



MICHIGAN CLIMATE ACTION PLAN MACROECONOMIC IMPACT STUDY FREQUENTLY ASKED QUESTIONS

By

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1. What are macroeconomic impacts?

Macroeconomic impacts refer to the outcomes of public and private sector decisions that influence the entire economy of a nation or region. They result from a positive or negative stimulus and various interaction effects among consumption, investment, cross-border trade, and government activity.

2. What do macroeconomic impacts tell us?

The results of the analysis provide projections of the most likely impacts on employment, income, and gross state product for Michigan. It also provides information on these impact indicators for individual sectors.

3. What kinds of models are usually used in macroeconomic impact study?

There are ranges of model types that can be used in macroeconomic analysis. One approach is input-output (I-O) analysis. This is a practical methodology but is considered very restrictive because it is a linear model that does not allow for any substitution and other adjustments in the economy. Yet another approach is computable general equilibrium (CGE) analysis, which incorporates most of the good features of I-O but overcomes many of the limitations. CGE models are non-linear, allow for substitution and other adjustments, and reflect the workings of prices and markets. However, they are expensive and time-consuming to construct. A third approach is macro econometric models (ME), which use statistical techniques applied to economic data and are based on a macroeconomic framework. ME models have the advantage of sounder statistical properties than the other two modeling types and a forecasting ability. However, they are often more aggregated than I-O or CGE models.

4. What is the REMI Policy Insight Plus (PI+) Model?

REMI stands for Regional Economic Models, Inc. The REMI model is a ME model template that can be applied to any region, including an entire state in the U.S. The template consists of an analytical framework that is estimated using econometric

techniques applied to data for the region in question. The REMI model also incorporates the features of the other three major modeling approaches: I-O, CGE, and Economic Geography. The REMI PI⁺ model is the new generation of the REMI Policy Insight Model.

5. How many economic sectors are included in the REMI model?

In this study, we chose the 169-sector Michigan REMI model (which is the most disaggregated REMI model in terms of sectoral resolution) to undertake the macroeconomic analysis.

6. How can we be sure that the REMI is a good choice for Michigan?

The REMI model in general has been used in every state in the U.S and is the most widely used modeling approach by state governments. The Michigan Department of Transportation and the Michigan Economic Development Corporation have used REMI models of Michigan successfully for several years. Moreover, the research team has applied the REMI model to analyze the macroeconomic impacts of climate action plans previously in Florida and Pennsylvania.

7. What data inputs go into the REMI model?

The database used for indirect or secondary impact analysis consists of state and national data obtained from reliable sources such as the U.S. Department of Commerce, U.S. Bureau of Labor Statistics, U.S. Census Bureau, and Michigan Department of Energy, Labor and Economic Growth. However, some data is scaled down from the national level, and where parameters are missing, national parameters or adaptations of national parameters are often used. Direct effects of policy options are input from other sources as a first step. In the Michigan Climate Action Plan study, cost-effectiveness (microeconomic) estimates of a wide range of stakeholder-approved climate policy options were used as inputs for the macroeconomic analysis.

8. Which is the latest historical year of data incorporated in the Michigan REMI model?

The Michigan REMI PI⁺ model is based on the state historical data through Year 2007.

9. What special features of the analysis were done to make it specific to Michigan?

The analysts reconciled the basic REMI model baseline with forecasts for the Michigan economy performed by Global Insight. Global Insight provides Michigan economic forecasts used in generating state Consensus Revenue forecasts. Other consistency checks used to validate the Michigan REMI model include comparisons of historical data and trends of several REMI variables, including employment, income, gross state product, and others. Several trial runs of the REMI model were conducted to validate variable responses over time.

10. Is the REMI model just another black box?

The REMI model is reasonably transparent in its structure and data. Its equations in general are well documented, and we have the ability to focus on specific components of the model. Model documents are available to the public at the REMI website: www.remi.com.

11. How can we be sure that the REMI model is accurate?

The REMI analysis is based on sound data, sound macroeconomic theory, realistic assumptions, has been subject to peer-scientist review spanning 30 years, and generates reasonable and tested impact estimates. Inputs for the direct effects of individual mitigation and sequestration options were developed through an intensive, year-long, formal consensus-building process involving over 50 stakeholders and technical work group representatives, following established principles and guidelines for cost-effectiveness analysis.

12. What basic assumptions go into the REMI analysis?

All models include many assumptions. In fact, this is the essence of modeling-- abstracting from many extraneous considerations to be able to focus on the core aspects of a topic. In the REMI model, the standard economic modeling assumptions are used. For example, individuals and businesses behave rationally, i.e., they utilize their incomes and resources prudently, and they respond to price signals. Also, import demand and demand for Michigan-produced exports respond to econometrically estimated price differentials.

Several other important assumptions are unique to the problem at hand. Examples include the extent to which investment in equipment that mitigates greenhouse gases adds to or displaces investment in ordinary plant and equipment, the extent to which any price changes are passed on to customers, the value of the discount rate that enables us to compare dollar gains in different years, etc. Assumptions are used because it is impossible to gauge each of these factors precisely in any study done within a time span of only a few months. A typical way to deal with this uncertainty is to perform sensitivity analyses. This means changing the levels of key parameters and exogenous variables in the model one at a time and seeing how the results are affected. If significant changes in parameters do not alter the results very much, we say the analysis is robust.

This is the case in the Michigan study-- assumptions for cost-effectiveness inputs were determined through a formal stakeholder process and are provided in transparent detail for each policy options in a final report and technical appendices for the Michigan Climate Action Plan.

13. How do the Michigan study results compare with previous results for the state or those of other states?

Many aspects of the impacts of state climate action plans are state-specific. For example, in a REMI analysis of a renewable portfolio standard (RPS) in Florida, the impacts were significantly positive. This is due to the fact that renewable energy (e.g., solar, wind, and biomass) is especially attractive in that state from an economic standpoint. Also, the displacement of electricity produced by conventional fossil fuels does not negatively affect that state very much, since only a very small portion of these energy fuel inputs are produced within Florida's boundaries. Moreover, it is reasonable to assume that if a state gets out in front on climate action planning, it will attract investment from other states.

These factors are not anywhere near as positive for the U.S. as a whole, for example. In that case, one needs to use national averages of the relative attractiveness of renewables. Fuel inputs for electricity generation are produced almost entirely within the country, and there is limited opportunity to attract foreign investment.

With respect to previous studies performed in Michigan, we note that the current study provides a more conservative macroeconomic outcome relative to the 2007 NextEnergy report on expected economic impact of a state RPS. These studies estimated economic impacts over different horizons and under different economic projections.

Since the 2007 study, the Michigan and national economic growth has declined substantially. While both studies project positive economic impacts, the CCS report projects, at the most, twice the economic impact as the NextEnergy report in terms of discounted gross state product impacts. The NextEnergy report used lower discounting factors that tend to increase the positive economic impact calculations, and used a less aggressive minimum portfolio standard of 15 percent in year 2020, compared to 20 percent for the CCS study.

14. Are the analysts who performed the Michigan REMI analysis qualified?

Dr. Steve Miller is the Director of the Center for Economic Analysis at Michigan State University. Dr. Miller specializes in modeling regional economies and his dissertation topic of research was the development of a dynamic economic impact model for Oklahoma. Dr. Dan Wei is a post-doctoral associate in the School of Policy, Planning, and Development at USC. She wrote her Ph.D. dissertation (from the Department of Energy and Environmental Economics at Penn State) on energy conservation policy, and has used the REMI Model successfully in several applications. Dr. Adam Rose is a research professor in the School of Policy, Planning, and Development at USC. Prior to coming to USC he served as Professor and Head of the Department of Energy and Environmental Economics at Penn State for fifteen years. He is a leading authority on energy and environmental economics, with special application to climate change. He was the research team leader on REMI applications to estimate the impacts of climate action plans on the Florida, Pennsylvania and the U.S. economies.

The CCS project team that supported development of Michigan Climate Action Plan options included several policy experts, analysts, and experienced technical facilitators with advanced degrees in economics, business, engineering, policy, law, science and government, including former officials in local, state and federal government. They include Thomas Peterson, President and CEO of CCS, Jefferey Wennberg, Senior Program Manager of CCS, Dr. Hal Nelson of Claremont University, Dr. David Von Hippel of CCS, Dr. Lewison Lem of Jack Faucett Associates, and Steve Roe of E.H. Pechan and Associates.