Uses of Macroeconomic Impact Models in the US and EU

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The purpose of this paper and presentation is to provide a summary of uses of macroeconomic regional models, focusing on US and the EU. We reviewed the use of several models and their common uses and users.[1] The range of models included in the review include the regional input-output model, RIMS II, and dynamic modeling frameworks such as REMI and the E3-ME models.

In the broadest terms, the uses for the different modeling frameworks can be quite similar across different platforms. The RIMs model, an input-output based means of generating local area multipliers, includes multiplier estimates for gross domestic product (GDP), earnings of local enterprises, and employment. Another regional input-output model often applied in the US is the IMPLAN model, which provides non-survey-adjusted (multi-)regional models constructed from the US input-output model. When applied in a multiregional framework, it allows for the estimation of secondary impacts over regions that are linked through estimated trade of goods and services. A third model, the REMI framework, is distinct from and expands the capabilities of the other two input-output frameworks by creating a dynamic environment that extends the range and complexity of impacts of policies or investments on the economy. The REMI model can be linked with other modeling frameworks to effectively capture how changes in energy prices or energy taxes affect the economy. It makes use of both computable general equilibrium (CGE) modeling techniques and econometric methods to estimate impacts over time dynamically.

The Cambridge Econometrics(CE) approach discussed below also relied on these methods, but emphasizes the econometric methods to a greater degree than most macroeconomic models. The CE framework extends the capabilities of macro-economic models through strong linkages between the economy, the energy sector, and the environment. Certain algorithms in the model also allow it to better incorporate the implications of newer technologies and policy interactions with the economy. Another feature of the CE modeling framework is its ability to measure impacts of a given investment or stimulus on both short impacts that are not likely to be captured in other models due to restrictive assumptions. Macroeconomic models such as the CE's E3-India model provide a variety of uses that typically inform the choices that are to be made by public policy officials. Macroeconomic models may be used by government itself, or by constituent interests of government that typically hope to use such analysis to influence the actions of public policy officials.

Macroeconomic models are most commonly associated with impact analysis for a particular investment or public sector policy or regulatory action (or inaction).Impacts are associated with some feature of the economy, such as economic growth or decline as measured by GDP, but may also include measures of production, job creation, and impacts on household disposable income.

[1] First, we reviewed the US government's RIMS II model, a standard input-output modeling framework that leverages a national model to create economic multipliers at the state and local level; second, the REMI model that is commonly used in the US at the state and city levels, and; third, the Cambridge Econometrics model, currently frequently used in the EU at the national and supra-national levels and now being introduced at the subnational level.

a. Policy Impact Analysis

Policy impact analysis is based on a simple principle: that policymakers should test, or at least simulate, and understand well the likely impacts before they commit to and undertake a policy. Impact analysis is analogous to cost-benefit analysis and its variations that are the focus of welfare economics. It helps us to understand the implications of the policies that are implemented, or are being considered, by government, as well as a wide variety of metrics or dimensions of public policy. Policies whose impact can be analyzed typically include interventions in such sectors as energy, environment, transportation, and the taxcode; they may include new economic or environmental regulations, tariff policy, new taxes, or investments of public works and community infrastructure. Impact evaluation is similar to cost-benefit analysis because it helps clarify the impact of the policy on the well-being of the population and/or constituencies that are most directly affected by the change. Cost-benefit analysis can be structured to focus on the welfare implications for an individual, group, or society. Impact analysis provides a corollary tool that measures impacts on an industry, region, or income strata, depending on data availability. Policy impact analysis looks at the many and varied impacts of a given policy or investments on relevant metrics of public sector performance, including economic growth and service delivery, but also the competitiveness of businesses and impacts on public finances. With adequate data, both cost-benefit and policy impact analysis can be scaled to a local economy, a state, region, nation or supra-national region.

Two key criticisms of policy impact analyses are often made. First is the analysts' failure to adequately account for the source of funds used to support policy actions, with the implicit assumption that exogenous funding can be used without consideration of internal economic effects as to its collection. Second, since these models depict current account transactions, they are usually very good at estimating secondary and tertiary impact on public operating costs and the like. However, they are not able to correct for physical capital constraints. As a result, some policy analyses assume that adequate public services are readily forthcoming when, in fact, constraints on public infrastructure (and certain private forms, as well) are binding. As in all forms of modeling, care on the part of users with regard to modeling limitations is important.

b. Sector and Policy Use-Cases

Transportation and Infrastructure Investment Potential

Public sector investment is typically associated with infrastructure or public works programs. Examples of infrastructure analysis include the construction of a new highway, rail or port. The modeling capabilities will be designed to both capture the impacts of the construction phase of the project and the longer-term impacts after it is built. Revenue agencies and planning bodies may be particularly interested, although the reports could be used to garner political support for projects by proponents.

Economic Development of Projects or Industry

The models can be used to capture the impact of adding an industrial park or closing a port facility, as well as the impact of a particular employer (either new or pre-existing) on the local economy. Projects to be analyzed may include investments in conference facilities, a sports stadium, or the hosting of large national or international events. Likely users of such studies would be government leaders who are attempting to attract this investment and need to understand value to the local economy in terms of GDP and earnings to local industry.

Energy and Natural Resources

Energy and the environment are typical areas of focus for dynamic CGE models and econometric models, particularly where there are significant market adjustments anticipated in response to policy decisions. Job creation can be associated with shifting toward lower-cost forms of energy that are locally produced. Local sources of energy are often cleaner and more labor-intensive, leading to the creation of direct jobs and reduced dependence on imports. Second-order impacts come from additional circulation of money through the local economy. To the extent that energy is lower-cost, its use can lead to increased disposable income and associated consumer spending. Energy efficiency initiatives, are, for example, programs that typically score well in such analysis. Studies might include the impacts of a particular policy or change in energy charges due, for example, to a tax. The implications can be shown both in the form of an economic impact (e.g., GDP and employment), but also on emissions and issues related to security and trade (e.g., coal import dependence on foreign governments).Impact studies of alternative energy policies are likely to emerge from civil society stakeholders who are intent on guiding the hand of government policymakers or energy regulators. Such studies may also emerge from the standpoint of a regulatory review into the beneficial economic impacts on the jurisdiction in question.

Tax Policy and Fiscal Impacts

Tax policy and tax concessions to a potential employer can be used to potential good effect for both economic development and revenue generation if the impacts of favorable concessions are well understood. Tax policy (e.g., a carbon tax) can be used to displace other taxes or the revenues used as a stimulus for other forms of public sector investment, or reinvestment in the sector for further benefits that can be modeled. The revenue implications of tax policies would be of most interest to the tax or revenue departments of state or national governments. The economic development implications would be of most interest to economic development agencies or commerce departments at the state, regional, or national levels of government.

Education and Academic Purposes

Macroeconomic impact models such as E3-India, the E3-ME model, the REMI model, and the IMPLAN model used in the US have strong linkages to educational institutions, especially in their origins. These models potentially benefit from ongoing ties to help strengthen the approach, build ties with government to foster better data, and use as an instrument of education and research. Strong linkages to academia is also essential to building trust in the model and its capabilities by government. Even beyond these important linkages, these models can be used to help demonstrate the impacts and value of education to the local economy that is served by their presence. The use, development, and refinement of these models can have a strong synergistic influence on commercial sponsors, educational institutions, and the government bodies that benefit from the information and influence of those models on public policy and regulation.

Trade Impacts

Policies that affect the competitiveness of domestic industry can have an impact on trade, in turn on currency strength, and ultimately on the purchasing capabilities of individuals, industry, and government. Tariff and trade policies can be used to protect domestic industry from foreign competition, but often at a price to the competitiveness of domestic industries with their foreign trading partners. The impacts of trade policy can be complex and not well understood due to uncertain trade responses. Macroeconomic models can be used to simulate the impacts of a range of potential

responses to policies designed to either protect domestic industry or foster open trade through agreements. The impacts here may be most relevant to agencies or departments responsible for trade and the competitiveness of domestic industry.

Health and the Environment

Increasingly, macroeconomic models are linked to modules that reflect the consequence to industry not only of regulations, including environmental regulation, but also the downstream impacts of the failure to take actions, or reduce regulations, that may be necessary to protect both the environment and the communities that are affected. Environmental protection may extend to energy production (e.g, hydro resources that dwindle in the case of heavy irrigation or changing climate conditions and may extend to agricultural resources (e.g., water tables and irrigation potential responding to energy prices).Short-term impacts of environmental policy favorable to industry may give way to longer-term and harmful impacts of air emissions or effluents on local populations. Impact analysis performed by these models can be useful to the government agencies and departments responsible for advancing public health and well-being, as well as the environment. Civil society concerns with these same issues may rely on such models to help guide the hand of government.

Forecasting and Planning

Even while policy impact evaluation and education are probably the most important uses of the models, dynamic models such as REMI and the E3-ME or E3-India model can also be used for forecasting and planning. It is most common for these models to be simply tied to an accepted forecast for a country or a region, and then be used for policy or investment impact studies. Although these models typically generate a baseline forecast, the forecasts are for comparative purposes only and not intended to provide a forecast of key marcroeconomic indicators. Even when these models are linked to another forecast, they can be used by planners to understand, for example, impacts of expected forecasts on other variables or populations of interest that will move with those forecasts. This will, for example, be relevant to planners in assessing the implications for infrastructure requirements of population growth under various scenarios for economic growth.

c. Summary and Conclusions

The use of economic impact models is widespread in the US and the EU. Regional IO modeling frameworks such as the RIMS II model are an effective tool in capturing the impacts of investments or policy events on a region focusing on standard outputs such as GDP, earnings, and employment. Dynamic frameworks such as the REMI and E3-ME frameworks greatly expand the impacts to capture impacts with additional detail and dimension, including impacts over time and with feedback elements.

The E3-India, which incorporates the structure of the E3-ME model platform, provides an opportunity for India state-level analysis of economic impacts (from investments or policy) that are commonly applied in the US to IO models, but in ways that incorporate system dynamics (e.g., feedbacks from changing price levels and the competitiveness of industry).All of the state-level analysis that is possible with state-specific IO models can be extended to capture the dynamic relationships just mentioned, plus analysis of investments in emerging energy technologies that are not part of the historical information set. Because the E3-India model (like the E3-ME model) does not assume an optimized use of labor and capital, common to even dynamic modeling frameworks, the E3-India model can be used to capture the shorter-term stimulus effect of policy on job creation and commitment of new capital.