Appendix 5A

Economic Models as Predictors of NAFTA Impacts[1]

More than a dozen economic models have been used to estimate how trade agreements among the United States, Mexico, and Canada might affect national income, exports and imports, and jobs gained or lost. Such models can be constructed in a variety of ways. Some deal with two of the three countries, some with all three, some with three plus the rest of the world. At best, the results are suggestive. None of the quantitative models and predictions reviewed by OTA provide a useful guide to policy choices.

Predictions from all the models depend on arbitrary assumptions+. g., the prices that Mexico can expect for its oil in the future, or levels of investment in industry. The predictions of the models are no better than the assumptions. It can be very difficult to decide whether a given assumption is ''good' or ' 'bad. Of the necessary assumptions, those dealing with investment are by far the most important. There is no way to model or otherwise generate quantitative predictions for future levels of either foreign or domestic investment (with or without a NAFTA). Investment levels can only be assumed. In fact, many of the models have assumed there will be no change in Mexican investment after a NAFTA, even though Mexico wants an agreement in large part to attract new investment.

Many of the models also suffer from dependence on input data that are old or of questionable accuracy or both. These problems are particularly severe on the Mexican side. For instance, Mexico's government reports values for imports from and exports to the United States that differ substantially from the U.S. figures; some of the reasons are known, and adjustments can be made, but this accounts for only a portion of the discrepancies.[2]

Results

Most of the modeling suggests relatively little impact on U.S. or Canadian gross domestic product (GDP), trade, or jobs as a result of lower tariffs, with greater changes in Mexico because its economy is so much smaller. Typical results suggest that a NAFTA would have broad if small benefits-growth in both (or all three) countries, with only minor negative impacts. Several sets of results—particularly those that disaggregate the economies into a number of sectors, so that impacts on, say, the apparel industry can be isolated—show larger impacts, including losses in U.S. jobs.

When predicted impacts are small, one of the reasons is usually that potentially important factors have been omitted (usually because the model cannot incorporate them). Many models, for example, fail to account for nontariff barriers (NTBs), even though Mexico has relied heavily on these over the years, and they have become even more important with reductions in Mexico's previously high tariffs. In principle, non-trade-related government policies-e. g., dealing with domestic price controls, subsidies, taxation, preferential credit, and the many other tools of economic and industrial policies—should also be incorporated, but rarely are. Again, given that Mexico has had a heavily regulated economy until recently, such factors carry particular weight; a NAFTA should properly be viewed in the context of a larger package of economic reforms in Mexico.

Types of Models and Limitations

A simple extrapolation of past trends is itself a model. But such a model can say nothing about what would happen if the United States and Mexico reduce their tariff levels, lower NTBs, or otherwise alter

[1] This discussion is based primarily on presentations at the Symposium on Economy-Wide Modeling of the Economic Implications of a FTA with Mexico and a NAFTA with Canada and Mexico, U.S. International Trade Commission, Washington, DC, Feb. 24-25, 1992. For the conclusions of the staff of the U.S. International Trade Commission concerning models and results presented at that symposium, see ***Economy-Wide Modeling of the Economic Implications of a FTA with Mexico and a NAFTA with Canada and Mexico,*** Report on Investigation No. 332-317 Under Section 332 of the Tariff Act of 1930, USITC Publication 2516 (Washington, DC: U.S. International Trade Commission, May 1992). The papers themselves are included in *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA with Canada and Mexico,* Addendum to the Report on Investigation No. 332-317 Under Section 332 of the Tariff Act of 1930, USITC Publication 2508 (Washington, DC: U.S. International Trade Commission, May 1992). For a useful review, see also Gregory K. Schoepfle and Jorge F. Perez-Lopez, ''U.S. Employment Effects of a North American Free Trade Agreement: A Survey of Issues and Estimated Employment Effects," draft dated Feb. 12, 1992 prepared for 1992 Joint Meeting of the Association of Borderland Scholars and Rocky Mountain Council of Latin American Studies, El Paso, TX, Feb. 20-22, 1992, Also see the papers presented at the conference on NAFTA: An Assessment of the Research, Brookings Institution Washington, DC, Apr. 9-10, 1992.

[2] Mexico leaves shipments to and from *maquila* plants out of its accounts. For a discussion of misreporting of trade data in the context of capital flight, see David Barkin, *Distorted Development: Mexico in the World Economy* (Boulder, CO: Westview, 1990), pp. 58-71.

policies affecting trade and investment: after all, the purpose of the policy changes is to change the trend.

More sophisticated models represent the economies through systems of equations-sometimes more than a thousand. These equations relate variables such as investment, productivity, employment, exports and imports, and GDP to one another. Models involving only a few equations can sometimes be solved without a computer. Such models rarely make use of empirical data, or indeed numbers of any sort; they are purely theoretical.

Computer-based models come in a number of varieties. Their common characteristic is that they involve too many equations----a equations of too much complexity-to be solved except with a computer. These equations might, for example, specify the relationships between rising income levels in Mexico and demand for goods ranging from autos to ice cream. The more an economy can be disaggregated—i. e., the greater the number of sectors the model treats independently-the more detailed the predictions. The price is greater complexity. Even the most complicated U. S.-Mexico models include only two dozen sectors or so. High levels of aggregation mean that the model may not distinguish demand for mainframe computers from that for chemical process equipment.

Some computer models are static, meaning that they produce estimates of the one-time change resulting from, say, a reduction in tariffs. A static model, in other words, calculates the increment in GDP or trade or employment resulting from the tariff change, without saying anything about the *process* of adjustment to the new tariff levels within either economy, or about the continuing path of either economy afterwards. The results are limited to a before-and-after comparison.

Dynamic models, in contrast, can include representations of ongoing adjustment processes. A prediction of, for example, a 1 percent annual increase in Mexico's GDP expected to continue (and compound) indefinitely is far more meaningful than a prediction of a one-time increase. But dynamic modeling is much more difficult; almost all NAFTA predictions have been based on static models. For an indication of the complexities encountered in the dynamic case, consider the effects of a NAFTA on FDI in Mexico. First, it would be necessary, or at least desirable, to have a model that would predict FDI as a function of NAFTA provisions (e.g., North American content requirements), real interest rates in Mexico and elsewhere, and other relevant variables. New investment, in turn, would bring with it new technology and improved managerial practices. As a result, Mexico's rate of productivity growth should increase. This, in turn, would make some Mexican industries more competitive, altering Mexico's patterns of trade with both the United States and third countries. No current model incorporates these dynamics, even in crude approximation.

Moreover, many computer-based models, because of their structure, make use of only a single year's data for "calibration.' While other types of models incorporate equations fit to lengthy time series, models calibrated on a single year cannot hope to reveal the impacts of a change in underlying conditions.

Finally, even the simpler computer-based models are complicated enough that only an expert, with considerable expenditure of time, can interpret the results. The more complicated models, which one would expect to be more useful because they are able to account for more variables, tend to be opaque even to those who have developed them. That is, the results simply emerge; the analyst must take them or leave them. If predictions seem counter-intuitive or otherwise surprising, and the model incorporates hundreds of equations-any of which might change under a given NAFTA scenario-it will generally be impossible to explain these predictions. The only choice is to try to make sure that the equations are individually correct, properly linked, and the computer coding free of errors. Because no one can understand a complex economic model in its entirety, it can be difficult or impossible to tell whether a particular model-based forecast of NAFTA impacts has been "tweaked" to give results supporting a particular advocacy position.

Note that there is a major difference between economic modeling and the equally complex mathematical models employed in the physical sciences. In most cases, models representing physical systems can be checked, debugged, and validated by comparing their predictions against empirical results. The very complex computer programs used to simulate flow around an airplane wing are verified and tuned based on both wind tunnel experiments and flight tests of prototype aircraft. It is true that, in a sense, a NAFTA would be an "experiment." However, it would be an experiment that ran only once, with many of the critical parameters outside the control of the modelers (e.g., decisions made by private investors). Under these circumstances, it is difficult to determine how well a given model actually performed.

Assumptions

The results of economic models are highly sensitive to assumptions. These may be hidden to all except

those skilled in complex computer calculations and intimately familiar with the particular model, Many economists who work with models are more interested in theory and/or in modeling itself than in a NAFTA or its impacts; they may have little interest in realistic assumptions if that would make other tasks more difficult. But even where modelers seek realism, the structure of the model often works against this. Development of more sophisticated models will permit some of the restrictive assumptions listed below to be relaxed or removed. But even then, the problem of validating the results will remain.

In addition to investment levels, discussed above, many other assumptions must be made even in the most sophisticated models currently available.[3] Not all of these assumptions feature in every model; but every model is subject to some of them:

- *Perfect Competition. The* model assumes many firms, none of which have market power. In reality, only a few firms compete in many of the industries in question-for instance, automobile production. In such cases, companies have considerable power to engage in strategic behavior and to set prices, whereas in a perfectly competitive setting, all companies become price takers.
- *Homogeneous Products.* While gasoline is gasoline (within grades), automobiles differ, and automakers develop strategies based on product differentiation. Few models incorporate such behavior.
- *Exchange Rates. The* slow unexpectedly response of the U.S. current account to dollar depreciation during the latter part of the 1980s shows how poorly exchange rate shifts are understood. But even if the effects of changes in the value of the peso relative to the dollar could be incorporated into a model linking the two economies, no one knows how to predict the future value of either currency (which will depend on factors including, for instance, the U.S. budget deficit),
- *Employment.* Many models require restrictive assumptions concerning labor markets. For instance, the model may be able to calculate the number of jobs created or destroyed only at an assumed fixed percentage of unemployment—not a very useful result.
- *Migration and Demographics.* A NAFTA could result in large numbers of Mexicans leaving the agricultural sector to seek other jobs. Some may migrate to the United States. If U.S. firms found it easier to hire low-cost, unskilled Mexican immigrants, this might reduce their incentives to shift production to Mexico. None of this can be modeled at present. When migration or immigration can be included at all, this is through more or less arbitrary assumptions (e.g., that the number of Mexicans entering the United States after a NAFTA will increase or decrease by a certain number).

If economic models seem of little use for forecasting, one reason is that many were not developed for such purposes. Many models have been built to explore the ramifications of this or that set of theoretical postulates. Economists who build and exercise models could help policymakers by running their models with differing sets of assumptions chosen to investigate the significance of factors such as investment levels, oil prices, or migration. Few have attempted this, in part because their interests are in modeling rather than in policy outcomes.

Summary

By and large, the results of economic models suggest little reason to fear overall loss of large numbers of U.S. jobs. Few analyses have suggested large impacts of any sort, particularly on the United States-as opposed to Mexico, with its much smaller economy. But to a considerable extent, such results are built into the theoretical frameworks and assumptions of the models.

Nor can models reveal much about sectoral impacts, still less regional impacts. Almost anything that economic models say about NAFTA outcomes that seems plausible might be said without their aid. But because only a few experts can comprehend the innards of such models, their results too easily acquire an air of scientific authority. In the future, modeling of complex economic systems may lead to results of use to decisionmakers concerning events such as a NAFTA. This is not the case today.

[3] Most NAFTA-related projections have been based on computable generat equilibrium (CGE) models, a relatively new species of great power but with the corresponding drawback of highly restrictive assumptions built into the theories on which the models are based. For an extensive discussion of the limitations resulting from these assumptions, see James O. Stanford, ''C.G.E. Models of North American Free Trade: A Critique of Methods and Assumptions, ' Testimony to the U.S. International Trade Commission Public Hearing on Economy-Wide Modeling of the Economic Implications of Free Trade, Investigation No. 332-317, April 1992,