of International Labeling Policies of Genetically Modified Food to Evaluate India's Proposed Rule." AgBioForum, 10(1), pp. 51-64.*

This study evaluates India's then-proposed GE mandatory labeling rules. The authors rely on a review of GE international labeling policies and international agreements, noting that most of the usable evidence derives from developed countries. The study cites a range of per capita labeling costs, relying on the same studies as Jaeger (2002), which we discuss below.

- *Jaeger, W. 2002. "Economic Issues and Oregon Ballot Measure 27: Labeling of Genetically Modified Foods." Oregon State University Extension Service EM 8817. October.*

An Oregon State University economist prepared this working paper describing economic issues related to Oregon's 2002 Ballot Measure 27, which would have required GE food labeling if passed by voters. This report is essentially a literature review of labeling cost studies that estimate the cost of labeling in other countries. Jaeger reviews cost estimates for four countries, each from a different study: the U.K., Australia, New Zealand, and Canada. Jaeger cites cost estimates for all four countries; however, he does not delve into the analyses by KPMG for Australia, New Zealand, and Canada, which are less detailed and, in the case of Canada, based on "more limited information."²⁶

²⁵ *Federal Register*, 1991, "Regulatory Impact Analysis of the Proposed Rules to Amend the Food Labeling Regulations," 56 FR 229, pp. 60856-60878.

²⁶ Jaeger, 2002, 2.

Jaeger states that, “the most detailed estimates come from the consulting firm National Economic Research Associates (NERA).”²⁷ NERA considered the impact of five different GE labeling initiative scenarios on consumer expenditures over a 20-year period, operating under the assumption that producers would pass 100 percent of the cost on to consumers. Scenario C most closely approximates the current Oregon initiative, Ballot Measure 92; the scenario assumes mandatory labeling of all foods containing GE materials.

The NERA study considers both the “compliance cost” to firms, defined as the “costs of food production and distribution,”²⁸ in addition to the government cost of monitoring and enforcement. As our review is concerned solely with the cost of labeling to firms, our review reports solely on the compliance cost segment.

Under Scenario C, the annualized average compliance cost would be \$105 million (2002 \$) over the 20-year analysis period. This equates to \$1.76 (2002 \$) per person.²⁹ Although NERA’s definition of compliance cost is broader than the labeling cost alone, “the evidence suggests that mandatory [GE food] labeling need not be highly costly.”³⁰

- *Washington Research Council. “Initiative 522: Costly, Flawed and Ill-Conceived.” Washington Research Council Special Report. September 2013.*

This special report of the Washington Research Council presents arguments against Washington’s 2013 GE labeling ballot initiative. Cost impacts addressed in the report include consumer food costs, regulation and monitoring costs, the cost of lawsuits brought under the proposed law, and impacts on research and development. The authors do provide a qualitative discussion of the potential impact on consumers. The only quantitative data reported comes from the Northbridge Environmental Management Consultants (2013) report described previously. Similar to the Northbridge study, this report does not separately report labeling costs.

1.5 Other Reviewed Resources

ECONorthwest read research and other documents that discuss genetic modification and associated economic effects, but that provided no quantitative estimates of labeling costs. We were provided these resources by the client or uncovered them during the research process. For purposes of completeness, we conclude our report with summaries of these documents.

²⁷ *Ibid*, 1.

²⁸ It is not clear from Jaeger’s study precisely what food production and distribution cost segments comprise “compliance cost”

²⁹ *Ibid*, 2.

³⁰ *Ibid*, 5.

- *Anderson, K., Nielsen, C., Robinson, S., and Thierfelder, K. 2001. "Estimating the Global Economic Effects of GMOs." In Agricultural Biotechnology: Markets and Policies in an International Setting. Pardey, P., ed. International Food Policy Research Institute, Washington, D.C.*

This report presents findings from the authors' related studies of the impacts of GE crop adoption. Specifically, the underlying studies each implement a global macroeconomic model to quantify the effects of widespread adoption of GE crops in selected countries and to understand how different assumptions about consumer preferences and policy responses might affect these impacts. The study does not directly quantify labeling costs.

- *Brookes, G., and Barfoot, P. 2014. "GM Crops: global socio-economic and environmental impacts 1996-2012." PG Economics, Ltd. Dorchester, UK. May.*

Brookes, G., and Barfoot, P. 2006. "Global Impact of Biotech Crops: Socio-Economic and Environmental Effects in the First Ten Years of Commercial Use." AgBioForum, 9(3), pp. 139-151.

The studies by Brookes and Barfoot present estimates of aggregate global economic effects attributable to GE crop production. The 2006 study evaluates the costs and benefits accrued between 1996, the first commercial introduction of a GE crop, and 2006; the 2012 study provides an update that incorporates more recent data. The authors do not directly address the costs or benefits of labeling.

- *Food & Water Watch. 2012. "How Much Will Labeling Genetically Engineered Foods Really Cost?" Food & Water Watch Fact Sheet, September.*

This fact sheet summarizes and rebuts common claims about the negative consequences of GE labeling, citing a number of studies that we discuss separately in this report. Claims addressed include the impact of labeling on food costs, government expenditures, burden on retailers, the appropriateness of state-level labeling mandates, and food safety. The authors do not separately discuss the direct costs of product labeling.

- *Food Standards Australia New Zealand, 2003. "Report on the Review of Labeling of Genetically Modified Foods." Food Standards Australia New Zealand. December.*

Food Standards Australia New Zealand (FSANZ) published a 2003 review of labeling requirements for genetically modified foods implemented by Australia and New Zealand in December 2001. The review covers a range of topics, including consumer attitudes and labeling policy. The report addresses industry costs generally, but does not separately discuss labeling costs. The Appendix to the report notes concerns about labeling and packaging costs submitted as part of comments submitted by stakeholders, but the submitted comments do not quantify direct labeling costs.

- Gruere, G., Bouet, A., Mevel, S. 2007. “Genetically Modified Food and International Trade: The Case of India, Bangladesh, Indonesia, and the Philippines.” Discussion Paper 00740, International Food Policy Research Institute. December.

This study simulates the impacts of introducing GE field crops (corn, cotton, rice, soybeans, and wheat) in selected countries using a global macroeconomic model. The study does not directly address the costs of GE labeling.

- Jones, S., Bramley-Harker, E., Aslam, S., Young, J., Spackman, M., and Dodgson, J. 2001. “Economic Appraisal of Options for Extension of Legislation on GM Labelling: A Final Report for the Food Standards Agency.” National Economic Research Associates, London. May.

The authors of this study evaluate the costs and benefits to the United Kingdom of labeling alternatives relative to the then-prevailing EU GE labeling regime. The authors address the costs and benefits of GE labeling generally, consumer perceptions of GE products, and the distribution of impacts across households and small business. The study does not present quantitative estimates of the incremental costs attributable to moving to a mandatory GE labeling regime from a *status quo* where labeling is not required, or the reverse.

- Jones, K., Somwaru, A., and Whitaker, J. “Country of Origin Labeling: Evaluating the Impacts on U.S. and World Markets.” *Agricultural and Resource Economics Review*, 38(3), pp. 397-405. December 2009.

This study presents findings from a simulation, based on a global macroeconomic model of the 2008 United States Country of Origin Labeling (COOL) law. Although the study includes estimates of increases in operating costs attributable to COOL, derived from the US Department of Agriculture’s Agricultural Marketing Service, the study does not separately identify the direct costs of developing and applying new labels.

- Marsh, T., Nester, E., Beary, J., Pendell, D., Poovaiah, B., and Unlu, G. “White Paper on Washington State Initiative 522 (I-522): Labeling of Foods Containing Genetically Modified Ingredients.” Washington State Academy of Sciences. October 2013.

In anticipation of Washington’s GE labeling initiative (I-522), the leadership of certain committees in the Washington State Legislature asked the Washington State Academy of Sciences to prepare a white paper that addresses issues related to GE labeling. The paper addresses the relative nutritional value of GE and non-GE ingredients, the relative safety of GE and non-GE ingredients, impacts of labeling on policy and trade, and compliance monitoring and enforcement. The authors do not present any quantitative evidence on the magnitude of likely increase in food prices or the cost of relabeling products to comply with I-522.

- *Portland City Club. "A City Club Report on IP44: GMO Labeling." City Club of Portland Bulletin, 97(1), July 30, 2014.*

This report summarizes the findings and recommendations of a Portland City Club committee tasked with conducting research and making a recommendation in favor of or against the Initiative Petition 44, which later became Ballot Measure 92, to City Club members. The report includes a review of recent research on GE products in an Oregon context. The report does not separately describe potential costs associated with label design and printing.

- *Robertson, K. "Independent Study: Why Label Changes Don't Affect Food Prices." For Just Label It. September 11, 2013.*

This study provides a qualitative review of factors related to the impact of labeling requirements on retail food prices. The author concludes that mandatory labeling changes will generally have minimal impact on prices paid by consumers because labeling costs represent a small share of the costs of production, because producers regularly redesign labels and can therefore implement mandatory changes as part of a routine relabeling cycle, and because market forces unrelated to labeling likely limit the ability of wholesalers and retailers to pass the likely small relabeling costs on to customers.

- *Van Eenennaam, A., Chassy, B., Kalaitzandonakes, N., and Redick, T. "The Potential Impacts of Mandatory Labeling for Genetically Engineered Food in the United States." Issue Paper 54, Council for Agricultural Science & Technology. April 2014.*

This issue paper reviews arguments for and against mandatory GE labeling. Issues addressed include public opinion and public perceptions about GE products, food safety, legal issues related to state and national labeling law, and costs associated with mandatory GE labels. The paper cites several of the studies we discuss elsewhere in this report, but presents no quantitative estimates of direct labeling costs. The author concludes that increases in costs might be minimal if food suppliers label everything without testing or product segregation.