CBO PAPERS

ESTIMATING THE EFFECTS OF NAFTA: AN ASSESSMENT OF THE ECONOMIC MODELS AND OTHER EMPIRICAL STUDIES

June 1993

CONGRESSIONAL BUDGET OFFICE
SECOND AND D STREETS, S.W.
WASHINGTON, D.C. 20515

PREFACE

During the past two years, a large number of empirical studies have been published that attempt to estimate the economic effects that the proposed North American Free Trade Agreement would have. This proliferation has generated a need for a survey that collects the results of the various studies, compares and contrasts them, analyzes their strengths and weaknesses, and explains why their results sometimes differ and what can reliably be concluded from them. This paper is intended to fill that need.

Since the research for and writing of this paper was begun, two surveys of NAFTA modeling results have been published, one by the International Trade Commission and one by Drusilla K. Brown in a volume published by the Brookings Institution. Those two papers do much to fill the void for trained economists, but they are less useful for policymakers and members of the general public. The papers assume substantial prior knowledge on the part of the reader regarding economic theory and terminology, the kinds of effects to be expected from NAFTA, and why those effects should be expected.

This paper makes no such assumptions; it is written for noneconomists as well as economists. All relevant economic theory, effects, and terms are fully explained, and the models and empirical studies are evaluated from the point of view of their usefulness to policymakers. Economists will note that the paper is written independent of the other two surveys, with its own emphases and point of view. It is often helpful for economists to step back and examine the sum total of their progress, as this paper does, from the point of view of the research consumer--the policymaker--rather than the research producer.

Bruce Arnold wrote the paper under the supervision of Jan Paul Acton and Elliot Schwartz. The paper benefited from the author's discussions with, and comments received from, Robert Dennis, Thomas Lutton, Thomas Loo, Christopher Williams, Victoria Farrell, Victoria Greenfield, Sherman Robinson, and Ralph Smith within the Congressional Budget Office (CBO), and from comments by Drusilla Brown outside of CBO. Frank Pierce edited the manuscript, and Christian Spoor provided editorial assistance. Angela McCollough prepared the paper for publication.

Robert D. Reischauer
Director

June 1993

CONTENTS

TABLES

BOX

INTRODUCTION

The negotiations for the proposed North American Free Trade Agreement (NAFTA) spawned a raft of empirical studies, many of them using applied general equilibrium models, attempting to predict the general economic effects such an agreement would have on the countries involved.[1] These studies have advanced the science of empirical modeling, and they have improved economists' understanding of the effects of NAFTA. The use of their results in the public debate, however, requires caution.

To draw reliable conclusions, one must examine the studies as a group rather than individually. Modelers are not yet able, and likely will never be able, to incorporate all of the significant effects of an agreement such as NAFTA into one model. The complexity and difficulty of their task forces them to pick and choose, emphasizing some effects and ignoring others.[2] Their choice is often complicated by a lack of good data. Hence, no one model can be relied upon for an accurate and reliable assessment of the effects of NAFTA. Such an assessment requires examining and comparing the results of many different models and studies using other methodologies, taking into account the strengths and weaknesses of each study.

This paper presents and explains the effects to be expected from NAFTA, discusses how well those effects are incorporated into and assessed by the economic models and other studies, and compares and contrasts the results of the studies.[3] Its emphasis is on general economic effects, such as changes in gross national product (GNP), employment, and wages, and on the distribution of effects among industries. It does not deal with in-depth analyses of particular industries or the effects NAFTA would have on individual states or regions within countries, except insofar as they relate to these more general effects.

The paper covers 19 empirical studies of NAFTA: 10 that use static general equilibrium models, 3 that use dynamic general equilibrium models,

---

1. Many other studies have dealt with the economic effects on particular industries, states, or regions, or with noneconomic effects such as impacts on the environment. This paper is concerned primarily with studies of the general economic effects.

2. This is true in all economic modeling, but much more so in the modeling of NAFTA.

3. Other surveys have compared and contrasted many of the NAFTA models, but with different emphases. See, for example, U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2516 (May 1992). See also Drusilla K. Brown, "The Impact of a North American Free Trade Area: Applied General Equilibrium Models," Sidney Weintraub, "Modeling the Industrial Effects of NAFTA," Raul Hinojosa-Ojeda and Sherman Robinson, "Labor Issues in a North American Free Trade Area," and Tim Josling, "NAFTA and Agriculture: A Review of the Economic Impacts," in Nora Lustig, Barry P. Bosworth, and Robert Z. Lawrence, eds., *North American Free Trade: Assessing the Impact* (Washington, D.C.: The Brookings Institution, 1992). All of these surveys are likely to be difficult reading for noneconomists.

2 that use macroeconomic models, and 4 that use various other methodologies.[4] An explanation of the different kinds of analysis and their relative merits is provided in Appendix A. The studies examined are listed in Table 1. Bibliographical references and brief descriptions of each study are given in Appendix C. These studies are not exhaustive of the empirical work that has been published on the general economic effects of NAFTA, but as a group they are sufficient in number, variety, and quality to assess accurately the general conclusions of the literature.

The standard by which this paper assesses the studies is that of a noneconomist who wants objective predictions of the effects NAFTA would have--predictions colored as little as possible by opinions, educated guesses, and assumptions on which there may be significant disagreement. Models that do badly by this standard can still be quite useful. By running numerous simulations based on various assumptions, economists can gain insights into the importance of different assumptions and their effects. Such insights can inform economists' subjective opinions and predictions of NAFTA's effects and guide future research. Simulations of that kind, however, are of little use to nonspecialists who lack the necessary time and economic training to understand and interpret them, and who may not wish to receive their information through the filter of economists' subjective opinions and predictions.

CONCLUSIONS IN BRIEF

The studies that the Congressional Budget Office (CBO) surveyed were completed before the details of NAFTA had been released, and their authors were forced to make assumptions about important features of the agreement. For the most part this is not a severe problem. The modelers usually assumed that all or most tariffs and quotas would be eliminated immediately or phased out, which is in fact what the negotiators ended up agreeing to. Nevertheless, some important details, such as rules of origin for various products and phaseout schedules for various trade barriers, could not be incorporated into the studies because they were not known.

4. In some cases, two or more papers were written by the same author (or group of coauthors) using the same model. In such cases, the papers are referred to here as one study.

TABLE 1. EMPIRICAL STUDIES CBO REVIEWED FOR THIS PAPER (Listed by author)

Static General Equilibrium Models:

Bachrach and Mizrahi (KPMG Peat Marwick)
Boyd, Krutilla, and McKinney
Brown, Deardorff, and Stern (Michigan)
Cox and Harris
Hinojosa-Ojeda and Robinson
Hunter, Markusen, and Rutherford
Robinson, Burfisher, Hinojosa-Ojeda, and Thierfelder
Roland-Holst, Reinert, and Shiells (U.S. International Trade Commission)
Sobarzo
Trela and Whalley

Dynamic General Equilibrium Models:

Levy and van Wijnbergen
McCleery
Young and Romero

Macroeconomic Models:

Adams, Alanis, and del Rio (CIEMEX-WEFA)
Almon

Other Methodologies:

Hufbauer and Schott (Institute for International Economics)
Kehoe
Leamer
Prestowitz, Cohen, Morici, and Tonelson (Economic Strategy Institute)

NOTE: The names in parentheses are commonly used in discussions of those models or studies.

Most of the models estimate only the effects of NAFTA; they do not forecast the future of the economy once NAFTA is put into effect. In particular, they do not incorporate such things as economic recessions or booms that have causes extraneous to NAFTA.[5] Recessions and booms are

5. Failure to understand this point has led some observers to conclude incorrectly that earlier models were wrong in their predictions of beneficial effects for Canada from the Canada-United States Free Trade Agreement. After this agreement began to be phased in, the U.S. and Canadian economies went into recession and, consequently, performed poorly. Most economists attribute the recession to causes totally separate from the agreement, however, and believe the performance would have been even worse without the agreement.

hard to predict and bear little relevance to the question of what the long-term effects of NAFTA will be. Further, including any of these factors could lead to confusion concerning the relative contributions of NAFTA and the boom, recession, or prevailing growth trends to the performance of the economy. Forecasts of the future of the economy can be produced by adding the effects of booms or recessions indicated by standard macroeconomic forecasting models to the effects of NAFTA indicated by the models assessed in this paper.

Confirmation of Prior Knowledge

Most, though not all, of what can reliably be concluded from the models merely confirms what economists already knew or believed to be very likely. The models predict that NAFTA, if passed, would produce both winners and losers, but that the total gain of the winners would be larger than the total loss of the losers in both Mexico and the United States.[6] The effects on the U.S. economy--both good and bad--would be small for many years because (1) U.S. tariffs and other trade barriers are already small, (2) elimination of the tariffs and other barriers would be phased in slowly, and (3) the Mexican economy is only about 4 percent of the size of the U.S. economy. The benefits would grow over time, however, as the Mexican economy grew larger. The effects on the Mexican economy--both good and bad--would be large right away because Mexico's trade barriers are larger than those of the United States and the U.S. economy is so much larger than the Mexican economy.

NAFTA might thus be viewed from the U.S. perspective as an agreement to integrate the U.S. and Mexican economies now, when the pain of transition for the United States is small and the benefits slightly larger, in order to obtain much larger benefits many years down the road, when the Mexican economy will be much larger. Integrating the two economies after the Mexican economy has grown larger would be more painful than doing it now. The pain and benefit for Mexico would both be large in either case.

Although all of this was already known before the models were run, the models tell us a few things that were not known. They give estimates of the sizes of NAFTA's effects, though the estimates are very rough. The models

6. The same will most likely be true for Canada, also. Most of the studies of NAFTA ignore Canada because (1) its economy is small, (2) its trade with Mexico is very small, and (3) the freeing-up of trade between the United States and Canada is not an issue since a U.S.-Canadian free trade area has already been agreed to separately and is being phased in. For the most part, this paper will also ignore Canada for the same reasons and because the subject matter of the studies constrains the subject matter of this paper.

also give a rough idea of the relative importance of the various effects. A synopsis of this new information follows.

Effects on the Economy as a Whole

The most important effects of NAFTA by far would most likely be those related to investment and (multifactor) productivity growth.[7] Unfortunately, these are among the most difficult to model of all the agreement's effects, and the estimates of them are not very reliable. Productivity growth in particular has received very little attention from the modeling profession. One preliminary study indicates that NAFTA could increase the annual growth rate of Mexican productivity by more than 1.6 percentage points, which compounds to a more than 50 percent increase in output per worker over 25 years. Such growth, should it actually occur, presumably would have beneficial (though smaller) effects on the United States since it would make Mexico a larger trading partner and therefore provide more opportunities for gains from trade. The study does not examine effects on the United States, however.

Studies that exclude effects on productivity growth rates but include investment and all other significant effects estimate increases in Mexican gross domestic product (GDP) resulting from NAFTA ranging from 3.09 percent to 12.68 percent, with most of that increase resulting from increased investment in Mexico. Corresponding estimates for U.S. GDP range from no effect to roughly a 0.3 percent increase (although one study that excludes investment effects finds an increase of over 1 percent). In 1991, 0.3 percent of U.S. GDP amounted to $17 billion. These increases for U.S. GDP are from about one to two times those estimated by the same models when investment effects are excluded along with productivity effects. Including investment effects raises the estimated increases for Mexican GDP by much higher factors.

After productivity-growth and investment effects, the next largest effects would be resource-allocation effects and effects related to economies of scale. Resource-allocation effects include the relocation of production among

7. In this paper, the term "productivity growth" will always refer to multifactor productivity growth excluding whatever component might arise from increases in the sizes of firms that exhibit increasing returns to scale or from the reallocation of resources among the various industries of the economy (both of which are discussed separately). There are many kinds of productivity: labor productivity, capital productivity, multifactor productivity, and others. Multifactor productivity growth is productivity growth that results from improvements in technology, skill, and organization. Technically, it is defined as the increase in output of a firm or industry that remains after subtracting all increases that result from increases in the use of labor, capital, land, and intermediate inputs. Thus, increasing the amount of capital of a firm increases its labor productivity but does not increase the multifactor productivity unless the capital incorporates new and improved technology.

countries according to comparative advantage, and the corresponding reallocation of each economy's resources among its various industries. Most of the studies estimate that resource-allocation effects would increase Mexican GDP, but by less than 1.1 percent. Taking resource-allocation effects together with economies of scale, the estimated increases in Mexican GDP range from 1.7 percent to 3.38 percent. Most of the studies estimate that resource-allocation effects would increase U.S. GDP, but by 0.23 percent or less. Estimates of the increases resulting from resource-allocation effects combined with economies of scale are insufficient in number and consistency to draw reliable conclusions. Theory, however, suggests that the effects of economies of scale on U.S. GDP should be positive but smaller than the effects on Mexican GDP.

Three of the studies CBO reviewed give sufficient data to calculate the ratio of the gain in annual U.S. GDP to the number of jobs that would shift from industries that contract as a result of NAFTA to industries that expand. The results of the three calculations are gains of $342,000, $92,000, and $35,000 per job shift.[8] The first of these is much larger than the results normally obtained for ratios of this kind and should therefore be viewed with suspicion. The second is more reasonable but is still above the normal range of estimates for similar ratios. The third is in the upper end of the normal range of estimates. These gains in GDP would be permanent. Thus, in the case of the third estimate, for each job shift GDP would be higher every year thereafter by $35,000. Over 10 years, the undiscounted ratio of gains to job shifts would be 10 times this amount, or $350,000. Further, not all of the job shifts out of contracting industries would require laying off workers. Many of the shifts would probably occur through attrition, since NAFTA calls for a slow, phased removal of trade barriers.

Effects on Wages

Many people have expressed concern that, under NAFTA, competition from imports produced by low-wage Mexican labor would force down the wages of U.S. workers. The results of the models indicate that this competition effect would be so small as to probably be overpowered by other effects beneficial to labor, including effects related to investment, productivity growth, economies of scale, and changes in real exchange rates with the rest of the

8. The second of these numbers is actually the ratio of the equivalent variation to the number of jobs that would shift. The equivalent variation is the change in GDP that would be required at pre-NAFTA prices to obtain the same level of well-being that the actual change in GDP brings at post-NAFTA prices. (The change in prices affects welfare independent of the change in GDP.) The equivalent variation is usually close in value to the change in GDP.

world. As a result, the real wages of even unskilled labor in the United States (which is the labor most likely to be negatively affected by competition with Mexican imports) would in all likelihood rise. Whether positive or negative, however, the effects of NAFTA on all classes of labor would be very small, with most estimates of changes in real wages being less than 1 percent.

Effects on Particular Industries

Of course, in industries that contracted as a result of NAFTA, both labor and the owners of capital would be hurt temporarily, and some capital that could not be used in other industries might have to be discarded.[9] Similarly, labor and capital in industries that expanded would be helped. Many people have expressed concern that the low prevailing wages in Mexico would allow Mexican firms to undercut their U.S. competitors in all or most industries, so that all or most U.S. labor and owners of capital would be hurt by NAFTA. On average, however, the Mexican wage advantage would be offset by low labor productivity (though the case for some industries might be different from the average). In addition, large investment flows into Mexico resulting from NAFTA would cause an appreciation of the Mexican peso, further boosting the competitiveness of all U.S. products. All effects considered, NAFTA should help Mexican firms in unskilled-labor-intensive industries, help U.S. firms in capital-intensive and skilled-labor-intensive industries, and improve the U.S. balance of trade with Mexico.

It is difficult to draw consistent conclusions from the models regarding effects on specific industries, other than that the effects would generally be small--the vast majority of gains and losses for U.S. industries being less than 1 percent. The division of the U.S. and Mexican economies into industrial sectors varies widely from model to model, making comparisons among models difficult, and conclusions as to which industries would be helped or hurt the most also vary.

Reasoning from theory, one would expect U.S. industries to be helped by NAFTA in proportion to their possessing the following characteristics: high capital intensity, high skilled-labor intensity, production of capital goods (since the increase in investment to be expected in Mexico would increase Mexican demand for capital goods), high current Mexican trade barriers

9. In some cases, owners of capital in industries that contracted might benefit. That could happen if the owners were to place their own capital in Mexico with the result that their operations became more competitive relative to imports from another country. Such might be the case with the apparel industry, where setting up operations in Mexico could make the production of U.S.-owned producers more competitive with imports from Asia.

(since the elimination of these barriers would make U.S. exports more competitive in the Mexican market), and low current U.S. trade barriers (since the elimination of low U.S. barriers would not greatly increase the competitiveness of Mexican imports). One would expect U.S. industries to be hurt by NAFTA in proportion to their being characterized by high unskilled-labor intensity, high current U.S. trade barriers, and low current Mexican trade barriers. In addition, climate, supplies of arable land, and other factors suggest that U.S. agriculture as a whole (and especially producers of grain, oilseeds, and animal products) should benefit, although some sectors, such as those that produce fruits and vegetables, could be hurt.

The effects NAFTA would have on individual industries are relevant to the question of how many workers would be forced to leave declining industries and find new jobs in expanding industries. The answer to this question is a qualified "not many." Three studies give sufficient information to calculate the number of jobs that would shift from declining industries to expanding industries. As was discussed earlier, only in part would these shifts represent involuntary dismissals from the declining industries--the rest of the employment declines would occur through attrition. The three studies estimate cumulative employment losses over many years of 55,300, 32,400, and 29,800 in the declining industries. The loss in any given year would be only a small fraction of the long-run amount. These numbers are quite small in comparison with the normal churning of the U.S. labor market that occurs even in the best of times. From 1981 through 1990, for example, the annual number of workers involuntarily dismissed from their jobs ranged from a low of 1.5 million in 1988, a boom year, to a high of 2.7 million in 1982, a recession year.[10]

The conclusion of small job losses has to be qualified because of the previously mentioned fact that the productivity-growth effects of NAFTA have not been well modeled. Their proper modeling could change the studies' estimates of gross job losses, as well as their estimates of the effects of NAFTA on particular industries. Further, the study that produces the estimate of 32,400 does not incorporate the large investment increase in Mexico that most analysts expect to occur (though the studies that produce the estimates of 55,300 and 29,800 *do* incorporate it). The estimates are so small, however, that even substantial increases would not make them large in comparison with the normal rate of involuntary dismissals.

10. Congressional Budget Office, *Displaced Workers: Trends in the 1980s and Implications for the Future* (February 1993), pp. x and 7.

MODELING NAFTA

Most of the empirical studies of NAFTA use either macroeconomic models or--much more often--applied general equilibrium models.[11] If such models are to give reasonably accurate estimates, they must incorporate a number of important effects that NAFTA would have. Most of these effects are incorporated into at least one of the models that CBO surveyed. None of the models incorporates all of them, however, and two particularly important effects are either ignored or treated in ad hoc or cursory ways in all of the models. The reasons for this lie in the complexity of the models, a lack of good data, the early state of development of some of the relevant modeling, and the difficulty (if not impossibility) of modeling some of the effects in question. In some cases modelers are interested in only one aspect of NAFTA and therefore choose to emphasize the effects that are most important for that aspect and to treat lightly or ignore the effects that are least important.

Resource Allocation

One group of effects of NAFTA concerns the allocation of resources among industries. These are the effects that usually come to mind first when free trade is discussed.

Trade Creation Versus Trade Diversion. The reduction and eventual elimination by NAFTA of trade barriers between the United States and Mexico would cause trade between the two countries to increase. Some of the increase in U.S. imports from Mexico would displace domestically produced products and some would displace imports from other countries. (Similarly, some of the increase in Mexican imports from the United States would displace Mexican-produced products and some would displace Mexican imports from other countries.) The displacement of domestically produced products by imports is referred to by economists as "trade creation" because it results in a net increase in trade. The displacement of other imports is referred to as "trade diversion" because there is no net increase in trade--merely a diversion of preexisting trade from one trading partner to another.

The distinction between trade creation and trade diversion is important because the net economic effect of trade creation is more likely to be beneficial in aggregate than that of trade diversion. Although some sectors

11. A discussion of these two types of models and other types of relevant analysis, and of when each is most appropriately used, is provided in Appendix A.

may be hurt by it, trade creation is almost always economically beneficial in aggregate because it happens only when the import price is lower than the domestic cost of production, allowing the domestic economy to obtain the good in question at lower cost than would be possible without trade.[12]

Trade diversion is less likely to be beneficial in aggregate (although some sectors are still likely to be helped) because it results in the import being obtained at higher cost to the economy. Using NAFTA as an illustration, the fact that the import came from elsewhere before NAFTA, when tariffs on imports from Mexico were equal to those on imports from other countries, indicates that the competing country was selling the product for a lower price than Mexico was. After NAFTA, the competing country's price would still be lower, but the domestic purchaser would choose the Mexican import because (in the case of trade diversion) the Mexican price would be lower than the competing country's price plus the tariff. Though the cost to the domestic purchaser of the competing-country import would be the price plus the tariff, the cost to the economy would be the price only. The tariff would be paid by the purchaser to the U.S. government and therefore would not be a loss to the economy.[13]

Because of the economic importance of the distinction between trade creation and trade diversion, an economic model should be able to distinguish between them. At a minimum, this requires separate sections of the model for the United States, Mexico, and the rest of the world (ROW). Most, but not all, of the models are so constructed. In many cases, the section for the ROW consists solely of import and export equations, but that is sufficient. In some cases, only Mexico is modeled, with equations for trade with an ROW that includes the United States. That is not sufficient for capturing trade diversion.

The Effect of Low Mexican Wages. Contrary to the fears expressed by many, the low wages of unskilled labor in Mexico would not and could not give a blanket advantage to all or even most Mexican firms under NAFTA. Rather, they would make it easier for Mexican firms to undercut U.S. firms in

12. In certain cases, a harmful effect of trade creation can more than offset the beneficial effect for a given country, though not for that country and its trading partners considered together as one. If a country's firms collectively constitute most of a particular world industry, the country can use optimally set tariffs to effectively cartelize the industry and thereby take advantage of monopoly power to improve the country's terms of trade. (In practice, tariffs are rarely if ever set at these optimal levels.) In such cases, the portion of trade creation that results from lowering tariffs below their optimal levels is economically detrimental to the country imposing them. It is beneficial to that country and its trading partners considered together as one, however.

13. In some cases, certain beneficial effects of trade diversion can more than offset this detrimental effect. Also, if tariffs are sufficiently low and the primary barrier to imports is quotas, this argument fails and trade diversion may not be harmful.

industries that use unskilled labor intensively and for U.S. firms to undercut Mexican firms in industries that use capital and skilled labor intensively.

The low Mexican wages result from low labor productivity, which in turn results from Mexico's small aggregate capital stock, low-quality capital, inferior technology, poor infrastructure, and other causes. Because of this low productivity, Mexican firms must hire more labor than U.S. firms to produce the same amount of output, and this added labor requirement offsets the lower wages. Only Mexican firms that are significantly closer to U.S. productivity levels than the Mexican average would have a significant labor-cost advantage over U.S. firms under NAFTA, and even these firms would have to overcome transportation costs to export to the United States. Of course, by definition less than half of the Mexican economy can be closer than average to U.S. productivity levels, and only part of that half would be close enough to have a significant labor-cost advantage over U.S. firms. For a similarly sized part of the other half, the U.S. productivity advantage would significantly outweigh the low Mexican wage, resulting in U.S. exports to Mexico. As productivity levels increase throughout the Mexican economy, Mexican wages should eventually increase along with them, so this conclusion should continue to hold.

Even if some aberration were to keep Mexican wages lower than justified by Mexican productivity levels, it would still not be possible for all or even most Mexican firms to undercut their U.S. counterparts. To see why, suppose that productivity and the cost of all inputs except unskilled labor were the same (measured in dollars) in both the United States and Mexico, and that unskilled labor were much cheaper in Mexico. Initially, all Mexican-produced goods and services would be cheaper than the corresponding U.S.-produced goods and services, and the United States would begin importing.

U.S. importers would need pesos to purchase the imports, however, and would have to purchase those pesos with dollars. This would drive up the dollar price of the peso (the exchange rate), which would make all Mexican goods and services more expensive in the United States. Only in industries that are unskilled-labor-intensive would the Mexican labor-cost advantage be sufficient to overcome this exchange rate effect. In other industries, the exchange rate effect would give U.S. firms an advantage over Mexican firms.

The Mexican government (or central bank) could intervene to keep the peso from rising, but doing so would increase the Mexican money supply. This would cause a general price inflation in the Mexican economy, making all Mexican-produced goods and services more expensive relative to the corresponding U.S.-produced goods and services. Again, only in industries

that are unskilled-labor-intensive would the Mexican labor-cost advantage be sufficient to overcome this inflation disadvantage. In other industries, the price inflation would give U.S. firms an advantage over Mexican firms.[14]

By a fundamental accounting identity, the trade balance of each country with the entire world must be equal to its aggregate saving minus its aggregate investment.[15] Thus, the U.S. trade balance could not deteriorate as a result of NAFTA unless domestic saving were to decline or domestic investment were to increase. There is no reason to expect either of these to occur. In fact, the opposite is more likely. The effects of NAFTA on trade balances will be discussed further in the section on the investment effects of NAFTA.

The formal modeling studies that CBO reviewed all incorporate the differing productivity levels of U.S. and Mexican industries, and they generally incorporate the trade-balance identity. Many of them, however, assume arbitrarily--and almost certainly incorrectly--that either the trade balance or the exchange rate between the United States and Mexico would remain fixed and unchanged under NAFTA. The Prestowitz et al. study, which is discussed later in this paper in the section on nonmodeling methodologies, appears to ignore the identity.

Substitution Among Inputs. The expansion of unskilled-labor-intensive industries in Mexico to produce the exports to the United States that would result from NAFTA would increase the demand for unskilled labor in Mexico relative to the demand for capital. This would cause the price of unskilled labor (the wage) to increase relative to that of capital. As a result, firms would find it profitable to purchase more labor-saving capital and thereby reduce their employment costs. In the United States, the reverse would happen. The price of capital would increase relative to that of unskilled labor, which would tend to deter firms from replacing labor with labor-saving capital.

The changes in the relative prices of capital and labor described here are referred to by economists as Stolper-Samuelson effects. An explanation of the

14. The conclusion that Mexico would export unskilled-labor-intensive goods and services to the United States and the United States would export skilled-labor-intensive and capital-intensive goods and services to Mexico is not restricted to the cases of fixed and floating exchange rates described here. It would also hold if Mexico and the United States had the same currency or even if they traded by barter. It is a fundamental result of the theory of comparative advantage, which was first set forth by David Ricardo in 1817 and has long been accepted by economists.

15. The term "trade balance" is used throughout this paper to mean the balance of trade in goods and services. Whether or not returns on capital are included among "services" depends on the model. Models that work with gross national product include returns on capital; those that work with gross domestic product do not.

concept that is more familiar to noneconomists is that competition with imports from low-wage producers in Mexico would put downward pressure on the wages of unskilled workers in the United States. Likewise, in Mexico, competition with imports from producers in the United States that have many college-educated and other skilled employees and large amounts of advanced labor-saving capital would put downward pressure on profits in capital-intensive and skilled-labor-intensive industries in Mexico, which does not have large supplies of capital or educated workers that these industries can draw on.

NAFTA would also cause firms to make substitutions among the intermediate goods that they purchase as inputs to their production processes. The reduction of U.S. tariffs and quotas would lower the domestic prices of the intermediate goods that were formerly restricted. As a result, firms would employ some of these goods in place of other, more expensive goods that they formerly used as substitutes. Mexican firms would react in similar fashion to the reduction of Mexican tariffs and quotas.

To estimate accurately the effects of NAFTA, a model must allow for these substitutions between capital and labor (or, more generally, among all factors of production in the model) and among intermediate goods. All except one of the models that CBO reviewed allow for substitution among factors of production. Only two of the models allow for substitution among intermediate goods, and one of those allows substitution only between energy and a composite of other intermediate goods.

The models that do not allow for substitution among intermediate goods assume that fixed amounts of each intermediate good are required to produce a given amount of a final good. There are several reasons for making this assumption. One is that when there are many intermediate goods (as there are in many of the models), solving a model that allows substitution among the goods is difficult (that is, it requires much computational power). Another is that economists know little about how much substitution would occur as a result of a given change in relative prices (much less than they know about the rate of substitution between capital and labor).

Improved Terms of Trade. NAFTA would improve the terms of trade of the United States, Canada, and Mexico with the rest of the world--that is, the three countries would not have to export as much in order to pay for a given value of imports. This would happen because NAFTA would divert trade with the rest of the world to other countries in the free-trade area. Since the three countries would supply less of their exports to the rest of the world, the prices of their exports would rise; likewise, since the three countries would

demand lower quantities of imports from the rest of the world, the prices of those imports would fall.

Sectoral Disaggregation. To assess accurately the effects NAFTA would have on resource allocation, a model must section the U.S. and Mexican economies into a reasonably large number of industrial sectors to coincide with the large number of tariffs and quotas that the United States and Mexico impose on goods and services. The models CBO surveyed vary tremendously on this score, ranging from one model with 78 U.S. sectors and 74 Mexican sectors to another model with only two sectors for each country.[16]

Significance of Effects on GDP. Nine of the modeling studies CBO reviewed examine the resource-allocation effects of NAFTA in isolation from the other effects discussed below, such as increased investment and productivity growth in Mexico.[17] These studies fairly uniformly find the resource-allocation effects to be very small.

Six of the studies present estimates of resource-allocation effects on U.S. GDP (see Table 2). Five of these estimate increases of 0.23 percent or less. The sixth--the Roland-Holst et al. study--estimates a 1.34 percent increase. This is the first of several instances to be discussed in this paper in which the Roland-Holst et al. estimates for the United States are larger than those of the other studies. One reason may be an upward bias created by the study's assumption of a fixed wage for the United States. This problem will be discussed later in the section on labor markets. Another reason is that the study assumes that existing nontariff barriers to trade are more restrictive than do the other studies. A final reason is that the study estimates the effects of eliminating the barriers to trade among the three countries that existed in 1988, which was before the implementation of the Canada-United States Free Trade Agreement (CFTA) began. Thus, in addition to the actual effects of NAFTA, the study attributes to NAFTA the effects of eliminating the barriers to U.S.-Canadian trade, which should actually be attributed to CFTA.

16. The study with 78 U.S. sectors--the Almon study--reports results for only 71 sectors (see Tables 13 and B-1). One of the missing sectors is "rest of world," which is not actually an industry sector. The study does not indicate what the other sectors are.

17. Two of these nine allow for migration between Mexico and the United States in the simulations relevant for this section. (A third gives results of relevant simulations both with and without migration, of which only the former are presented here.) The two are included here among the group that examine only resource-allocation effects for four reasons. First, migration is not a source of gain or loss from NAFTA; it merely influences the gains or losses that arise from other effects. Second, the studies in question do not present results for resource-allocation effects without the migration. Third, the migration does not appear to alter significantly the results *in this case*. (This is not true in other cases, such as when investment effects are included.) Finally, there is no other table in this paper in which it is appropriate to include these results.

TABLE 2. ESTIMATES OF NAFTA'S EFFECTS ON GDP BY MODELS INCORPORATING ONLY RESOURCE-ALLOCATION EFFECTS (Percentage change in GDP)

Model	United States	Mexico	Canada
Adams, Alanis, and del Rio	n.e.	1.09	n.e.
Almon	0.09	-0.04	n.e.
Bachrach and Mizrahi	0.02	0.32	n.e.
Boyd, Krutilla, and McKinney	n.e.	n.e.	n.e.
Hinojosa-Ojeda and Robinson	0.0[a]	0.3[a]	n.e.
McCleery	0.22	0.01	n.e.
Robinson et al.	0.23[a]	0.27[a]	n.e.
Roland-Holst et al.	1.34[b]	2.27[b]	7.22[b]
Young and Romero	n.e.	2.6	n.e.

NOTES: n.e. = no estimate made by study. The value for the Adams, Alanis, and del Rio study is for the cumulative change in GDP through 2001 for liberalization that begins in 1991. The values for the Almon study are for the cumulative change in annual GNP through 1995 assuming that liberalization begins in 1990. The values for the McCleery model are for the year 2000 assuming the phasing out of tariffs only (no change in quotas) over the years 1991 to 2000. The other models are static general equilibrium models, so the numbers are for the cumulative change some time many years into the future.

a. Unlike the case for the other results in this table, the simulations that produced these numbers allowed for migration of labor between Mexico and the United States.

b. The values for the Roland-Holst et al. study are for the effects of NAFTA assuming that the Canada-United States Free Trade Agreement (CFTA) does not exist. Thus, in addition to the actual effects of NAFTA, they include the effects of eliminating barriers to U.S.-Canadian trade, which are effects of CFTA and which will occur (or have already occurred) regardless of whether NAFTA is implemented.

The estimates of NAFTA's effect on Mexican GDP are larger on average than those of the effect on U.S. GDP, but are still not very large. Five of the eight studies that give such estimates find less than a 0.4 percent increase; the other three find increases of 1.09 percent, 2.27 percent, and 2.6 percent.

Though the numbers for the United States may seem small, it must be remembered that the U.S. economy is very large, and 0.1 percent of U.S. GDP in 1991 was $5.7 billion. Moreover, one might question the relevance of increases expressed in percentage terms. Proposed policy changes are usually assessed by comparing benefits with costs, not by comparing benefits with GDP. Ignoring foreign-policy concerns for the moment, the benefit of NAFTA for the United States would be the absolute dollar increase in GDP. The cost (or at least a major portion of the cost) would be the temporary unemployment of people who would lose their jobs in contracting industries

and hence would have to find new ones in expanding industries. Thus, a more standard measure would be the ratio of the absolute increase in GDP to the number of people forced to find new jobs as a result of NAFTA. This ratio represents the average annual cost per person (over and above the person's wages or salary) of maintaining the restrictions on imports from Mexico in order to keep U.S. workers from being forced to change jobs.

Partial equilibrium studies of various U.S. trade restrictions (not necessarily those on imports from Mexico) typically find the value of this ratio for those restrictions to be in a range of about $10,000 to $40,000 per job per year.[18] For NAFTA, the Almon study gives sufficient numbers for calculating the ratio of the increase in GDP to the number of jobs that will shift from declining industries to expanding industries, which is an approximation to the ratio in question.[19] The result is $342,000 per job, which is enough larger than the partial equilibrium results to raise suspicion that it may be wrong.[20] The same calculation from numbers given in the Brown, Deardorff, and Stern study (discussed later in this paper because the simulation includes economies of scale and investment effects) produces an estimate of $92,000 per job, which is closer to--but still higher than--the normal range of partial equilibrium results.[21] The calculation from numbers in the Bachrach and Mizrahi study for a simulation that includes investment effects (a different simulation from that reported in Table 2) gives an estimate of $35,000 per job, which is in the upper end of the normal range. None of the other studies that CBO reviewed gives sufficient information for calculating the ratio.

The Young and Romero study, which is the only one to allow substitution among all (or even most) intermediate inputs, finds the largest effect on Mexico of any of the studies--an increase in GDP of 2.6 percent.[22] (The study does not model effects on the U.S. economy.) It is not clear, however,

---

18. See, for example, Congressional Budget Office, *Trade Restraints and the Competitive Status of the Textile, Apparel, and Nonrubber-Footwear Industries* (December 1991), Chapter III.

19. It is not exactly the same as the ratio in question because some job shifts out of declining industries would occur through attrition rather than through involuntary dismissals. Also, NAFTA could cause some involuntary dismissals that were not related to job shifts out of an industry if it caused one firm in the industry to expand while another in the same industry contracted.

20. This number is in 1991 dollars and is calculated from the Almon study's results for 1995 under the assumption that liberalization began in 1990.

21. This number is actually the ratio of the equivalent variation to the number of job shifts, which should be close in value to the ratio of the change in GDP to the number of job shifts. (See note 8.)

22. The Bachrach and Mizrahi study allows substitution between energy and a composite of other intermediate inputs.

how much of this increase can be attributed to substitution among intermediate inputs. Unlike most other studies, the Young and Romero study assumes that imports and domestically produced goods are perfect substitutes, which leads to greater gains from specialization as a result of NAFTA.

The study also employs a dynamic general equilibrium model and uses it to model effects on investment. The largest of these investment effects--that resulting from lower interest rates in Mexico--is reserved for a different simulation discussed later in this paper. The simulation reported here does, however, include the increased investment that results from elimination of Mexican tariffs on imported capital goods (machinery). That investment, along with the substitution among intermediate inputs, could help account for the 2.6 percent increase obtained by the study. This particular investment effect could be thought of as a substitution effect in a more general sense, however, if capital is regarded as an intermediate input. (Other investment effects discussed later cannot be so thought of.)

Significance of Effects on Average Wages. The models predict that the resource-allocation effects of NAFTA on wages, like those on GDP, would be small. Further, they predict that the effects on labor as a whole would be positive, and they give little evidence of a significant Stolper-Samuelson effect.

Six of the models CBO reviewed estimate these effects on U.S. wages (see Table 3). Four of the six estimate effects of less than 0.5 percent in magnitude, and all four of them find the effects will be positive. Looking at the other two, the Robinson et al. study estimates that the wages of rural and unskilled urban workers would decline by 1.3 percent and 1.7 percent, respectively, and the wages of skilled urban and white-collar workers would each increase by 0.1 percent. The results of the McCleery study might be questioned on the basis of the extreme degree of abstraction and aggregation that characterizes the model (it has only two industrial sectors) and two peculiar findings that are contrary to the results of most of the other models.[23] A seventh study--the aforementioned Roland-Holst et al. study--assumes wages to be fixed and estimates the effect on employment. It is not clear what the magnitude of the estimated wage change would have been had

23. The study predicts that the effects on Mexican GDP and wages will be smaller than those on U.S. GDP and wages and that the wages of high-wage manufacturing labor in the United States will decline while those of low-wage services labor will increase. Though neither of these predictions is necessarily wrong, they are contrary to expectations and to the results of most of the other studies. The first prediction contradicts expectations based on the relative sizes of the U.S. and Mexican economies. The second is in the opposite direction to Stolper-Samuelson effects, which means that some other factor in the model must be overpowering the Stolper-Samuelson effects.

TABLE 3. ESTIMATES OF NAFTA'S EFFECTS ON LABOR MARKETS BY MODELS INCORPORATING ONLY RESOURCE-ALLOCATION EFFECTS (Percentage change)

Model	United States	Mexico	Canada
Effects on Average Real Wages			
Adams, Alanis, and del Rio	n.c.	-0.01	n.e.
Almon	0.19	n.e.	n.e.
Bachrach and Mizrahi	0.02	0 assumed	n.e.
Boyd, Krutilla, and McKinney	0.01[a]	n.e.	n.e.
Hinojosa-Ojeda and Robinson			
rural workers	0.3[b]	-0.2[b]	n.e.
unskilled urban workers	0.4[b]	-0.2[b]	n.e.
skilled urban workers	0.0[b]	1.0[b]	n.e.
white-collar workers	0.0[b]	0.1[b]	n.e.
McCleery			
low-wage services workers	2.35	-0.56	n.e.
high-wage services workers	0.12	0.18	n.e.
high-wage manufacturing workers	-1.44	0.24	n.e.
Robinson et al.			
rural workers	-1.3[b]	1.8[b]	n.e.
unskilled urban workers	-1.7[b]	-0.2[b]	n.e.
skilled urban workers	0.1[b]	1.1[b]	n.e.
white-collar workers	0.1[b]	1.0[b]	n.e.
Roland-Holst et al.	0 assumed	0 assumed	0 assumed
Young and Romero	n.e.	n.e.	n.e.

(Continued)

the study held employment rather than the wage fixed, but the direction of the change would have been positive. Thus, the results of the study are consistent with those of the four that show positive effects on wages.

Significance of Effects on Individual Industries. Not all of the studies give results for individual industries, and most of those that do so give them for only one simulation (whereas they give GDP and wage results for all simulations). Hence, there are relatively few such results, and it is not possible to isolate the various kinds of effects (resource allocation, economies of scale, investment, productivity growth). Consequently, the industry results for all models and all kinds of effects are assessed together at the end of this paper.

TABLE 3. CONTINUED

Model	United States	Mexico	Canada
Effects on Aggregate Employment			
Adams, Alanis, and del Rio	n.e.	0.29	n.e.
Almon	0.07	-0.55	n.e.
Bachrach and Mizrahi	0 assumed	0.85	n.e.
Boyd, Krutilla, and McKinney	n.e.	n.e.	n.e.
Hinojosa-Ojeda and Robinson	-0.1[b]	0.3[b]	n.e.
McCleery	0 assumed	0 assumed	n.e.
Robinson et al.	c	c	n.e.
Roland-Holst et al.	1.88[d]	1.49[d]	8.96[d]
Young and Romero	n.e.	0 assumed	n.e.

NOTES: n.e. = no estimate made by study. The values for the Adams, Alanis, and del Rio study are for the cumulative changes in the average wage and employment through 2001 for liberalization that begins in 1991. The values for the Almon model are for the cumulative change in the average wage and employment through 1995 assuming that liberalization begins in 1990. The values for the McCleery model are for the year 2000 assuming the phasing out of tariffs only (no change in quotas) over the years 1991 to 2000. The other models are static general equilibrium models, so the numbers are for the cumulative change some time many years into the future.

a. The results from the Boyd, Krutilla, and McKinney study do not include the effects of liberalizing nontariff barriers to trade.

b. The results from the Hinojosa-Ojeda and Robinson study and the Robinson et al. study include the effects of labor migration between the United States and Mexico.

c. The Robinson et al. study reports absolute changes rather than percentage changes in employment: an increase of 238,000 people in the United States and an equal decrease in Mexico as a result of migration from Mexico to the United States.

d. The values for the Roland-Holst et al. study are for the effects of NAFTA assuming that the Canada-United States Free Trade Agreement (CFTA) does not exist. Thus, in addition to the actual effects of NAFTA, they include the effects of eliminating barriers to U.S.-Canadian trade, which are effects of CFTA and which will occur (or have already occurred) regardless of whether NAFTA is implemented.

Economies of Scale

Many industries exhibit economies of scale over some range of sizes of their firms. This means that the long-run average cost per unit of output declines

as output increases.[24] Scale economies can occur at the level of the plant, the firm, or the entire industry. The most obvious examples arise at the levels of the firm and the plant. The automobile industry is illustrative. Scale economies at the level of the firm occur because sizable design and engineering costs are just as large for the production of one car as for the production of 1 million cars of the same model, and must be spread over tens of thousands of cars before the average cost per car declines to a level that the average consumer can afford. Scale economies also occur at the level of assembly plants, which are more efficient if designed and operated to produce 50,000 cars per year rather than 1,000 cars per year.

Economies of scale open more avenues for NAFTA to affect the countries involved. In a small economy such as Mexico's, the total demand for an industry's product may be too small to exhaust the economies of scale in that industry. If so, opening the country to free trade with a larger country would allow its firms (or those of the partner country) to expand to a size larger than the market of the one country (Mexico in this case) and thereby increase efficiency. The U.S. economy is sufficiently large that economies of scale are probably already exhausted in most industries, so this avenue should be more significant for Mexico than for the United States.

More likely than unexhausted economies of scale, especially for the United States, is the possibility that the minimum efficient scale of an industry is so large relative to demand for the industry's products that only two or three firms--possibly only one--will exist in an economy closed to trade. Many industries in the United States are dominated by a few firms. In cases such as these, lack of competition can result in firms charging higher prices than they otherwise would, and feeling little pressure to engage in research and development or to improve product quality and customer service. Free trade can increase competition in such cases.

Economies of scale decrease the ability of a single economy to produce all of the varieties of technology, capital, and intermediate goods that can improve productivity and output. Free trade allows some of these to be imported. Once again the automobile industry provides a good example. Most automobiles sold in the United States, regardless of the nationality of their maker, contain parts from other countries. In some cases, different aspects of engineering and design are conducted in different countries.

---

24. The NAFTA modeling studies often refer to economies of scale as *increasing returns to scale*. Though many economists and others use the terms interchangeably, some do not, insisting on a slightly narrower definition for increasing returns to scale that relates output to inputs rather than to the cost of inputs. That different definition is not appropriate for this paper; so, to avoid confusion, the term is not used.

Economies of scale have distributional as well as aggregate effects. Some industries exhibit economies of scale at their current levels of operation; others do not. Under NAFTA, the former could improve their efficiencies, but the latter could not. Hence, the effect on the relative competitiveness of U.S. and Mexican firms will vary from industry to industry, and this could cause changes in which products are exported and which imported by each country.

Significance of Effects on GDP. Incorporating economies of scale into the models significantly boosts the estimated effects of NAFTA on Mexican GDP. The effects on estimates of U.S. GDP are less clear, but they are probably small and positive.

Only four of the models CBO reviewed incorporate economies of scale, and of those, one gives results only for Canada and another gives results only for Mexico (see Table 4). Further, only the Roland-Holst et al. study facilitates a clean analysis of its effects by presenting results for both constant-returns-to-scale and economies-of-scale versions of the same model. Consequently, one must resort largely to comparing the results of two separate groups of models to ascertain the effects of scale economies. The four models formally incorporate scale economies at the industry level only, but this feature of the models may function as much or more as an approximation of scale economies at the firm or plant level. These latter economies could not be incorporated into the models directly without a substantial increase in their complexity.

Models that incorporate economies of scale along with the resource-allocation effects discussed earlier show significantly larger effects on Mexican GDP than do those that incorporate only the resource-allocation effects. The sizes of the increases in GDP estimated by the models that include economies of scale range from 1.7 percent to 3.38 percent (see Table 4). The increases estimated by five of the eight models or simulations that include only resource-allocation effects were below 0.4 percent (see Table 2). None was as high as 3.38 percent.

The effects of scale economies on U.S. GDP are less clear, though they appear to be positive and much smaller (in percentage terms) than those on Mexican GDP. Only two models give such estimates. The economies-of-scale version of the Roland-Holst et al. model gives two different results depending on the type of market structure assumed. If Cournot equilibrium is assumed, the model shows an increase in U.S. GDP of 1.30 percent, which is trivially less than the 1.34 percent increase estimated by the constant-returns-to-scale

TABLE 4. ESTIMATES OF NAFTA'S EFFECTS ON GDP BY MODELS INCORPORATING ECONOMIES OF SCALE AND RESOURCE-ALLOCATION EFFECTS (*Percentage change in GDP*)

Model	United States	Mexico	Canada
Brown, Deardorff, and Stern	0.1[a]	2.2[a]	0.0[a]
Cox and Harris	n.e.	n.e.	0.12
Roland-Holst et al.			
assuming Cournot equilibrium	1.30[b]	2.57[b]	5.82[b]
assuming contestable markets	2.07[b]	3.38[b]	10.57[b]
Sobarzo			
fixed trade bal., variable exch. rate	n.e.	1.7[c]	n.e.
variable trade bal., fixed exch. rate	n.e.	1.9[c]	n.e.

NOTE: n.e. = no estimate made by study.

a. The values for the Brown, Deardorff, and Stern model are equivalent variations as a percentage of GDP. Equivalent variation is the change in GDP that would be required at pre-NAFTA prices to obtain the same level of well-being that NAFTA would bring. (NAFTA would change well-being by changing relative prices of imports and domestic production as well as by increasing GDP.)

b. The values for the Roland-Holst et al. study are for the effects of NAFTA assuming that the Canada-United States Free Trade Agreement (CFTA) does not exist. Thus, in addition to the actual effects of NAFTA, they include the effects of eliminating barriers to U.S.-Canadian trade, which are effects of CFTA and which will occur (or have already occurred) regardless of whether NAFTA is implemented.

c. The results for the Sobarzo study do not include the effects of liberalizing nontariff barriers to trade.

version of the same model (see Table 2). If contestable markets are assumed, the model estimates a 2.07 percent increase, which is 1.5 times as large. (For the moment, the reader should not be concerned with what these market structures are. The effects of market structure will be discussed shortly. What is important here is the range of results for GDP.)

These results suggest that the existence of economies of scale probably increases the amount by which NAFTA would benefit the United States. The size of the effect is uncertain, however, for four reasons: uncertainty as to the relevant extent of the two market structures in the U.S. economy, the previously mentioned upward bias in the estimates of this model resulting from its assumption of a fixed wage for the United States, the previously mentioned question about the assumed restrictiveness of current nontariff barriers to trade, and the previously mentioned inclusion of the effects of CFTA in the estimated effects of NAFTA.

The other model--the Brown, Deardorff, and Stern model--estimates an increase in U.S. GDP of 0.1 percent, which is larger than three of the estimates of the models in Table 2, which assume constant returns to scale, and smaller than the other three.

The models reviewed here do not incorporate all of the effects of economies of scale--only the exhausting of unexhausted economies of scale and the reduction of monopolistic pricing. The competitive effects on research and development, product quality, and customer service are difficult, if not impossible, to model. Consequently, the models may underestimate the total effect of economies of scale. One might argue, alternatively, that the unmodeled competitive effects are more properly classified as among the productivity-growth effects that are discussed later in this paper. In that case, the models underestimate the productivity-growth effects of NAFTA rather than the effects of economies of scale.

The assumption that economies of scale exist requires an assumption of some form of imperfectly competitive market. A few examples of such assumptions are monopoly, Bertrand competition, Cournot competition, focal pricing with free entry and exit, and contestable markets.[25] Numerous other assumptions could be used.

The models reviewed here simply assume particular forms of market behavior without any discussion of empirical evidence. They generally assume the behavior to be the same in all industries, although this is not likely to be the case in actuality. In fact, there is no reason why actual behavior could not change periodically in a given industry, or why at a given time one firm in an industry might not act in a Cournot fashion while another firm acted in a Bertrand fashion.[26]

All of this would not be important were it not for the fact that the results of the models vary substantially depending on the assumption made about market behavior. The Sobarzo study demonstrates this point. It assumes that

---

25. In *Bertrand competition*, each firm sets its own price for profit maximization under the assumption that other firms' prices are fixed. In *Cournot competition*, each firm sets its own level of output for profit maximization under the assumption that other firms' levels of output are fixed. *Focal pricing with free entry and exit* means that firms collude around a price that is easily observed (for example, the price of imports), and that it is easy and relatively costless for new firms to enter the industry and for unprofitable firms to leave. *Contestable markets* means that each industry has a single firm that sets its price equal to the average cost per unit of its output, where average cost includes a specified reasonable, or "normal," rate of profit.

26. Disparate behavior by different firms in the same industry can sometimes result in an unstable equilibrium, and therefore it may not be sustainable without periodic changes in behavior by one or more firms. There is no reason why such changes could not occur, however, and therefore no reason why such disparate behavior could not occur.

pricing behavior is a weighted average of a focal pricing rule and a modified Cournot-Chamberlain equilibrium. It estimates the changes in Mexican GDP and welfare for several different weightings of the two pricing behaviors. The study finds that a 100 percent weight on the focal-pricing rule results in an estimated change in Mexican GDP that is 14 times as large as that resulting from a 100 percent weight on the Cournot-Chamberlain rule (see Table 5).

The Roland-Holst et al. study also gets different results for different market assumptions, though the difference is not quite as drastic. Assuming a Cournot equilibrium, it estimates a 1.30 percent increase in U.S. GDP; assuming contestable markets, it estimates a 2.07 percent increase (see Table 4).

Significance of Effects on Average Wages. The results of the models concerning the effects of economies of scale on wages are unclear (see Table 6). From theory, one would expect scale economies to increase the positive effect of NAFTA on average real wages in both countries, but much more so for Mexico than for the United States (since there are likely to be more unexhausted economies of scale in Mexico's small economy).

The Roland-Holst et al. study, which assumes fixed wages, obtains clearly larger employment increases for Mexico with economies of scale than without them (compare the results in Tables 3 and 6). For U.S. employment, the study obtains a larger effect with economies of scale (than with constant returns to scale) using the contestable-markets assumption, and a slightly smaller effect (than with constant returns) using the Cournot-equilibrium assumption. This means that if the study had assumed fixed employment and variable wages, it would have obtained larger wage increases with economies of scale than without them using the contestable-markets assumption, and slightly smaller increases using the Cournot-equilibrium assumption.

None of the other studies gives results for both constant-average-cost and economies-of-scale versions of the same model, and few if any conclusions are discernible from a comparison of the results of the economies-of-scale studies with those of the constant-returns-to-scale studies.

Labor-Market Effects

Two factors relating to the labor market are relevant: labor migration and unemployment.

TABLE 5. RESULTS FOR DIFFERENT PRICING-RULE WEIGHTINGS IN THE SOBARZO MODEL

Focal-Pricing Weight	Cournot-Chamberlain Weight	Percentage Change in Mexican GDP	Percentage Change in Mexican Welfare
100	0	15.5	3.5
75	25	8.1	2.3
50	50	4.6	1.6
0	100	1.1	0.7

SOURCE: Horacio E. Sobarzo, "A General Equilibrium Analysis of the Gains from Trade for the Mexican Economy of a North American Free Trade Agreement," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA with Mexico and a NAFTA with Canada and Mexico*, USITC Publication 2508 (May 1992).

Labor Migration. NAFTA would be likely to affect emigration from Mexico to the United States (legal and illegal) in two ways. First, the elimination of Mexican import barriers would probably result in substantial declines in some uncompetitive Mexican sectors--especially the corn sector in agriculture. If the barrier reductions were not phased in gradually along with programs to ameliorate the effects on labor, the declines could result in substantial unemployment that could significantly increase emigration to the United States. Second, the combination of NAFTA and the rest of the economic liberalization that Mexico is undertaking would probably lead to substantial economic growth, reducing unemployment and emigration. Since labor migration has the potential to affect unemployment and wages significantly in both the United States and Mexico, its size must be assessed before one can rely on the estimates of models of NAFTA.

Only four of the studies that CBO reviewed--the Robinson et al. study, the Adams, Alanis, and del Rio study, the Hinojosa-Ojeda and Robinson study, and the Brown, Deardorff, and Stern study--incorporate or assess effects of NAFTA on cross-border migration. The Levy and van Wijnbergen study incorporates effects on rural-urban migration within Mexico (and several others do so implicitly) but not effects on Mexican-U.S. migration.

The Robinson et al. model indicates that if all trade barriers and all Mexican subsidies to farmers and food processors were eliminated, the resulting increase in unemployment in Mexico would increase the cumulative

TABLE 6. ESTIMATES OF NAFTA'S EFFECTS ON LABOR MARKETS BY MODELS INCORPORATING ECONOMIES OF SCALE AND RESOURCE-ALLOCATION EFFECTS (Percentage change)

Model	United States	Mexico	Canada
Effects on Average Real Wages			
Brown, Deardorff, and Stern	0.1	0.5	-0.1
Cox and Harris	n.e.	n.e.	0.04
Roland-Holst et al.	0 assumed	0 assumed	0 assumed
Sobarzo	n.e.	0 assumed	n.e.
Effects on Aggregate Employment			
Brown, Deardorff, and Stern	0 assumed	0 assumed	0 assumed
Cox and Harris	n.e.	n.e.	0 assumed
Roland-Holst et al.			
assuming Cournot equilibrium	1.79[a]	1.73[a]	7.29[a]
assuming contestable markets	2.47[a]	2.40[a]	11.02[a]
Sobarzo			
fixed trade bal., variable exch. rate	n.e.	5.1[b]	n.e.
variable trade bal., fixed exch. rate	n.e.	5.8[b]	n.e.

NOTES: n.e. = no estimate made by study. All of the models are static general equilibrium models, so the numbers are for the cumulative change some time many years into the future.

a. The values for the Roland-Holst, et al study are for the effects of NAFTA assuming that the Canada-United States Free Trade Agreement (CFTA) does not exist. Thus, in addition to the actual effects of NAFTA, they include the effects of eliminating barriers to U.S.-Canadian trade, which are effects of CFTA and which will occur (or have already occurred) regardless of whether NAFTA is implemented.

b. The results for the Sobarzo study do not include the effects of liberalizing nontariff barriers to trade.

migration to the United States over the years by 610,000 people if no increased economic growth in Mexico were to result. If, however, the agricultural trade barriers were only partially eliminated (quotas being replaced by tariffs at one-half the rate that would be equivalent to the quotas), if an agricultural deficiency payment program were implemented in Mexico, and if the Mexican capital stock were to grow by 10 percent as a result of the liberalization, then the model indicates that cumulative migration to the United States over the years would not increase but would instead decline by 2,000 people.

The Adams, Alanis, and del Rio study finds that NAFTA would decrease Mexican emigration to the United States by 0.52 percent if there were no growth in foreign-investment in Mexico, and by 6.11 percent if there were such growth.[27] The study does not give sufficient explanation of modeling details to assess how well the migration is modeled.

The Hinojosa-Ojeda and Robinson study--which uses an earlier and less detailed version of the model used in the Robinson et al. study--indicates that migration could have significant effects on the wages of rural workers and unskilled urban workers in the United States. In one scenario, it finds that NAFTA would increase the wages of these workers by over 5 percent because induced growth in the Mexican economy would significantly reduce Mexican migration to the United States and thereby tighten the U.S. labor market. Subsequent research has led Hinojosa-Ojeda and Robinson to conclude that the detail that the Robinson et al. study adds in the agricultural sector is necessary if migration is to be accurately modeled, but the point remains that the effects of migration are significant.

Both the Robinson et al. study and the Hinojosa-Ojeda and Robinson study assume that migration is sufficiently large to keep the ratio of average wages in the United States to average wages in Mexico constant for each category of labor. This means they assume that migration is infinitely sensitive to changes in the wage ratio. The precise sensitivity of migration to changes in the wage ratio is not known, but most likely it is much less than infinite. Hence, the studies may overestimate the size and effects of migration.

The model in the Brown, Deardorff, and Stern has only one kind of labor, so the study can examine effects only on labor as a whole; it cannot examine effects on parts of the labor force that are likely to be more significantly affected than the others by NAFTA. It finds that that migration as large as 5 percent of the Mexican labor force in either direction--from Mexico to the United States or from the United States to Mexico--would have no significant effect on the average U.S. wage. It finds further that including migration in the modeling simulations significantly increases the estimated number of workers forced to find new jobs as a result of NAFTA. Even so, however, the estimated number is small. Forced job changes resulting from NAFTA are discussed later in this paper.

27. For details of the growth scenario, see discussion of the CIEMEX-WEFA study below in the section on NAFTA's effects on investment in Mexico.

The large numbers in some of the scenarios suggest that models that do not incorporate migration--which include most of the NAFTA models--cannot make completely reliable predictions of the effects of NAFTA on some segments of the labor market (rural workers and unskilled urban workers). Nevertheless, the conclusion from those models that the effects of NAFTA on U.S. labor in general would be very small remains intact.

Unemployment and the Issue of Fixed Versus Variable Wages. Fluctuations in unemployment are not easily modeled using general equilibrium models. These models are more easily used for long-run equilibria in which wages have time to adjust and eliminate temporary labor shortages or excess unemployment, at least in countries with well-functioning labor markets. Thus, studies using these models usually fix employment equal to the labor force and solve for the average wage rate that allows this to happen. Historically, markets in Mexico have not functioned well, however, and sizable unemployment or underemployment has been the rule even in the long run. The question then arises as to how much the Mexican wage rate should be allowed to adjust in general equilibrium models and to what extent employment should be allowed to deviate from full employment.

Some models assume a fixed wage for Mexico and variable unemployment, while others assume full employment and a flexible wage. The truth is somewhere in between, and one may legitimately argue about which approximation is closer to the truth. In the United States, however, where markets have functioned very well for many decades, the case is different. Given the long-term nature of general equilibrium modeling and the permanence of NAFTA, the appropriate formulation for the U.S. labor market is flexible wages and full employment, which is the formulation used in most of the models. The Roland-Holst et al. study, however, for reasons it does not state, assumes a long-term fixed wage and unemployment in the United States. The Hufbauer and Schott study and the Prestowitz et al. study, which are discussed later in the section on nonmodeling methodologies, make a roughly equivalent assumption.

The assumption of a fixed wage and variable employment causes a model to predict higher increases in GDP because firms can easily increase production by increasing employment without drawing workers away from other firms. Under full employment, output could increase only if workers move from less efficient industries into more efficient ones, and the increased output of the more efficient industries would be partially offset by the decreases in output of the less efficient industries. It has already been noted that the Roland-Holst et al. model generally finds much larger effects of NAFTA on the United States than do the other models.

In the case of the U.S. labor market, the assumption of a fixed wage and variable employment results in incorrect estimates of changes in wages and employment. Employment changes in some industries have the wrong sign, and in many industries they have the wrong magnitude. If the aggregate effect estimated for employment is small and positive, however (which it is in the Roland-Holst et al. model), one may still legitimately conclude that the true effect on the average wage is small and positive.

Investment in Mexico

NAFTA, in conjunction with the other economic liberalization that Mexico is undertaking on its own, would be likely to make Mexico a much more attractive place to invest for several reasons. One reason is that labor-intensive industries, in which Mexico has a comparative advantage over the United States, would face lower tariffs, fewer quotas, and greater certainty that the United States would not suddenly put up protectionist barriers if they expanded exports. A second reason is that the liberalization and deregulation, assuming it continues, will improve the economic climate and make industry in Mexico in general--not just those industries that export--more profitable. NAFTA would help lock in the economic liberalization and thereby increase investor confidence.

A third reason why Mexico would become a more attractive place to invest is that NAFTA would eliminate most of the current restrictions on foreign ownership of Mexican firms. A fourth is that interest rates in Mexico, which are currently very high and which make the financing of investment expensive, might be expected to decline. Assuming that the reason for these high rates is inefficiencies in the Mexican banking system, as is suggested by one of the papers that CBO reviewed, the entry of more efficient U.S. banks would be likely to lower interest rates, resulting in more investment.

Finally, the United States has a comparative advantage in the production of many capital goods, making it the logical place for Mexican firms to purchase them. Mexico currently imposes high tariffs on imports of many capital goods. NAFTA's elimination of these tariffs would lower the cost of investment.

Increased investment in Mexico would affect the United States in several ways. First, it would allow greater expansion of Mexico's labor-intensive industries for export to the United States and would result in greater Mexican demand for U.S. exports--especially capital goods. Viewed another way, the

investment would cause Mexico's economy to grow, resulting in Mexico becoming a larger trading partner for the United States.

Second, increased investment in Mexico, unless accompanied by an equal increase in saving in Mexico and other countries (which is not likely), must come at the expense of investment in other countries. To the extent that it were to come at the expense of investment in the United States, it would decrease economic growth in the United States. This effect would probably not be very significant because reasonable estimates of the investment to be expected in Mexico are very small in comparison with that in the United States, and not all of the investment would be at the expense of investment in the United States. Even some U.S. citizens and corporations that would invest in Mexico would be likely to make at least part of that investment at the expense of investment in other foreign countries. Further, to the extent that investment were to come from the United States, it would raise U.S. interest rates, which would attract funds from the rest of the world to replace part of that investment.

Third, the increased investment would affect the trade balance. As discussed above, the trade balance of an economy is equal to aggregate saving minus aggregate investment. A large increase in aggregate investment in Mexico resulting from NAFTA would thus cause Mexico's trade balance to move toward deficit. This would not happen if the increase in investment were accompanied by an equally large increase in saving, but there is no reason to expect that to occur. Economic liberalization by developing countries in the past has typically led to increases in both saving and investment, but the increases in investment have generally been larger.

Finally, the level of investment in Mexico would affect the distribution of trade by sector. Mexico imports capital goods from the United States, so increasing investment in Mexico would skew Mexico's imports from the United States in the direction of more capital goods. Another mechanism by which increased investment would affect the distribution of trade will be discussed later in the section dealing with the effects of NAFTA on productivity growth.

Significance of Effects on GDP. Investment is difficult to model, so even in those models that devote the most attention to it, the treatment leaves something to be desired. Nevertheless, the results of the studies make clear that the investment effects of NAFTA would be much larger than any of the other effects discussed so far in this paper. Eight of the studies that CBO reviewed include investment effects of NAFTA along with the standard resource-allocation effects. All eight of them give results for the Mexican

economy; five give results for the U.S. economy. The studies estimate increases in Mexican GDP ranging from 3.09 percent to 12.68 percent, and effects on U.S. GDP ranging from no effect to a 0.32 percent increase (see Table 7).

Unlike the case for economies of scale, the studies all give results both with and without the investment effects, thereby allowing a clean assessment of the significance of the investment. Thus, one can see that including the investment effects in the models multiplies the predicted increase in U.S. GDP in most cases by a factor in the range of about one to two, and multiplies the predicted increase in Mexican GDP by a much larger factor. Unfortunately, however, the magnitudes of the investment increases in Mexico used to produce these estimates are more assumed than objectively modeled on the basis of assumptions that are widely agreed upon.

Most of the models that CBO reviewed are static general equilibrium models. The simplest procedure with static models is to assume that the respective aggregate capital stocks of the United States and Mexico (and Canada if the model includes a section for Canada) would be unaffected by NAFTA and thus to use the same values for them in both the pre-NAFTA and post-NAFTA equilibrium calculations. Though the aggregate totals are held constant, capital is allowed to shift from declining industries to expanding industries in each country. In the case of Mexico, the result is that capital moves out of capital-intensive industries and into unskilled-labor-intensive industries. In the case of the United States, the result is that capital moves in the opposite direction.

All of the results presented in this paper up to this point, except those of the Almon study, the McCleery study, and the Young and Romero study, were obtained using this procedure. The Almon study and the McCleery study, which respectively used a macroeconomic model and a dynamic general equilibrium model rather than static general equilibrium models, employed procedures that were approximately equivalent in effect to this procedure.[28] The Young and Romero study will be discussed at the end of this section.

28. The McCleery study actually reports several different simulation results. The results presented earlier in this paper are from a simulation with no increased investment in Mexico resulting from NAFTA. A simulation with increased investment is discussed later in this section.

TABLE 7. ESTIMATES OF NAFTA'S EFFECTS ON GDP BY MODELS INCORPORATING INVESTMENT EFFECTS (Percentage change)

Study	Simulation with No Investment Effects	Simulation with Increased Mexican Capital Stock	Simulation of Transition Point
	Effects on U.S. GDP		
Adams, Alanis, and del Rio	n.e.	n.e.	n.e.
Bachrach and Mizrahi	0.02	0.04	n.e.
Brown, Deardorff, and Stern	0.1[a]	0.1[a]	n.e.
Hinojosa-Ojeda and Robinson	0.1[b]	0.1	0.1
McCleery	0.22	n.e.	0.32
Robinson et al.	0.04[c]	0.00[c]	n.e.
Sobarzo	n.e.	n.e.	n.e.
Young and Romero	n.e.	n.e.	n.e.

(Continued)

NOTES: n.e. = no estimate made by study. The values for the Adams, Alanis, and del Rio study are for the cumulative changes in the average wage and employment through 2001 for liberalization that begins in 1991. The value for the transition-point simulation for the Young and Romero study is the value for the year 2002 assuming that NAFTA begins in 1992.

a. The numbers for the Brown, Deardorff, and Stern study are the equivalent variation as a percentage of GDP rather than the percentage change in GDP. The study incorporates economies of scale as well as the investment and resource-allocation effects incorporated by the other models in the table, and it does not include the effects of liberalizing nontariff barriers to trade. The simulation with no investment effects reported here is not the same as the simulation reported in Table 4, which *does* include the effects of liberalizing nontariff barriers to trade. A different simulation was chosen here to provide for comparability with the simulation with the increased Mexican capital stock, which is the only such simulation reported in the study and which also does not include the effects of liberalizing nontariff barriers.

TABLE 7. CONTINUED

Study	Simulation with No Investment Effects	Simulation with Increased Mexican Capital Stock	Simulation of Transition Point
	Effects on Mexican GDP		
Adams, Alanis, and del Rio	1.09	n.e.	12.68
Bachrach and Mizrahi	0.32	4.64	n.e.
Brown, Deardorff, and Stern	1.4[a]	4.6[a]	n.e.
Hinojosa-Ojeda and Robinson	1.2[b]	6.4	3.0
McCleery	0.01	n.e.	3.09
Robinson et al.	0.15[c]	7.43[c]	n.e.
Sobarzo	1.7, 1.9[d]	8.0[d]	n.e.
Young and Romero	2.6[e]	8.1	6.44

b. The simulation with no investment effects for the Hinojosa-Ojeda and Robinson study includes migration effects whereas the other two simulations do not. Therefore, the numbers do not give a clean comparison of NAFTA's effects with and without investment effects.

c. The Robinson et al. study incorporates labor migration between the United States and Mexico as well as the investment and resource-allocation effects incorporated by the other models in the table. The result reported for the simulation with no investment effects is not the same one as reported in Table 2. The one in Table 2 is for full trade liberalization. The result reported here is for partial trade liberalization. This was necessary in order to make the number comparable with the number for the simulation with increased Mexican capital stock, the simulation for which involves the same partial trade liberalization plus the increased capital stock.

d. The Sobarzo study presents results for two slightly different simulations with no increased investment allowed from NAFTA. None of the results from the study includes the effects of liberalizing nontariff barriers to trade.

e. The simulation giving the 2.6 percent increase in the Young and Romero study does have *some* increase in investment: the increase resulting from reduced Mexican tariffs on imports of capital goods from the United States. The 8.1 percent increase adds to that the increase that results from reducing Mexican interest rates.

The simple static procedure has significant conceptual problems, however. Static models are designed to model long-term equilibria.[29] The fact that capital is allowed to shift from industry to industry implies that the equilibria are indeed extremely long-term. Much capital can be used only by the industry that originally purchases it. For example, a steel company's surplus open-hearth or basic oxygen furnace cannot be used by a semiconductor firm. To say that capital is allowed to shift from declining industries to expanding industries is really a short-hand way of saying that capital that depreciates in some industries is not replaced and the capital stocks in those industries therefore decline, while investment in other industries is larger by the amount of that depreciation and the capital stocks in these latter industries therefore increase. The net result is that the aggregate capital stock of the country as a whole remains constant. Hence, the "shift" of capital from one industry to another takes the length of time required for capital to depreciate, which is likely to be from 10 to 20 years or more.

Most people believe, however, that NAFTA would increase the rate of investment in Mexico so that in 10 to 20 years the capital stock in Mexico would be substantially larger than it is now, not the same. One might try to get around this problem by arguing that the objective is not to measure the effects of NAFTA put into effect now, but rather to measure what the economic situation would be now if NAFTA had been implemented many years ago. If NAFTA had been implemented many years ago, however, investment in the years since would have been higher than it actually was, and the Mexican capital stock would therefore be higher than it is now.

Several studies have recognized this problem and tried to solve it by imposing on the model some assumed increase in the Mexican capital stock. At its worst--when the size of the increase is simply assumed without much in the way of supporting arguments--this procedure amounts to assuming one of the major results of NAFTA rather than using the model to estimate it. At its best--when arguments and calculations are used to support the chosen size of the increase--the procedure is much better than no correction at all but is still not completely satisfactory. The calculations are generally crude, and most of the studies examine only the equilibrium after the capital stock has increased. They do not examine the interim period during which the capital stock is increasing.

---

29. The Almon model looks at shorter-term projections, but some of them extend as far as 10 years into the future, so the following critique is applicable.

During this interim period, the rate of investment in Mexico would rise. The higher rate of investment would cause a deterioration in the Mexican trade balance and would skew Mexico's import demand in the direction of more capital goods. If NAFTA and the rest of the ongoing economic liberalization in Mexico succeed in launching Mexico onto a path of rapid long-term economic development, this interim period could last for several decades or more. (The United States ran trade deficits fairly continuously from its founding to near the turn of the present century.) Thus, studies that ignore the interim period ignore much, or even most, of what is likely to be considered important even by people who place little stress on short-term effects.

Three studies that use the procedure and correction described here are the Bachrach and Mizrahi study, the Brown, Deardorff, and Stern study, and the Robinson et al. study. The Bachrach and Mizrahi study runs two simulations: one with no change in the Mexican capital stock, and one with a 7.6 percent increase in the Mexican capital stock, which is the increase required for the model to give the same rate of return on capital in Mexico after NAFTA as before NAFTA. As the authors note, this is a conservative estimate of the increase in capital to be expected from NAFTA; most likely the actual increase would be larger.

The study estimates that NAFTA will increase U.S. real income by 0.02 percent without the increase in Mexico's capital stock, and by 0.04 percent with the increase (see Table 7). The respective numbers for the increase in Mexican real income are 0.32 percent and 4.64 percent. Clearly, the estimated effects on Mexican GDP of the capital increase are much larger than those of resource reallocation alone, though the effects on U.S. GDP are still not very large.

The effect of looking at the final increased-capital equilibrium rather than at the long interim period of higher investment levels and trade deficits is apparent in the trade figures (see Table 8). Without the rise in capital, the model estimates an improvement in the Mexican trade balance equal to 0.09 percent of total trade (1.18 percent of the trade balance); with the rise it estimates a much larger improvement of 4.62 percent of total trade (59.12

TABLE 8. ESTIMATES OF NAFTA'S EFFECTS ON THE TRADE BALANCE AND REAL EXCHANGE RATE BY MODELS INCORPORATING INVESTMENT EFFECTS (Percentage change except where otherwise indicated)

Study	Simulation with No Investment Effects	Simulation with Increased Capital Stock	Simulation of Transition Point
Effects on the U.S. Trade Balance			
Adams, Alanis, and del Rio	n.e.	n.e.	n.e.
Bachrach and Mizrahi			
Balance with Mexico	-0.24[a]	-2.80[a]	n.e.
Balance with ROW	0.02[a]	0.18[a]	n.e.
Balance with entire world	0.00[a]	0.01[a]	n.e.
Brown, Deardorff, and Stern	0 assumed	0 assumed	n.e.
Hinojosa-Ojeda and Robinson	0 assumed	0 assumed	$4.7 billion assumed
McCleery	n.e.	n.e.	n.e.
Robinson et al.	0 assumed	0 assumed	n.e.
Sobarzo	n.e.	n.e.	n.e.
Young and Romero	n.e.	n.e.	n.e.
Effects on the U.S. Real Exchange Rate			
Adams, Alanis, and del Rio	n.e.	n.e.	n.e.
Bachrach and Mizrahi	n.e.	n.e.	n.e.
Brown, Deardorff, and Stern	0.1	-0.1	n.e.
Hinojosa-Ojeda and Robinson	-0.6[b]	-0.5	-0.5
McCleery	n.e.	n.e.	n.e.
Robinson et al.	-0.3[c]	-0.6[c]	n.e.
Sobarzo	n.e.	n.e.	n.e.
Young and Romero	n.e.	n.e.	n.e.
Effects on the Mexican Trade Balance			
Adams, Alanis, and del Rio	$1.72 billion[d]	n.e.	-$7.16 billion[d]
Bachrach and Mizrahi			
Balance with United States	0.22[a]	3.62[a]	n.e.
Balance with ROW	-0.31[a]	7.84[a]	n.e.
Balance with entire world	0.09[a]	4.62[a]	n.e.
Brown, Deardorff, and Stern	0 assumed	0 assumed	n.e.
Hinojosa-Ojeda and Robinson	0 assumed	0 assumed	-$5 billion assumed
McCleery	n.e.	n.e.	n.e.

(Continued)

TABLE 8. CONTINUED

Study	Simulation with No Investment Effects	Simulation with Increased Capital Stock	Simulation of Transition Point
Effects on the Mexican Trade Balance (continued)			
Robinson et al.	0 assumed	0 assumed	0 assumed
Sobarzo	2.1	17.1	n.e.
Young and Romero	0 assumed	0 assumed	n.e.
Effects on the Mexican Real Exchange Rate			
Adams, Alanis, and del Rio	1.22[e]	n.e.	-8.34[e]
Bachrach and Mizrahi	n.e.	n.e.	n.e.
Brown, Deardorff, and Stern	-0.9	-4.6	n.e.
Hinojosa-Ojeda and Robinson	-1.8[b]	1.8	-16.2
McCleery	n.e.	n.e.	n.e.
Robinson et al.	1.5[c]	-0.5[c]	n.e.
Sobarzo	0 assumed	0 assumed	n.e.
Young and Romero	n.e.	n.e.	n.e.

NOTE: n.e. = no estimate made by study; ROW = rest of world.

a. The changes in trade balances for the Bachrach and Mizrahi study are expressed as percentages of total trade rather than as percentages of the trade balances.

b. The simulation with no investment effect for the Hinojosa-Ojeda and Robinson study includes migration effects whereas the other two simulations do not. Therefore, the numbers do not give a clean comparison of NAFTA's effects with and without investment effects.

c. The Robinson et al. study incorporates labor migration between the United States and Mexico as well as the investment and resource-allocation effects of the other models in the table.

d. The trade-balance numbers for the Adams, Alanis, and del Rio study are the numbers reported by the study for the absolute dollar changes in the Mexican *current-account* balance in the year 2001 for liberalization that begins in 1991. They are not the numbers the study reports for the *trade* balance; unlike this paper, that study uses that term to refer to the merchandise trade balance. Also, since the study predicts that the exchange rate between the peso and the dollar changes, it is not clear exactly what is meant by a change in the Mexican balance measured in dollars.

e. The exchange rate numbers for the Adams, Alanis, and del Rio study are for the nominal exchange rate—not the real exchange rate—in the year 2001.

percent of the trade balance).[30] This is the opposite of what would be expected for the long interim period of increased investment, and the effect spills over to the predicted effects on the U.S. economy. Without the rise in capital, the estimates show NAFTA causing a deterioration in the U.S. trade balance with Mexico equal to 0.24 percent of total trade (1.81 percent of the trade balance); with the rise they indicate a much larger deterioration of 2.80 percent of total trade (20.79 percent of the trade balance). Again, this is the opposite of what would be expected for the long interim period of increased investment.

The Robinson et al. study runs simulations for several different scenarios. The two that are relevant for determining the effects of investment are those the study labels "partial trade liberalization" and "partial trade liberalization with growth." In these scenarios, all nonagricultural tariffs and quotas are removed, agricultural quotas are replaced by tariffs equal to 50 percent of the tariffs that would give protection equivalent to that given by the quotas, and Mexico adds a deficiency payment program for its corn sector. The growth is an externally imposed increase in the Mexican capital stock of 10 percent.

The results for the effect on Mexican GDP are similar to those obtained in the Bachrach and Mizrahi study: the rise in the capital stock increases the positive effect from 0.15 percent to 7.43 percent. For the United States, the results show the increase in the Mexican capital stock eliminating the benefit of NAFTA for the United States in terms of GDP, though the effects are small in any case.

The elimination of the gain by the increased investment in Mexico results at least in part, and probably entirely, from the model's incorporation of migration effects. The model indicates that the increased investment in Mexico slows the rate of emigration to the United States. This reduces the U.S. labor supply, which in turn reduces U.S. GDP. This kind of GDP reduction does not lower, and may even increase, the average economic well-being of the remaining U.S. population as measured by per capita GDP. Only one other study that CBO reviewed--the Brown, Deardorff, and Stern study--contains simulations indicating that increased investment in Mexico would reduce the size of (or even reverse) the increase in U.S. GDP resulting from NAFTA, and those simulations (not reported in Table 7) incorporate reduced

30. The increase results from the fact that the model and the calculated trade balance are constructed on the basis of GDP rather than GNP. If the model and calculated trade balance were constructed on a GNP basis, there would be no equilibrium change in the trade balance. On a GNP basis, U.S.-owned capital in Mexico is treated as an annual import by Mexico of capital services from the United States, while on a GDP basis it is not. If the model and trade balance were on a GNP basis, increases in Mexican imports of capital services would exactly offset the other changes in the trade balance in final equilibrium.

rates of migration from Mexico to the United States resulting from the investment.

In the Robinson et al. study, a specific value for the trade balance is imposed on the model from outside, and the value is not allowed to change with the implementation of NAFTA. In order for the trade balance to remain constant (which it is forced to do by assumption), any change that would otherwise occur in it as a result of changes in investment flows must be exactly offset by equal but opposite changes resulting from movements in the exchange rate. Thus, the missing interim investment in the model shows up in exchange rate movements rather than in the trade balance.

A negative change in the Mexican exchange rate indicated in Table 8 (fewer pesos to the dollar) represents an appreciation of the peso. Thus, the results show the capital-stock rise causing a real appreciation of the Mexican peso. An appreciation causes a deterioration of the trade balance, and, as described in the previous paragraph, this deterioration must be equal but opposite to the effect on the trade balance that would have occurred if the trade balance had not been held fixed by assumption. It follows that that effect would have been an improvement in the Mexican trade balance--the opposite of what should be the case for the interim period of high investment.

The Brown, Deardorff, and Stern study runs one simulation with no investment effects and one simulation with an assumed 10 percent increase in the Mexican capital stock. Except for the effect on Mexican GDP in the simulation with the increased capital stock, this study obtains larger effects than those of the Robinson et al. and Bachrach and Mizrahi studies shown in Table 7, most likely because it includes the effects of economies of scale whereas the other two do not. The effect of looking at the final equilibrium after NAFTA again appears in the Mexican real exchange rate, for which the study shows an appreciation resulting from the increase in the capital stock rather than the depreciation that would be expected in the interim period of higher investment (see Table 8).

The Hinojosa-Ojeda and Robinson study recognizes the need for a simulation of the interim period of increased investment and reduced Mexican trade balance. This study runs two relevant increased-investment simulations. The first assumes a 7.6 percent increase in the Mexican capital stock (taken from the Bachrach and Mizrahi study). The second simulates a transition point midway toward that increase: the Mexican capital stock is assumed to have increased by 3.8 percent and the trade balance to be in deficit by $5 billion. The results are presented in Tables 7 and 8.

The important point to note from these results is the appreciation of the Mexican real exchange rate by 18 percentage points from a net 1.8 percent depreciation (simulation with increased capital stock) to a net 16.2 percent appreciation (simulation of the midway transition point). This appreciation is required to obtain the $5 billion dollar Mexican trade deficit. Because the capital-stock increase and the trade deficit are assumed rather than modeled, the 18 percentage point appreciation figure cannot be viewed as a completely objective result of the model. Different assumptions would yield different results. The assumptions are reasonable, however, and the estimated appreciation is sizable enough to affect trade significantly in particular goods and services. Therefore, one must conclude that trade flows and possibly other effects of NAFTA cannot be modeled accurately without taking account of the effects of investment on the trade balance.

The Adams, Alanis, and del Rio study, which uses a macroeconomic model rather than a general equilibrium model, also examines transition points. It runs two relevant simulations: one in which tariffs and quotas are eliminated but foreign investment in Mexico does not increase, and another in which annual flows of foreign investment into Mexico are assumed to rise by $1 billion in 1992 as a result of NAFTA and by gradually increasing amounts each year thereafter, reaching an increase in annual flows of $5 billion in 2001. In the latter simulation, the study assumes that 50 percent of the output produced by the new foreign investment is exported to the United States and that 50 percent replaces Mexican imports. The study presents no arguments or calculations to support these assumed values.

The study estimates that, without the increased investment, NAFTA would raise Mexican GDP by 1.09 percent, and with it, by 12.68 percent--a substantial increase. Without the investment, the study estimates an improvement in the Mexican trade balance of $1.72 billion; with it, a deterioration of $7.16 billion. Since the study reports the trade balance in dollars rather than pesos and finds that the peso-dollar exchange rate would change, it is not clear exactly what these changes in the trade balance mean. Ignoring that problem, however, the change in the trade-balance effect caused by the investment is consistent with the trade-balance identity. The investment causes the estimated effect of NAFTA on the nominal exchange rate to change from a 1.22 percent depreciation of the peso to an 8.34 percent appreciation, which is a change in the right direction to cause the deterioration of the trade balance. It is not clear what happens to the real exchange rate, however.

Three studies--the McCleery study, the Sobarzo study, and the Young and Romero study--put a little more effort into modeling the effects of

NAFTA on investment. The McCleery study models foreign direct investment in Mexico as a function of the interest rate (among other variables) and then assumes that NAFTA would affect that investment by reducing the risk premium on interest rates by 1 percentage point in the manufacturing sector and by 0.7 percentage points in the nonmanufacturing sector over 10 years beginning in 1991.

This procedure captures the effects of increased investor confidence on investment, but none of the other mechanisms by which NAFTA might affect investment. Since the size of the interest rate drop is assumed rather than modeled and one can obtain any investment level that is desired by adjusting the assumption, one might question how much better this procedure is than the static-model procedure of assuming a capital-stock increase of a size determined by crude calculations. This study has the advantage, however, of using a dynamic model that incorporates the effects of investment on the trade balance.

The study calculates that NAFTA would increase foreign direct investment in Mexico by a total of $46 billion dollars over the period 1991 to 2000--an average of $5 billion per year. Without this investment, the study estimates that NAFTA would increase U.S. GDP by 0.22 percent; with it, the estimated increase is 0.32 percent (see Table 7). The respective numbers for the increases in Mexican GDP are 0.01 percent and 3.09 percent.

The Sobarzo study runs three simulations. The first two are very similar: both allow employment in Mexico to vary and both hold the capital stock there fixed. The third holds employment fixed, fixes the interest rate at the world rate, and allows the capital stock to vary. The first two estimate that NAFTA would increase Mexican GDP by 1.7 percent and 1.9 percent, respectively. The third estimates an increase of 8.0 percent.

Sobarzo does not report how much the capital stock increases in the last simulation. Further, the study exhibits the common static-model problem of looking at the final equilibrium with an increased capital stock while ignoring the long interim period of high investment required to achieve that increased capital stock. Also, the simulations reported in the study do not allow one to separate the effects of the increased capital stock from the effects of their different treatments of the labor market.

The Young and Romero study has the most rigorous and detailed treatment of investment of any of the studies CBO reviewed. The study uses a dynamic model that explicitly models the optimal level of investment in three different kinds of capital: machines, buildings, and vehicles. It

incorporates two effects that NAFTA would have on investment. The first effect is a reduction in the cost of investment as a result of the elimination of the high tariffs (16 percent to 20 percent) that Mexico currently imposes on machinery and other capital goods imports. The second effect is a reduction in interest rates in Mexico resulting from decreased uncertainty about future monetary policy and the economy generally. The study computes the effect of a decline in the interest rate in Mexico from 10 percent to 7.5 percent.

The study finds that in the very long run (after the interim period discussed earlier is completed), eliminating all tariffs while keeping the interest rate fixed at 10 percent increases Mexican GDP by 2.6 percent, and decreasing the interest rate to 7.5 percent increases GDP by another 5.5 percentage points on top of the 2.6 percent, for a total of 8.1 percent. The study also gives estimates of GDP at various interim points between the pre-NAFTA and post-NAFTA static equilibria. The changes in GDP at most of the points are not far different from the final equilibrium values given here, however, and the study reports no estimates for the trade balance or trade patterns.

Though the Young and Romero model has the most rigorous and detailed treatment of investment, that treatment still has flaws. It clearly does not cover all of the ways in which NAFTA could affect investment, and the size of the drop in interest rates is simply assumed without any supporting arguments. Further, the model assumes full employment in Mexico, which is questionable at best. Also, the paper does not give estimates of changes in output or employment in particular sectors, or of effects on the United States.

Last but not least, though the Young and Romero study assumes that the increased investment in Mexico comes from abroad, it also assumes that the investment incorporates the same technology, with its resulting productivity, as the current Mexican capital stock, rather than the technology and productivity of capital in the countries from which the investment originates (such as the United States) or some intermediate level of productivity. This questionable assumption is also made by all of the other modeling studies that CBO reviewed except the Prestowitz et al. study. (The Prestowitz et al. study uses a simple extrapolation model rather than a standard general equilibrium or macroeconomic model. Hence, this paper covers that study later in the section on other methodologies.)

The foregoing problem is discussed in more detail in the section on productivity growth below. Its significance for this section lies in its effect on estimates of investment levels. An investment with a high productivity level will be more profitable, other things remaining the same, than one with a low

productivity level. Investments that are more profitable are more likely to be engaged in by investors, and are likely to be larger, than less profitable investments. Therefore, assuming that all new investment in Mexico would have Mexican levels of productivity rather than higher U.S. levels is likely to mean underestimating the effect of NAFTA on investment.

Given the importance of foreign investment, it is noteworthy that many of the models measure effects on GDP rather than on GNP. If most of the new investment in Mexico were to come from abroad, GDP would increase more than GNP.[31] GNP is a more relevant measure of the income of a country's citizens in equilibrium. GDP is preferable when one is concerned primarily with short-run fluctuations in employment or with measuring the economic activity that is most directly under a government's control.

Significance of Effects on Average Wages. Allowing for NAFTA's effects on investment clearly increases the estimates of its benefits for labor in both the United States and Mexico (see Table 9). This is especially true for Mexico. When the models leave out the effects of investment, they estimate increases in average real Mexican wages ranging mostly from -0.01 percent to 3.5 percent, but when they include investment effects they estimate increases mostly in the range of 3.2 percent to 9.2 percent. The same is true to a lesser extent for the United States. If one leaves aside the Hinojosa-Ojeda and Robinson study, in which the simulations with and without investment employ different migration assumptions and therefore are not comparable, most of the estimates are for higher wages for U.S. workers when investment effects are included than when they are not included.

Multifactor Productivity Growth

The most important consequence of NAFTA could be its effects on multifactor productivity growth, especially that in Mexico.[32] Such effects could bring substantial changes in Mexican GDP and the pattern of trade

31. GDP is the total value of economic output produced by factors (labor, capital, land, and so forth) located within the geographic borders of the country in question. GNP is the total value of economic output produced by factors owned by the country in question. Thus, if the United States invests in Mexico, the investment combines with Mexican labor to produce output. All of this output is part of Mexican GDP, but only the portion of it attributable to Mexican labor is part of Mexican GNP. The portion attributable to U.S. capital is part of U.S. GNP.

32. Broadly speaking, the increases in economic efficiency resulting from changes in resource allocation and from increasing returns to scale, which were discussed earlier, could be considered to be productivity effects. The use of the term *productivity* in this paper is narrower, referring to new technologies and production processes and improved organizational structures of firms.

TABLE 9. ESTIMATES OF NAFTA'S EFFECTS ON LABOR MARKETS BY MODELS INCORPORATING INVESTMENT EFFECTS (Percentage change)

Study	Simulation with No Investment Effects	Simulation with Increased Capital Stock	Simulation of Transition Point
Changes in U.S. Average Real Wages			
Adams, Alanis, and del Rio	n.e.	n.e.	n.e.
Bachrach and Mizrahi	0.02	0.03	n.e.
Brown, Deardorff, and Stern	0.1[a]	0.1[a]	n.e.
Hinojosa-Ojeda and Robinson			
rural workers	1.5[b]	-0.4	-0.2
unskilled urban workers	1.5[b]	0.7	0.6
skilled urban workers	0.1[b]	0.1	0.1
white-collar workers	0.2[b]	0.3	0.3
McCleery			
low-wage services workers	2.35	n.e.	3.20
high-wage services workers	0.12	n.e.	0.05
high-wage mfg. workers	-1.44	n.e.	-1.31
Robinson et al.			
rural workers	-0.2[c]	0.2[c]	n.e.
unskilled urban workers	-0.3[c]	0.0[c]	n.e.
skilled urban workers	0.0[c]	0.0[c]	n.e.
white-collar workers	0.0[c]	0.0[c]	n.e.
Sobarzo	n.e.	n.e.	n.e.
Young and Romero	n.e.	n.e.	n.e.
Changes in U.S. Aggregate Employment			
Hinojosa-Ojeda and Robinson	-0.2	0 assumed	0 assumed
All other models	Either U.S. employment held fixed by assumption or no percentage changes reported.		
Changes in Mexican Average Real Wages			
Adams, Alanis, and del Rio	-0.01	n.e.	6.67
Bachrach and Mizrahi	0 assumed	0 assumed	n.e.
Brown, Deardorff, and Stern	0.4[a]	7.2[a]	n.e.
Hinojosa-Ojeda and Robinson			
rural workers	0.2[b]	9.2	6.7
unskilled urban workers	0.2[b]	9.2	6.7
skilled urban workers	2.6[b]	7.4	4.6
white-collar workers	3.5[b]	8.8	6.4

(Continued)

TABLE 9. CONTINUED

Study	Simulation with No Investment Effects	Simulation with Increased Capital Stock	Simulation of Transition Point
Changes in Mexican Average Real Wages (continued)			
McCleery			
low-wage services workers	-0.56	n.e.	6.42
high-wage services workers	0.18	n.e.	-3.28
high-wage mfg. workers	0.24	n.e.	-2.91
Robinson et al.			
rural workers	1.2[c]	4.5[c]	n.e.
unskilled urban workers	0.7[c]	3.2[c]	n.e.
skilled urban workers	0.8[c]	3.5[c]	n.e.
white-collar workers	0.7[c]	3.4[c]	n.e.
Sobarzo	0.0, 0.0[d]	16.2[d]	n.e.
Young and Romero	n.e.	n.e.	n.e.
Changes in Mexican Aggregate Employment			
Adams, Alanis, and del Rio	0.29	n.e.	2.41
Bachrach and Mizrahi	0.85	6.60	n.e.
Hinojosa-Ojeda and Robinson	1.0	0 assumed	0 assumed
All other models	Either Mexican employment held fixed by assumption or no percentage changes reported.		

NOTES: n.e. = no estimate made by study. The values for the Adams, Alanis, and del Rio study are for the cumulative changes in the average wage and in employment through 2001 for liberalization that begins in 1991. The value for the transition-point simulation for the Young and Romero study is the value for the year 2002 assuming that NAFTA begins in 1992.

a. The Brown, Deardorff, and Stern study incorporates economies of scale as well as the investment and resource-allocation effects incorporated by the other models in the table, and it does not include the effects of liberalizing nontariff barriers to trade. The simulation with no investment effects reported here is not the same as the simulation reported in Table 6, which *does* include the effects of liberalizing nontariff barriers to trade. A different simulation was chosen here to provide for comparability with the simulation with the increased Mexican capital stock, which is the only such simulation reported in the study and which also does not include the effects of liberalizing nontariff barriers.

b. The simulation with no investment effects for the Hinojosa-Ojeda and Robinson study includes migration effects whereas the other two simulations do not. Therefore, the numbers do not give a clean comparison of NAFTA's effects with and without investment effects.

c. The Robinson et al. study incorporates labor migration between the United States and Mexico as well as the investment and resource-allocation effects incorporated by the other models in the table.

d. The Sobarzo study presents results from two slightly different simulations with no increased investment. Both predict a 0.0 percent change in the Mexican average real wage. None of the results from the study include the effects of liberalizing nontariff barriers to trade.

between the United States and Mexico (that is, which products are exported and which imported by each country). Their implications for investment have already been discussed.

How Productivity Would Be Affected. NAFTA would promote productivity growth in several ways. One is through the medium of foreign direct investment. As U.S. corporations invested in Mexico, they would bring capital equipment embodying U.S. technology, which in many cases would be more advanced than Mexican technology. They also would bring their established corporate organizations and methods of production, which in many cases are more efficient and productive than those of their Mexican competitors. (That is one reason why per capita GDP is higher in the United States than in Mexico).

Increased productivity growth could also result from increased competition in imperfectly competitive industries, as discussed earlier in the section on economies of scale. None of the studies that CBO reviewed considers this effect, and it is questionable whether the effect can be modeled satisfactorily.

With free trade, a firm can import specialized inputs and capital that it would otherwise have to develop itself, thereby improving productivity more rapidly. Further, free trade allows a country to specialize in certain industries and products and to import the products of other industries rather than having to produce all of them. Specialization allows the country to get more experience in the industries it specializes in, and thereby improve its productivity through "learning by doing."

Productivity growth resulting from NAFTA would have important consequences for several reasons. First, it would increase the GDP of the United States and increase that of Mexico even more, with the result that Mexico would become a larger trading partner of the United States. Second, to the extent that Mexican productivity growth were to result from technology embedded in capital invested from abroad, and from U.S. corporations bringing in their established organizations and ways of doing things, the growth would be likely to vary by industry. Thus, it would be likely to change the relative competitiveness of U.S. and Mexican production differently in different industries, resulting in changes in the pattern of trade (that is, changes in which products are exported and which imported by each country).

Third, productivity changes would affect investment flows. The magnitudes of differences between U.S. and Mexican technological advancement would affect the profitability, and therefore the level, of U.S.

investment in Mexico, with larger differences leading to more investment. As discussed earlier, this would be likely to affect the U.S.-Mexican trade balance and the level of Mexican capital-goods imports from the United States. The differences would probably vary among industries, leading to more investment in some than in others. The output of the more technologically backward industries would thus be increased more than that of the others both because of the improved productivity and because of the increased investment. This, in turn, would affect the pattern of trade.

Significance of Effects. Effects on productivity growth have received little attention from modelers of NAFTA, perhaps because they are difficult to model. Only two of the models CBO reviewed analyze such effects. One of those indicates that the effects could be very important.

The Kehoe study presents preliminary calculations indicating that the specialized-input and learning-by-doing mechanisms that were discussed above could conceivably increase Mexico's annual rate of productivity growth by more than 1.6 percentage points. Such an effect might not be important to the United States for the first few years. With annual compounding, however, this increased growth rate would raise Mexican output per worker by over 50 percent in 25 years, which would have significant effects on the United States.

The point of the Kehoe study is not to have the last word on the size of the effects but to convince other modelers that productivity effects of NAFTA are likely to be much larger than the other effects and that, therefore, they should receive much more attention in the design of models. Should productivity effects actually turn out to be as significant as these calculations indicate they could be, they would be more important than any of the other effects of NAFTA. Given this and the fact that other effects of NAFTA--such as those on investment flows, resource allocation, and trade patterns--would be significantly affected by productivity changes, it is clear that modeling results cannot be trusted completely until productivity effects are properly incorporated into the models.

The McCleery study runs a simulation in which there are two provisions for productivity growth. The first is that manufacturing productivity in the United States is assumed to increase by an amount equal to 0.01 times the increase in capital-goods production, and nonmanufacturing productivity is assumed to grow by one-half the rate of manufacturing productivity growth. The second is that productivity in Mexican manufacturing is assumed to grow by an amount equal to 0.005 times the increase in capital flows into Mexico, and nonmanufacturing productivity is assumed to grow by one-half the rate of manufacturing productivity growth. Using these assumptions, the McCleery

study estimates that NAFTA would increase U.S. GDP in the year 2000 by 0.51 percent, which is 0.19 percentage points higher than the 0.32 percent increase the study estimates without the productivity effects (see Table 7). With the productivity effects, the study estimates that NAFTA would increase Mexican GDP in the year 2000 by 11.39 percent, which is 8.3 percentage points higher than the 3.09 percent increase that the study estimates without the productivity effects.

These estimates cannot be viewed as reliable. Like the Kehoe study, this simulation in the McCleery study is perhaps best viewed as a tentative, initial exploration of one particular modeling formulation of productivity effects, designed to give economists an order-of-magnitude estimate of their importance for the purpose of guiding future research. The study simply assumes the factors of 0.01 and 0.005 and that nonmanufacturing productivity grows at one-half the rate of manufacturing productivity growth, and it assumes them without giving any supporting arguments or calculations. Further, since the productivity estimates are based on the level of investment, they are dependent on the adequacy of the study's modeling of that investment. The problems with the investment modeling in this and all of the other studies that CBO surveyed were discussed earlier.

Difficulties That Hinder Modeling

The foregoing discussion has pointed out several substantial difficulties faced by modelers of NAFTA that reduce the rigor and reliability of their predictions. There are numerous other problems as well. First, Mexico has substantially liberalized its internal regulation and its regulation of international trade in the past few years. The effects of that liberalization are still working their way through the economy and will continue to do so for years (provided a rejection of NAFTA by one of the governments does not start a political chain of events in which the liberalization is reversed). It is difficult to disentangle the effects of the further liberalization in NAFTA from the effects of this recent liberalization. Moreover, as discussed above, a significant part of the effect of NAFTA would be simply to bolster the confidence of investors that these recent reforms will not be undone. Modeling investor confidence is difficult at best.

A second problem is that important details of NAFTA had not been negotiated (or at least had not been announced publicly) when these studies were done, so the modelers had to make assumptions about the outcome of the negotiations. A third problem, the complexity of the economic systems being modeled and the simplifying approximations necessary to make the

models tractable, has already been alluded to. These two problems prevented the incorporation of such important intricacies as the rules of origin for determining whether or not a good or service is North American and therefore exempt from tariffs and quotas.[33]

A fourth problem, which was only touched upon above, relates to the availability of reasonably good data. General equilibrium models have a large number of parameters, and the proper values for many of them are not well known and are difficult to estimate. For example, the rates at which various industries can and do substitute among intermediate inputs as their relative prices change is not well known. This substitution could play a significant part in the resource-allocation effects of NAFTA.

Further, there are serious inconsistencies between data on the U.S. economy (collected by the U.S. government) and data on the Mexican economy (collected by the Mexican government). Modelers have made considerable progress in making the two sets of data consistent, but much of that progress has occurred since the completion of some of the studies that CBO reviewed. It is not clear whether this problem substantially affects the results of the models. To the extent that it does, however, one would expect the effects to be most pronounced on estimates of expansion and contraction of particular industries in models with very detailed industry structures. Estimates of NAFTA's effects on GDP and the average wage should be less affected.

A final problem is that the effects of NAFTA depend on whether or not the Uruguay Round of negotiations to liberalize trade among countries participating in the General Agreement on Tariffs and Trade (GATT) succeeds. For example, one component of any Uruguay Round agreement will be a phaseout of the Multifiber Arrangement, which allows industrialized countries such as the United States to impose quotas on imports of textiles and apparel. A phaseout of quotas on imports from Mexico is also an element of NAFTA. Clearly the quantity of apparel imports from Mexico resulting from the elimination of quotas on those imports would depend upon whether or not competing imports from the big Asian producers were still constrained by quotas. The studies that CBO reviewed ignore the possibility of a new GATT agreement.

---

33. If a rule of origin is made sufficiently stringent, it can serve as a substantial impediment to trade and thereby defeat the effects of liberalizing measures such as reductions of tariffs or eliminations of quotas. The rules of origin for textiles, apparel, motor vehicles, and motor-vehicle parts were big issues in the NAFTA negotiations.

OTHER EMPIRICAL METHODOLOGIES

Not all of the empirical studies of NAFTA use standard macroeconomic or general equilibrium models for their analysis. Four of the studies that CBO surveyed use other methodologies. These four studies predict larger effects for NAFTA than the others do because, unlike all except one of the standard modeling studies, they assume that NAFTA would increase Mexican multifactor productivity. Like the standard modeling studies, however, most of these studies simply assume the values of various crucial parameters. One of the four studies--the Kehoe study--was discussed above along with the modeling studies. The other three--the Hufbauer and Schott study, the Leamer study, and the Prestowitz et al. study--do not fit easily into the framework of that discussion.

The Hufbauer and Schott Study. The Hufbauer and Schott study makes use of analogy with 31 other episodes of economic liberalization by other developing countries that were examined in a World Bank study.[34] Hufbauer and Schott assume the following:

- privatization across the board in Mexico;
- stepped-up Mexican oil production;
- fiscal and monetary restraint in Mexico;
- trade liberalization;
- Mexican export growth at the average rate experienced by the countries in the World Bank study;
- net annual foreign investment in Mexico of $12 billion (which is somewhat larger than current levels);
- 75 percent of Mexico's imports being purchased from the United States, and 75 percent of its exports being sold to the United States (Hufbauer and Schott argue that these are slightly higher than current percentages but that the percentages should grow with the implementation of NAFTA);

34. Demetrious Papageorgiou, Michael Michaely, and Armeane M. Choksi, eds., *Liberalizing Foreign Trade: Lessons of Experience in the Developing World*, 7 vols. (Washington, D.C.: World Bank, 1991).

- per capita GDP growth of 2 percent per year in the United States and 4 percent per year in Mexico (which is based on a Sala-i-Martin finding that the income gaps between poor and rich regions within the United States and within Europe have declined by about 2 percent per year over time); and

- U.S. job creation at the rate of 14,500 jobs per billion dollars of net improvement in the U.S. trade balance, and Mexican job creation at the rate of 87,000 jobs per billion dollars of net exports.

Assuming that the liberalization occurred in 1989 (the beginning of the Salinas administration in Mexico), they estimate the effects for 1995 listed in Table 10. These results are larger than those obtained by most of the modeling studies.

The methodology of analogy used in this study has the big advantage that the analyst does not have to model substitution among inputs, economies of scale, productivity growth, and most of the other effects that are difficult or impossible to model. Since all of these effects presumably occurred in the 31 episodes of economic liberalization that are the focus of the World Bank study, they are implicitly included in the analogy with NAFTA. An estimate of the increase of investment in Mexico is still needed, however, and this study--like most of the modeling studies already discussed--simply assumes an increase without trying to model it.

The methodology also has the big disadvantage that it gives no information about how the effects of NAFTA would be distributed among industries--which ones would be hurt and which helped.[35] Further, it is difficult to factor in any differences between Mexico and the other 31 countries that might cause the effects of NAFTA to be different. Also, the Hufbauer and Schott study does not distinguish between the effects of NAFTA alone and the effects of the other liberalization that has taken place recently in Mexico or is expected to take place soon.

In assuming that each billion-dollar improvement in the U.S. trade balance increases U.S. employment by 14,500 jobs, Hufbauer and Schott follow a long tradition of similar assumptions made by others in analyses of international trade. The tradition is unfortunate because such assumptions

35. It should be noted, however, that some of the modeling studies also did not report the distribution of effects by industry.

TABLE 10. ESTIMATES BY THE HUFBAUER AND SCHOTT STUDY OF THE EFFECTS OF NAFTA AND OTHER MEXICAN LIBERALIZATION

	Changes by 1995 (In billions of dollars)
U.S. Exports	no estimate
Mexican Exports	10.3
U.S. Imports	no estimate
Mexican Imports	22.3
U.S. Exports to Mexico	16.7
Mexican Exports to United States	7.7
U.S. Net Exports to Rest of World	0
Mexican Net Exports to Rest of World	-3
U.S. Trade Balance	9
Mexican Trade Balance	-12
U.S. Employment (Thousands)	130
Mexican Employment (Thousands)	609
U.S. Wage (Percentage change)	0
Mexican Wage (Percentage change)	8.7

are at odds with accepted economic theory and empirical fact. The problems with such assumptions are discussed in Box 1.

Fortunately, Hufbauer and Schott use the assumption only for computing the effects of NAFTA on employment, and none of their other results is affected. Further, they conclude that the net effect on jobs in the United States would be small. One can conclude from this that had a more appropriate assumption been made (flexible wages and full employment), the study would have estimated only a small effect on the average wage. No conclusion can be drawn, however, about how many workers would lose jobs in one industry and have to find jobs in another.

The Leamer Study. Unlike the other studies that CBO surveyed, the Leamer study does not estimate the effects of NAFTA. Rather, it estimates how wages and the earnings of capital are likely to change over the years if NAFTA is implemented. It does not estimate how they are likely to change if NAFTA is not implemented, although such changes have occurred over the past two decades in the absence of NAFTA and are likely to continue in the absence of NAFTA. Those changes are likely to be in the same direction as

Box 1.
The Relation Between the Trade Balance and Aggregate Employment

Both the Hufbauer and Schott study and the Prestowitz et al. study make the assumption that each billion-dollar increase in the U.S. trade balance increases aggregate U.S. employment by a fixed amount (14,500 jobs in the case of Hufbauer and Schott, and 30,000 jobs in the case of Prestowitz et al.), or--stated in the negative direction--that each billion-dollar increase in the trade deficit increases unemployment by the same fixed amount.

This assumption implies fixed wages and excess unemployment, which is not an accurate description of the long-term behavior of the U.S. labor market. Regardless of any short-term effect the trade balance might have on employment, in the long term the average wage adjusts to a level that equates the demand for labor with the supply, eliminating any excess or shortage of labor. Thus, in the long term, the trade balance has no effect on unemployment. Empirically, the idea that large long-term trade deficits cause large long-term unemployment is belied by the U.S. experience of simultaneous large trade deficits and full employment in the mid-to-late 1980s.

There is no generally valid, fixed relation between the trade balance and aggregate employment in the short term either. Although the balance can and often does have short-term effects on employment, the effects depend on the precise circumstances. It is not enough to know the size of the total trade surplus or deficit in order to determine the number of jobs gained or lost in the industries directly affected. One must know the trade surplus or deficit of each industry and also the labor intensity of each industry that is in surplus or deficit. Because the apparel industry is more labor-intensive than the textile industry, a billion-dollar increase in the apparel trade deficit would eliminate more jobs in the apparel industry than the same increase in the textile trade deficit would eliminate in the textile industry. In addition, an increase in the apparel trade deficit would cost jobs in the textile industry, which supplies the fabric that is the raw material of the apparel industry.

A further problem results from the trade-balance identity discussed in the main body of this paper. Any increase in the trade deficit must be accompanied by an equal dollar amount of decreased saving (which means increased consumption or decreased GDP) or increased investment. Any increased consumption or investment would increase employment in the industries producing the products being consumed or invested. A sophisticated economic model would be needed to determine whether for a particular policy change (such as the implementation of NAFTA) this increase in employment would be less than, equal to, or greater than the decrease in employment in the industries directly affected by the trade deficit.

the changes that would result from NAFTA, but not as large. Since the study does not estimate the magnitudes of changes in the absence of NAFTA, there is no way to determine how much of the changes estimated in the study would be caused by NAFTA and how much of them would occur anyway.

The Leamer study calculates that between 1972 and 1985 changes in the relative world prices of goods produced by industries using unskilled labor intensively, those produced by industries using skilled labor intensively, and those by industries using capital intensively have caused the annual wages of skilled labor (which includes highly educated professionals such as scientists and engineers) to increase by $1,919, the annual wages of unskilled labor to decrease by $465, and the annual earnings of capital to increase by 0.3 percent. The study assumes that these trends in prices of goods will continue indefinitely, and concludes that the United States might eventually want to impose new tariffs, quotas, or other trade barriers to prevent them from having further effects on the wages of unskilled labor in the United States.

The study then examines the possibility that one effect of NAFTA might be to render that course of action ineffective. If Mexican industries are large enough, and if the United States is prevented by NAFTA from imposing trade barriers against Mexico, then any new trade barriers erected against other countries will fail to prevent world price trends from affecting U.S. firms and labor. While the barriers could prevent imports from the other countries, Mexico could always supply the resulting shortfall without any increase in price. The question the study then asks is: "Will Mexican industries be large enough to make such trade restrictions ineffective?" The answer is, if Mexican productivity were to rise to levels near those of developed countries, and if the ratio of capital to labor in Mexico were to rise to a point halfway between the current Mexican level and the current U.S. level, many Mexican industries would indeed be large enough to make U.S. trade restrictions against other countries ineffective.

The study concludes that if NAFTA were implemented, the United States would soon (perhaps in a decade or so) be unable to use trade restrictions to halt the continuing effects of long-term trends in world product prices on wages and the return on capital in the United States. Thus, over the next 13 years or so, the wages of skilled labor would be likely to increase another $1,919, those of unskilled labor to decline another $465, and the earnings of capital to increase another 0.3 percent. More recent research by Leamer has significantly qualified this conclusion: he now says that Mexican productivity

growth is sufficiently slow that trade restrictions would probably not become ineffective for several decades.[36]

The Prestowitz et al. Study. The last of the four studies CBO reviewed that use other methodologies is that of Prestowitz et al., which bases its estimates primarily on extrapolations of current investment trends and Mexican trading behavior. It assumes that new U.S. investment in Mexico would have the same productivity as investment in the United States, which is probably a more accurate assumption than the one made in almost all of the other studies CBO reviewed--that such investment would have the same productivity as the average for Mexican capital currently in place. Unfortunately, the study ignores the requirement that the trade balance equal aggregate saving minus aggregate investment.

The study makes two assumptions that virtually guarantee a U.S. trade deficit with Mexico:

- that 70 percent of new production capacity in Mexico resulting from NAFTA would produce net new imports for the United States (as opposed to displacing U.S. imports from other countries); and

- that Mexican imports from the United States would increase by only 2 percent of the increase in Mexican output.

Consequently, the study the concludes that, under a scenario of low growth in Mexico, the U.S. trade balance with Mexico would decline from a $5 billion surplus in the mid-1990s to a $13.5 billion deficit by 1999, and that under a high-growth scenario it would decline to deficit earlier and reach a $30 billion deficit by 1999. This conclusion is out of line with the results of the other studies that CBO reviewed, and it most likely is wrong. As was discussed earlier, increased investment in Mexico in conjunction with the trade-balance identity make it very unlikely that Mexico would run a surplus with the world or with its largest trading partner, the United States. It is much more likely that the United States would run a surplus with Mexico.

The Prestowitz et al. study also assumes that a $1 billion deterioration in the U.S. trade balance translates into a loss of 30,000 jobs. As was discussed earlier in relation to the Hufbauer and Schott study, this assumption is not supported by economic theory or empirical evidence, and it often conflicts with them (see Box 1). Combining this assumption with the doubtful

36. Telephone conversation with Edward Leamer.

conclusion about the effect of NAFTA on the trade balance, the Prestowitz et al. study arrives at an estimate of 400,000 to 900,000 jobs lost in the United States as a result of NAFTA.

SUMMARY OF RESULTS

One economist, after reviewing the results of many of the models, noted provocatively that they do not tell us much about NAFTA that could not be ascertained from back-of-the-envelope calculations. To wit: since Mexico's economy is about one-twenty-fifth the size of the U.S. economy, NAFTA could not possibly have much effect on the U.S. economy for a long time, and it would be likely to have a substantial effect rather quickly on the Mexican economy. Mexican industries that are now protected by substantial trade barriers would be more likely than others to be hurt, and their counterparts in the United States more likely to be helped. Similarly, U.S. industries that are currently protected by substantial trade barriers would be more likely than others to be hurt, and their counterparts in Mexico more likely to be helped. Overall, NAFTA would increase the economic welfare of both the United States and Mexico.[37]

This statement is an exaggeration, of course. The models tell us a few things not previously known, and even confirmation of what economists already expected to be true is worth something. Nevertheless, there is much truth in the observation.

Effects on GDP. The studies that CBO reviewed indicate that the most important effects of NAFTA would be those on productivity growth rates and investment (see Table 11). Unfortunately, these effects are among the most difficult to model, and the estimates of them are not very reliable. One study indicates that two of the effects of NAFTA on Mexican productivity growth could increase Mexican output per worker by over 50 percent in 25 years. Another study that looks at two other productivity-growth effects estimates that they could increase U.S. GDP in the year 2000 by an additional 0.19 percentage points on top of the 0.32 percent increase arising from investment and resource-allocation effects, and that they could increase Mexican GDP in that year by an additional 8.3 percentage points over and above the 3.09 percent increase arising from the other effects.

37. The comment was made by Barry Bosworth at the conference, "NAFTA: An Assessment of the Research," held at the Brookings Institution on April 9-10, 1992.

TABLE 11. SUMMARY OF MODELING ESTIMATES OF NAFTA'S EFFECTS ON REAL GDP (Percentage increase)

Effects Considered by Studies	Estimated Increases in GDP
Increases in U.S. GDP	
Resource Allocation	0.0[a], 0.02, 0.09, 0.22, 0.23[a], 1.34[b]
Economies of Scale + Resource Allocation	0.1, 1.685[b,c]
Investment + Resource Allocation	0.00[a], 0.04, 0.1, 0.1[d], 0.32
Productivity + Investment + Resource Allocation	0.51
Increases in Mexican GDP	
Resource Allocation	-0.04, 0.01, 0.27[a], 0.3[a], 0.32, 1.09, 2.27[b], 2.6[e]
Economies of Scale + Resource Allocation	1.8[e,f], 2.2, 2.975[b,c]
Investment + Resource Allocation	3.09, 4.6[d], 4.64, 6.4, 7.43[a], 8.0, 8.1[f], 12.68
Productivity + Investment + Resource Allocation	1.6 per year = 50 in 25 years[g], 11.4

NOTE: The table gives the results of all of the standard modeling studies that CBO reviewed; the Prestowitz et al. and the Hufbauer and Schott studies are not included.

a. The simulation that produced this value included the effects of labor migration in addition to investment and resource-allocation effects.

b. The simulation that produced this value included the effects of the Canada-United States Free Trade Agreement in addition to the effects of NAFTA.

c. This value is the average of the results of two different simulations reported by the same study.

d. The simulation that produced this value included the effects of economies of scale in addition to investment and resource-allocation effects, and it did not include the effects of liberalizing nontariff barriers to trade. Also, the number is the equivalent variation as a percentage of GDP, not the percentage increase in GDP.

e. Though the largest investment effects in the study that produced this result were reserved for a different simulation, the simulation that produced this result did include *some* investment effects.

f. The simulation that produced this value did not include the effects of liberalizing nontariff barriers to trade.

g. The study that produced this value included productivity effects only—no investment or resource-allocation effects.

These numbers should be viewed as representing tentative early attempts at estimating productivity effects. The paper in which the 50 percent figure for Mexico was published was written to convince other economists that such effects could be large and therefore deserve much more than the scant attention they have received to date from researchers and modelers. Until they receive that increased attention, estimates of productivity effects cannot be viewed as reliable.

Effects on investment have received more attention than those on productivity, but must still be viewed as not well modeled and as somewhat tentative. Studies that include investment effects along with the standard resource-allocation effects estimate increases in Mexican GDP ranging from 3.09 percent to 12.68 percent. Their estimates of effects on U.S. GDP range from no effect to roughly a 0.3 percent increase.

The effects of economies of scale in conjunction with NAFTA are also not well modeled. Studies that incorporate these effects along with the standard resource-allocation effects (but no investment effects) find that NAFTA would increase Mexican GDP by 1.7 percent to 3.38 percent.[38] Only two such studies estimate effects on U.S. GDP. The results of one are biased upward by a questionable labor-market assumption; the other estimates an increase in U.S. GDP of 0.1 percent.

Studies and simulations that include only resource-allocation effects give estimates of increases in Mexican GDP ranging from -0.04 percent to 2.6 percent, with six of the eight predictions being for less than a 1.1 percent increase. Predictions for U.S. GDP range from no effect to a 1.34 percent increase, with five of the six predictions being for increases of 0.23 percent or less. The higher sixth prediction again comes from the study with the questionable labor-market assumption.

Although these estimated benefits to the United States may appear small, expressed as they are in percentage terms, they appear larger in relation to costs. Three calculations of the ratio of the increase in U.S. GDP to the number of jobs that would shift from industries that decline as a result of NAFTA to industries that expand (which is an approximation of the number of people that would be involuntarily dismissed from the contracting industries) produce estimates of $342,000, $92,000, and $35,000 per year per

38. The lower end of this range is one of the two simulation results averaged to get the number 1.8 in Table 11. Similarly, the upper end is one of the two simulations averaged to get the number 2.975.

forced job change.[39] The third of these results is consistent with ratios estimated for particular trade restrictions (aimed at many different countries--not just at Mexico) in numerous partial equilibrium studies, although it is in the upper end of the range of values obtained by those studies. The second is higher than that range. The first is enough higher that it should be viewed with suspicion.

Wages and Employment. Many in the United States have voiced concern that NAFTA would result in lower wages for U.S. workers as their employers compete with firms in Mexico having access to low-cost Mexican labor. The models indicate that this effect of NAFTA would be very small and would be overpowered by other effects that are beneficial to labor (see Table 12). Even looking at resource-allocation effects alone, most of the estimates indicate increases in real wages. These increases would result from improvements in the real U.S. exchange rate with the rest of the world, which would lower the price of imports and thereby increase the real value of a given nominal wage. Factoring in the effects of investment, economies of scale, and productivity growth increases the estimated gain to labor, but the effect remains very small.

Most of the estimated increases in the average real wage of U.S. labor as a whole or of segments of the U.S. labor force are in the range of 0.01 percent to 0.6 percent. One study estimates declines of 1.3 percent and 1.7 percent, respectively, for rural and unskilled urban workers and increases of 0.1 percent for skilled and white-collar workers. A second estimates a decline of 0.85 percent in the average real wage of high-wage manufacturing workers, while estimating an increase of 2.35 percent for low-wage service workers. A third estimates a loss of 0.2 percent for rural workers and gains of 0.1 percent to 0.6 percent for other parts of the labor force. All of the estimates of changes in average wages by all of the other models are positive. Whether positive or negative, almost all of the estimated changes are very small.

The Balance of Trade. NAFTA would probably improve the U.S. balance of trade with Mexico for many years, cause a deterioration in the Mexican trade balance with the world as a whole (including the United States), and have very little effect on the U.S. trade balance with the world as a whole (including Mexico). All of these conclusions stem from the probable effects of NAFTA on aggregate saving and investment in the United States and Mexico, and from the accounting identity equating the trade balance with the difference between aggregate saving and aggregate investment. Unfortunately,

39. The second of these numbers is actually the ratio of the equivalent variation to the number of job shifts, which should be close in value to the ratio of the change in GDP to the number of job shifts. (See note 8.)

TABLE 12. SUMMARY OF MODELING ESTIMATES OF NAFTA'S EFFECTS ON REAL U.S. WAGES (Percentage increase)

Effects Considered by Study	Estimated Increases in Real U.S. Wages: Studies with One Kind of Labor	Studies with Four Kinds of Labor	Studies with Three Kinds of Labor
Resource Allocation	0.01[a], 0.02, 0.186	0.3,-1.3[b] rural 0.4,-1.7[b] urban unskilled 0.0, 0.1[b] urban skilled 0.0, 0.1[b] white collar	2.35 low-wage service 0.12 high-wage service -1.44 high-wage mfg.
Economies of Scale + Resource Allocation	0.1	n.a.	n.a.
Investment + Resource Allocation	0.03, 0.1[c]	0.2[b],-0.2 rural 0.0[b], 0.6 urban unskilled 0.0[b], 0.1 urban skilled 0.0[b], 0.3 white collar	3.20 low-wage service 0.05 high-wage service -1.31 high-wage mfg.
Productivity + Investment + Resource Allocation	n.a.	n.a.	2.35 low-wage service 0.32 high-wage service -0.85 high-wage mfg.

NOTES: n.a. = not applicable. Except for the Roland-Holst et al. study, the table gives the results of all of the standard modeling studies that CBO reviewed; the Prestowitz et al. and the Hufbauer and Schott studies are included. The results of the Roland-Holst et al. study are not listed because that study assumed a fixed wage for the United States and calculated effects on employment instead of effects on the wage.

a. The study that produced this value did not include the effects of liberalizing nontariff barriers to trade.

b. The study that produced this value included the effects of labor migration in addition to investment and resource-allocation effects.

c. The study that produced this value included the effects of economies of scale in addition to investment and resource-allocation effects and did not include the effects of liberalizing nontariff barriers to trade.

Unfortunately, most of the studies improperly handle investment or saving in Mexico (many assume the trade balance would be unaffected by NAFTA), so it is not possible to say much about the sizes of the effects on the U.S. and world balances of trade with Mexico. To the extent that trade balances are important, however, it is the balance with the world as a whole that is most important, and as just stated, the U.S. balance with the world as a whole would probably not be affected much at all because U.S. domestic saving and investment would probably not change much.

Effects on Particular Industries. The models estimate that NAFTA would have little effect on the vast majority of major industries in the United States, and that even the largest of these effects would be surprisingly small. Very few industry sectors would see output increased or decreased by more than 1 percent (see Table 13). Once again the Roland-Holst et al. study stands out from the others, this time as the only one to estimate more than a 1 percent change in output for a large number of industry sectors. According to its estimates, 22 sectors would increase output by more than 1 percent, and only two of the remaining four would decrease output--further evidence of the upward bias introduced by the study's assumption of a fixed wage in the United States.

The Brown, Deardorff, and Stern study estimates that 2 out of 29 industry sectors would see output decrease by more than 1 percent, and the Bachrach and Mizrahi study estimates that 1 out of 44 would. The remaining four studies that examine all sectors of the economy find that no sectors would see such losses, though some of the studies have rather large aggregate sectors within which gains and losses might occur to more narrowly defined industries without appearing in the sectoral results.[40]

Looking at the largest individual industry effects in each study (see Table 13), the study that predicts the largest loss--the Prestowitz et al. study--is suspect for reasons discussed earlier in this paper. The 5.0 percent output loss in the Trela and Whalley study is for the apparel industry (the study examines the textile and apparel industries only). The 3.89 percent loss in the Bachrach and Mizrahi study is for the sugar industry.[41] As might be expected by now, the Roland-Holst et al. study produces the largest predicted gain.

---

40. Number counts of sectors with losses larger than 1 percent are not meaningful for the Hunter, Markusen, and Rutherford study, the Prestowitz et al. study, and the Trela and Whalley study because those studies give results for only one or a few industries that do not encompass the whole economy.

41. Detailed tables of the industry sector predictions of all the models that CBO examined are given in Appendix B.

TABLE 13. SUMMARY OF ESTIMATES OF NAFTA'S EFFECTS ON OUTPUTS OF INDIVIDUAL U.S. INDUSTRY SECTORS

Study	Total Number of Sectors	Number with More Than 1 Percent Gain in Output	Number with More Than 1 Percent Loss in Output	Largest Gain in Output (Percent)	Largest Loss in Output (Percent)
Almon	71	1	0	1.10	0.72
Bachrach and Mizrahi	44	1	1	1.21	3.89
Boyd, Krutilla, and McKinney	9	0	0	0.33	0.26
Brown, Deardorff, and Stern	29	1	2	1.27	2.37
Hinojosa-Ojeda and Robinson	7	1	0	2.3	0.5
Hunter, Markusen, and Rutherford	n.a.	n.a.	n.a.	n.a.	1.7
Prestowitz et al.	n.a.	n.a.	n.a.	n.a.	15[a]
Roland-Holst et al.	26	22	0	25.7	0.9
Robinson et al.	11	1	0	2.6	0.3
Trela and Whalley	n.a.	n.a.	n.a.	n.a.	5.0

NOTES: n.a. = not applicable; used for studies that give results for only one or a few industries that do not encompass the entire economy. All other studies in the table examine the entire economy. The table includes all studies that CBO examined that presented results for individual industries. In studies with more than one simulation, the numbers given are for the simulation that CBO judged most realistic, or when it is unclear which simulation is most realistic, the simulation that gives the largest results. For the Brown, Deardorff, and Stern study, the simulation chosen was that for tariff elimination with foreign direct investment effects included (but no liberalization of nontariff barriers). For the Hinojosa-Ojeda and Robinson study, the simulation chosen was that for free trade plus distortion elimination plus Mexican transition plus labor migration. For the Hunter, Markusen, and Rutherford study, the simulation chosen was that labeled "INTEG." For the Prestowitz et al. study, the number is from the low-Mexican-growth simulation. For the Robinson et al. study, the simulation chosen was that for partial trade liberalization plus Mexican growth. For the Roland-Holst et al. study, the number given is from the contestable-markets simulation.

a. The number given for the Prestowitz et al. study is for the percentage change in employment rather than the percentage change in output, which the study did not give.

The results of three modeling studies indicate that the number of jobs that would shift from declining industries to expanding industries is not likely to be large. The Bachrach and Mizrahi study, the Almon study, and the Brown, Deardorff, and Stern study give sufficient information to calculate the number. The resulting estimates are for cumulative job shifts of 29,800, 32,400 and 55,300, respectively, over many years; the annual losses would be only a small fraction of these amounts. The numbers are extremely small in comparison with the number of workers who typically are permanently dismissed from their jobs involuntarily in any given year. From 1981 through 1990, the annual

number of workers so dismissed ranged from a low of 1.5 million to a high of 2.7 million.[42] If the models made proper allowance for productivity growth in Mexico resulting from NAFTA, the estimates of job shifts might be higher. Similarly, accounting for increased investment in Mexico would probably increase the estimate from the Almon study, and accounting for liberalization of nontariff barriers to trade would probably increase the estimate from the Brown, Deardorff, and Stern study. Even with these increases, however, the estimates would most likely be much smaller than the lowest annual total of involuntary dismissals that occurred in the 1980s.

It is difficult to draw firm conclusions as to which industries would gain or lose the most from NAFTA. Each study divides the economy into a different number of industry sectors, so the sectoral results of different studies are not strictly comparable (see Table 13). Further, the rankings of industry sectors from biggest gainers to biggest losers vary erratically from study to study, with some industries being fairly consistently ranked and others not. When industry sectors are ranked from largest percentage gainers to largest percentage losers in employment, for example, four of the five studies that list the chemical industry separately (or with plastics) rank it in the top third of all industries, and the fifth study ranks it in the top half. The textile industry's ranking is quite varied, however: it is 28th out of 53 sectors in the Almon study, 36th out of 44 in the Bachrach and Mizrahi study, 6th out of 29 in the Brown, Deardorff, and Stern study, and 7th out of 26 in the Roland-Holst et al. study.[43] The Almon study ranks "computers" 3rd out of 53, while the Bachrach and Mizrahi study ranks "computing equipment" 41st out of 44.

Such variability is not surprising given the tremendous differences among the models regarding investment, economies of scale, the sensitivities of demand and supply of various products to their prices, and other factors that could significantly affect the distribution of trade. Furthermore, even if there were no significant variability from study to study, the industry results would still be somewhat suspect because all of the studies that give such results assume that the relative amounts of intermediate goods demanded by industries as inputs to their production processes are constant at levels published by the U.S. Department of Commerce and are not affected by changes in the relative prices of those goods. This assumption is incorrect, and NAFTA would certainly change the relative prices.

---

42. Congressional Budget Office, *Displaced Workers: Trends in the 1980s and Implications for the Future* (February 1993), pp. x and 7.

43. Although the Almon study divides the U.S. economy into 71 sectors for output, it divides the economy into only 53 sectors for employment. Thus, there is no conflict between this sentence and Table 13.

Still another factor casting doubt on the rankings is the assumption (used in all of the models that give rankings for the entire economy) that as investment caused Mexican industries to grow, their productivity levels would stay at current Mexican levels rather than rising to U.S. levels. Since Mexican lags in productivity levels vary from industry to industry, this assumption affects the rankings of industries.

Given the variability of the rankings, it is probably safest to conclude that the models do not tell us much about specific industry effects other than that they would not be very large. Standard economic theory tells us that individual U.S. industries would be likely to be helped by NAFTA in proportion to their being characterized by:

- high capital intensity,
- high skilled-labor intensity,
- production of capital goods (since the increase in investment to be expected in Mexico would increase Mexican demand for capital goods),
- high current Mexican trade barriers (since the elimination of these barriers would make U.S. exports more competitive in the Mexican market), and
- low current U.S. trade barriers (since the elimination of low U.S. barriers would not increase the competitiveness of Mexican imports by much).

Conversely, U.S. industries would be likely to be hurt by NAFTA in proportion to their being characterized by:

- high unskilled-labor intensity,
- high current U.S. trade barriers, and
- low current Mexican trade barriers.

Climate, supplies of arable land, and other factors make it likely that most U.S. agricultural producers--including producers of grain, oilseeds, and animal products--would benefit, while the fruits and vegetables sector and possibly a few others might be hurt. Since the models of NAFTA incorporate this standard economic theory, however, judgments based on these factors are not

likely to be any more accurate than the models' predictions unless the judgments are informed by other knowledge that is not amenable to being incorporated into models. The individual industry estimates for each of the models that CBO reviewed are given in Appendix B.

APPENDIX A: A PRIMER ON TYPES OF MODELS AND ANALYSIS

Because most of the general empirical studies of the North American Free Trade Agreement employ general equilibrium models, which are different from the macroeconomic models used in forecasting short-term fluctuations of the economy, it is worth examining what general equilibrium models are, what distinguishes them from macroeconomic models, and why most economists consider general equilibrium models preferable for purposes such as modeling NAFTA. The examination will illuminate some of the common pitfalls in casual analysis of trade issues.

To determine the effects of NAFTA on a particular industry, the first inclination of most people is to compare the price and quality of the industry's output in the United States with that of its competitors in Mexico and to conclude that the country with the lower price and/or higher quality will export the good or service once trade barriers are removed, while the other will import it. This type of analysis is referred to by economists as *partial equilibrium* analysis because it examines only part of the economic system and tacitly assumes that the behavior of the rest of the system does not change. NAFTA, however, would change the behavior of the whole system, and the changes in the rest of the system could substantially affect the industry in question. Therefore, partial equilibrium analysis alone, without some attempt to assess the significance of effects on the rest of the system, is not completely reliable.

Perhaps the most obvious effect on another part of the system is that on the customers of the industry in question. Suppose that imports of apparel from Mexico were to expand at the expense of the U.S. apparel industry as a result of NAFTA. The decline in the U.S. apparel industry would hurt the U.S. textile industry, for which it is the major customer. The textile industry would be helped, however, by increased exports of textiles to Mexico to supply the expanding Mexican apparel industry.

Other effects are less obvious but still important. Suppose that, as a result of NAFTA, U.S. investment in Mexico were to increase substantially. For this to occur, U.S. investors would have to exchange their dollars for pesos to purchase Mexican stocks and bonds or capital goods produced in Mexico. The resulting increased demand for the peso would drive up its price in terms of dollars, making all Mexican exports more expensive relative to competing U.S. goods and services. This change in the exchange rate, which could be very long lived, would have to be taken into account before valid conclusions could be drawn from partial equilibrium price comparisons.

These and other systemwide effects make it necessary to consider all parts of the economic system and the interactions among them when answering questions about the effects of NAFTA, even if one is concerned with the effects

on only one industry. Of course, all parts of the system must also be considered to determine the effects on aggregate macroeconomic variables such as gross domestic product, employment, or the average wage.

There are two basic approaches to systemwide analysis: the macroeconomic approach and the general equilibrium approach. The macroeconomic approach involves constructing models based on observed statistical correlations among aggregate variables in the recent past. This approach is based on the assumption that the statistical correlations will continue into the future. It is the approach used in the large macroeconomic forecasting models of Data Resources, Inc.; WEFA, Inc.; and the Board of Governors of the Federal Reserve System.

The general equilibrium approach involves constructing models that explicitly incorporate fundamental theoretical assumptions about the behavior of individual actors. Statistical estimation is used only for determining fundamental theoretical parameters, not for determining correlations among aggregate variables. These correlations can determined if desired by solving the model. Most often the assumptions incorporated are that (1) firms maximize profits subject to the constraints imposed by technology, prices, interest rates, and possibly other economic variables, and (2) consumers maximize their economic well-being (which is usually assumed to be some specified increasing function of the goods and services that they consume) subject to the constraints imposed by wealth, income, prices, and interest rates.[44]

In practice, the difference between the two approaches is not as stark as one might infer from this description. Economists using the macroeconomic approach typically guide their search for aggregate statistical correlations by assuming that the correlations and their functional forms result from individual producers and consumers behaving according to assumptions typically incorporated in the general equilibrium approach. Further, the behavioral assumptions incorporated in the general equilibrium approach are usually long-accepted assumptions that the economics profession has gleaned from observations of correlations and past behavior of the economy and individual actors (similar to the macroeconomic approach). Nevertheless, the two approaches are distinct and have different uses for which they are most appropriate.

---

44. For those familiar with the jargon of econometrics, the distinction between the two kinds of models is much like the distinction between reduced-form models and structural models. Macroeconomic models are more in the nature of reduced-form models, and general equilibrium models are more in the nature of structural models.

The macroeconomic approach is most appropriate for modeling situations in which the economist has more confidence in the accuracy of his estimates of the statistical correlations and in the stability of those correlations than he does in his understanding of and ability to model accurately the behavior of the economic actors involved. This is generally true when changes in all variables are not far different from the changes seen in the data in the recent past and when the modeling of behavior is difficult. Examples include short-run fluctuations and disequilibria in macroeconomic variables, such as booms, recessions, and cyclical unemployment, and matters related to the money supply and absolute prices. The name of the approach--*macroeconomic*--stems from the fact that it is most easily and commonly used for modeling these macroeconomic variables.

When expected changes in variables are significantly different from those contained in the historical data (different in kind, much larger in magnitude, or more widespread throughout the economy), one loses confidence that the statistical correlations on which macroeconomic models are based--and which these models assume are constant--will indeed remain constant. In such cases, if the relevant economic behavior is well understood theoretically and relatively easy to model, general equilibrium modeling is likely to be more accurate. The approach is most easily and commonly applied to long-term equilibria--hence the name general *equilibrium*.

Most economists would argue that NAFTA requires general equilibrium analysis. Only two of the modeling studies that the Congressional Budget Office surveyed--the Almon study and the Adams, Alanis, and del Rio study--used macroeconomic models; the rest used general equilibrium models. CBO also surveyed four studies that used methodologies other than modeling for predicting the effects of NAFTA.

General equilibrium models are easiest to construct if they are designed to model equilibria that are sufficiently long term that output, prices, wages, imports, exports, and other variables have time to adjust and settle down to a static equilibrium. Such models are called *static* general equilibrium models. As applied to NAFTA, such models are solved for the static equilibrium that occurs many years after NAFTA is implemented--when all the changes of NAFTA have had time to work their way through the economy--and for the static equilibrium in the same time frame but without NAFTA. The difference between the two equilibria gives the long-term cumulative effect of NAFTA, but no information about the path the economy would take to get there.

Some general equilibrium models are designed to model not only the final equilibrium but also the path that the economy takes over time to reach

that equilibrium. Because they look at variables as they change over time, these models are referred to as *dynamic* general equilibrium models. All else being the same, dynamic models are more complicated and difficult to construct than static models. (Effectively, they amount to using the general equilibrium approach to model some forms of disequilibrium, which was noted earlier to be more easily--though not necessarily more accurately--modeled using the macroeconomic approach.) They can model important effects of NAFTA that static models cannot, however. Most important, dynamic models are better than static models for modeling effects on investment flows and productivity growth, which are likely to be among the most important effects of NAFTA.

Unfortunately, the need for tractability usually forces dynamic modelers to omit or simplify significant features that are usually included or treated more fully in static models. The most common simplification is to reduce the number of industrial sectors. Dynamic models typically have substantially fewer sectors than static models do--in the case of the McCleery study, only two sectors.

APPENDIX B: ESTIMATES OF NAFTA'S EFFECTS ON INDIVIDUAL INDUSTRIES IN THE UNITED STATES

The following tables give the estimates of output and employment effects by U.S. industry from the studies that the Congressional Budget Office reviewed. Some studies did not give estimates by industry. Some gave only output estimates or only employment estimates.

TABLE B-1. ALMON STUDY: OUTPUT EFFECTS

	Industry Sector	Change in Output (Millions of 1991 dollars)	Change in Output (Percent)
1	Electric Industrial Apparatus	609	1.10
2	Computers	1,564	0.89
3	Copper	143	0.89
4	Metalworking Machinery	327	0.85
5	Misc. Nonelectrical Machinery	778	0.77
6	Agricultural Machinery	160	0.68
7	Special Industry Machinery	150	0.65
8	Engines and Turbines	169	0.64
9	Plastic Products	877	0.64
10	Motor Vehicles	1,770	0.62
11	Communications Equipment and Electronics	1,328	0.57
12	Construction, Mining, Oilfield Equipment	188	0.52
13	Rubber Products	164	0.40
14	Other Nonferrous Metals	335	0.39
15	Agriculture, Forestry	1,391	0.37
16	Ferrous Metals	356	0.37
17	Nonferrous Ore Mining	28	0.34
18	Metal Products	843	0.32
19	Electric Lighting and Wiring Equipment	166	0.30
20	Chemicals, Except Agricultural	716	0.20
21	Instruments	202	0.20
22	Agricultural Chemicals	59	0.19
23	Service Industry Machinery	74	0.19
24	Natural Gas	51	0.15
25	Stone, Clay, and Glass	126	0.14
26	Gas Utilities	129	0.14
27	Iron Ore Mining	7	0.14
28	Nonmetallic Minerals	20	0.10
29	Coal Mining	46	0.09
30	Wholesale Trade	632	0.08
31	Water Transport	42	0.08
32	Crude Petroleum	36	0.06
33	Paper	97	0.06
34	Fuel Oil	19	0.05
35	Petroleum Refining	105	0.05
36	Railroads	30	0.04
37	Pipeline	4	0.04
38	Electric Utilities	74	0.04

(Continued)

TABLE B-1. CONTINUED

	Industry Sector	Change in Output (Millions of 1991 dollars)	Change in Output (Percent)
39	Business Services	274	0.03
40	Trucking	59	0.03
41	Auto Repairs	57	0.03
42	Aerospace	25	0.02
43	Food and Tobacco	126	0.02
44	Communication Services	63	0.02
45	Transportation Services	3	0.02
46	Misc. Manufacturing	6	0.01
47	Textiles, Except Knits	11	0.01
48	Air Transport	13	0.01
49	Printing and Publishing	17	0.01
50	Government Enterprises	0	0.00
51	Government Industry	0	0.00
52	Finance and Insurance	-126	-0.02
53	Retail Trade	-190	-0.03
54	Water and Sanitation	-13	-0.04
55	Real Estate	-169	-0.04
56	Medicine, Education, Nonprofit Organizations	-253	-0.04
57	Eating and Drinking	-105	-0.04
58	Household Appliances	-13	-0.04
59	Shoes and Leather	-5	-0.06
60	Hotels	-82	-0.06
61	Movies and Amusements	-89	-0.07
62	Furniture	-40	-0.07
63	Other Transportation Equipment	-11	-0.08
64	Construction	-506	-0.15
65	Knitting	-38	-0.16
66	Lumber	-221	-0.18
67	Owner-Occupied Housing	-695	-0.18
68	Ships, Boats	-32	-0.18
69	Other Office Equipment	-17	-0.19
70	Apparel	-643	-0.60
71	TV Sets, Radios, Phonographs	-145	-0.72

NOTE: The numbers given are the cumulative changes in annual output through 1995 assuming that liberalization begins in 1990. The numbers reported in the study were in 1977 dollars. CBO converted the numbers to 1991 dollars.

TABLE B-2. ALMON STUDY: EMPLOYMENT EFFECTS

	Industry Sector	Change in Employment (Thousands)	Change in Employment (Percent)
1	Electrical Appliances	5.2	1.17
2	Metalworking Machinery	4.0	0.91
3	Computers	3.1	0.83
4	Misc. Nonelectrical Machinery	7.8	0.75
5	Engines, Turbines	0.7	0.66
6	Motor Vehicles	5.0	0.64
7	Rubber, Plastic Goods	5.3	0.59
8	Communications Machinery	6.3	0.57
9	Agricultural Machinery	0.5	0.48
10	Nonferrous Metals	1.7	0.46
11	Iron, Steel	2.0	0.42
12	Agriculture	10.6	0.38
13	Metal Products	6.1	0.33
14	Electric Lighting and Wiring	1.3	0.32
15	Special Industrial Machinery	0.5	0.29
16	Chemicals	2.5	0.23
17	Instruments	1.3	0.22
18	Fertilizers, Pesticides	0.1	0.19
19	Service Industry Machinery	0.4	0.18
20	Stone, Clay, Glass	1.2	0.17
21	Mining	0.4	0.12
22	Paper	0.5	0.07
23	Railroads	0.2	0.07
24	Petroleum Refining	0.1	0.07
25	Electric Utilities	0.4	0.05
26	Gas, Water, Sanitation	0.2	0.05
27	Business Services	5.0	0.05
28	Textiles	0.2	0.04
29	Trucking	1.4	0.04
30	Auto Repair	0.5	0.03

(Continued)

TABLE B-2. CONTINUED

	Industry Sector	Change in Employment (Thousands)	Change in Employment (Percent)
31	Communications	0.4	0.03
32	Misc. Manufacturing	0.1	0.03
33	Food, Tobacco	0.4	0.03
34	Aerospace	0.2	0.02
35	Printing	0.3	0.02
36	Air Transport	0.1	0.01
37	Wholesale and Retail Trade	1.0	0.00
38	Leather Footwear	0.0	0.00
39	Household Appliances	0.0	0.00
40	Other Transportation Equipment	0.0	0.00
41	Crude Oil	-0.1	-0.02
42	Finance, Insurance	-1.5	-0.02
43	Real Estate	-0.6	-0.03
44	Medicine, Education, Nonprofit Organizations	-6.0	-0.04
45	Hotels	-2.4	-0.06
46	Ships, Boats	-0.1	-0.06
47	Movies, Amusements	-1.0	-0.07
48	Furniture	-0.4	-0.07
49	Knitting	-0.3	-0.14
50	Lumber	-1.2	-0.14
51	Construction	-12.8	-0.16
52	TV Sets, Radios, Phonographs	-0.1	-0.20
53	Apparel	-5.9	-0.57
	Total for Declining Industries	-32.4	
	Total for All Industries	44.6	

TABLE B-3. BACHRACH AND MIZRAHI STUDY: EMPLOYMENT AND OUTPUT EFFECTS

Industry Sector	Change in Output (Millions of 1988 dollars)	Change in Output (Percent)	Change in Employment (Thousands)	Change in Employment (Percent)
1 Misc. Manufacturing	1,302.9	1.21	11.4	0.91
2 Motor Vehicles and Bodies	373.4	0.28	2.0	0.45
3 Machinery and Equipment	856.9	0.48	4.5	0.27
4 Chemicals	376.0	0.22	0.9	0.13
5 Rubber and Misc. Plastics	120.5	0.14	0.6	0.07
6 Motor Vehicle Parts	26.6	0.05	0.2	0.06
7 Transportation Equipment	77.9	0.06	0.6	0.05
8 Food Products	197.0	0.06	0.6	0.04
9 Utilities	35.4	0.02	0.4	0.04
10 Crude Oil and Gas	6.1	0.01	0.2	0.04
11 Other Business Services	158.5	0.01	4.1	0.03
12 Finance and Insurance	51.1	0.01	1.1	0.02
13 Petroleum Refining	24.6	0.02	0.0	0.02
14 Health, Education, Nonprofit Organizations, and Government	156.1	0.01	2.3	0.01
15 Animal Products	-3.5	0.00	0.1	0.01
16 Wholesale and Retail Trade	-41.9	-0.01	0.7	0.00
17 Leather	3.2	0.04	0.0	0.00
18 Mining	-11.1	-0.02	0.0	-0.01
19 Communications	-45.3	-0.03	-0.1	-0.01
20 Fabricated Metal	32.6	0.02	-0.2	-0.01
21 Transportation	-46.9	-0.02	-0.3	-0.01
22 Tobacco Manufactures	-15.2	-0.05	0.0	-0.02
23 Iron and Steel	25.7	0.03	-0.1	-0.02
24 Lumber and Wood	-7.8	-0.01	-0.2	-0.02

(Continued)

TABLE B-3. CONTINUED

Industry Sector	Change in Output (Millions of 1988 dollars)	Change in Output (Percent)	Change in Employment (Thousands)	Change in Employment (Percent)
25 Drugs	-3.8	-0.01	-0.1	-0.03
26 Paper	-3.4	-0.00	-0.2	-0.03
27 Printing and Publishing	14.3	0.01	-0.4	-0.03
28 Construction	-181.8	-0.03	-1.5	-0.03
29 Hotels and Restaurants	-177.4	-0.04	-3.6	-0.03
30 Electrical Equipment	-106.5	-0.08	-0.5	-0.04
31 Other Agriculture	-22.3	-0.06	-0.5	-0.05
32 Cleaning and Toilet Prep.	-10.2	-0.03	-0.1	-0.08
33 Stone and Clay	-34.2	-0.08	-0.5	-0.12
34 Field Crops	-87.1	-0.13	-1.4	-0.12
35 Furniture and Fixtures	-60.1	-0.15	-0.8	-0.14
36 Textiles	-91.5	-0.13	-1.0	-0.14
37 Glass	-25.6	-0.17	-0.3	-0.19
38 Nonferrous Metals	-16.0	-0.02	-0.9	-0.24
39 Apparel	-384.4	-0.62	-4.4	-0.40
40 Household Appliances	-157.5	-0.58	-1.0	-0.46
41 Computing Equipment	-227.8	-0.49	-2.7	-0.68
42 Electronic Components	-437.9	-0.96	-4.7	-0.76
43 Fruits and Vegetables	-143.4	-0.80	-2.6	-0.79
44 Sugar	-442.1	-3.89	-1.7	-2.38
Total for Declining Industries			-29.8	
Total for all Industries			0 by assumption	

TABLE B-4. BOYD, KRUTILLA, AND McKINNEY STUDY: OUTPUT EFFECTS

Industry Sector	Change in Output (Percent)
Program Crops	0.33
Manufacturing	0.02
Chemicals and Plastics	0.02
Livestock	0.02
Mining	-0.04
Food and Tobacco	-0.05
Fruits, Nuts, Vegetables	-0.13
Refining	-0.16
Crude Oil	-0.26

NOTE: This study did not include the effects of liberalizing nontariff barriers to trade.

TABLE B-5. BROWN, DEARDORFF, AND STERN STUDY: OUTPUT AND EMPLOYMENT EFFECTS

Industry Sector	Change in Output (Percent)	Change in Employment (Thousands)	Change in Employment (Percent)
1 Glass Products	1.27	2.756	1.21
2 Rubber Products	0.61	1.696	0.55
3 Transport Equipment	0.54	11.758	0.46
4 Agriculture	0.31	12.748	0.31
5 Nonelectrical Machinery	0.28	8.979	0.27
6 Textiles	0.39	3.357	0.26
7 Clothing	0.37	3.467	0.23
8 Leather Products	0.31	0.236	0.22
9 Wood Products	0.24	1.176	0.18
10 Iron, Steel	0.16	1.350	0.14
11 Chemicals	0.20	1.817	0.14
12 Footwear	0.22	0.235	0.12
13 Food	0.16	2.129	0.10
14 Metal Products	0.06	1.363	0.07
15 Nonmetal Mineral Products	0.09	0.390	0.07
16 Paper Products	0.11	0.323	0.04
17 Printing, Publishing	0.06	0.416	0.02
18 Construction	0.01	0.652	0.01
19 Personal Services	0.00	0.447	0.00
20 Transportation	0.00	-0.147	0.00
21 Wholesale Trade	0.01	-1.234	-0.01
22 Utilities	-0.01	-0.411	-0.02
23 Financial Services	0.00	-1.918	-0.02
24 Petroleum Products	-0.01	-0.067	-0.04
25 Furniture, Fixtures	-0.06	-0.734	-0.12
26 Miscellaneous Manufactures	-0.11	-2.788	-0.14
27 Mining, Quarrying	-0.29	-3.632	-0.31
28 Electrical Machinery	-1.37	-35.835	-1.36
29 Nonferrous Metals	-2.37	-8.527	-2.17
Total for Declining Industries		-55.146	
Total for All Industries		0 by assumption	

NOTE: The simulation producing these results did not include the effects of liberalizing nontariff barriers to trade.

TABLE B-6. HINOJOSA-OJEDA AND ROBINSON STUDY: OUTPUT EFFECTS

Industry Sector	Percentage Change in Output: Free Trade + Distortion Elimination	Free Trade + Distortion Elimination + Mexican Growth	Free Trade + Distortion Elimination + Mexican Transition	Free Trade + Distortion Elimination + Mexican Growth + Migration	Free Trade + Distortion Elimination + Mexican Transition + Migration
Consumer Durables	1.8	1.8	2.5	1.7	2.3
Light Manufacturing	1.3	1.3	1.5	1.2	1.0
Intermediates	0.8	0.8	1.1	0.7	0.8
Agriculture	0.3	0.5	0.7	0.2	0.0
Oil and Refining	0.0	0.0	0.0	0.0	0.0
Capital Goods	-0.6	-0.6	-0.3	-0.6	-0.5
Services	-0.1	-0.1	-0.1	-0.1	-0.5

TABLE B-7. HUNTER, MARKUSEN, AND RUTHERFORD STUDY: OUTPUT EFFECT

Industry Sector	Change in Output (Percent)
Automobiles	
If trade is liberalized for producers only	-0.5
If trade is liberalized for producers and consumers	-1.7

NOTE: Other industries are not covered by the study.

TABLE B-8. PRESTOWITZ ET AL. STUDY: EMPLOYMENT EFFECTS

Industry Sector	Loss in Employment (Number)	Loss in Employment (Percent)
Radio and TV	19,000 to 52,650	15 to 41
Auto Parts	41,770 to 62,980	10 to 16
Telecommunications Equipment	9,540 to 21,600	7 to 16
Autos	7,970 to 12,990	3 to 5
Electrical Equipment	4,280 to 16,000	0.3 to 1
Machinery	4,600 to 9,900	0.2 to 0.5

NOTE: Unlike most of the other studies, this study does not include the entire economy. Many industries are not covered by the study.

TABLE B-9. ROBINSON ET AL. STUDY: OUTPUT EFFECTS

Industry Sector	Industry Output as Percentage of Total U.S. Employment	Percentage Change in Output: All Trade Liberalization	Trade Liberalization + Ag. Program Removal	Partial Trade Liberalization	Partial Trade Liberalization + Growth
Food Corn	0.0	4.1	5.1	1.2	2.6
Program Crops	0.4	0.8	1.7	0.2	0.5
Consumer Durables	1.7	0.3	0.7	0.2	0.1
Capital Goods	4.9	0.2	0.5	0.1	0.0
Other Agriculture	1.4	0.2	0.6	0.1	0.0
Food Processing	1.5	0.3	0.7	0.1	0.0
Services	79.6	0.2	0.6	0.0	0.0
Intermediates	4.5	0.2	0.5	0.0	0.0
Oil and Refining	0.5	0.0	0.0	0.0	0.0
Other Light Mfg.	5.1	0.2	0.5	0.0	-0.1
Fruits, Vegetables	0.4	0.1	0.7	-0.2	-0.3

TABLE B-10. ROLAND-HOLST ET AL. STUDY: OUTPUT EFFECTS

Industry Sector	Percentage Change in Real U.S. Output: Cournot Pricing	Percentage Change in Real U.S. Output: Contestable Markets
1 Transportation Equipment	15.9	25.7
2 Iron and Steel	5.2	8.5
3 Nonferrous Metals	4.3	6.9
4 Leather	4.0	5.8
5 Nonelectrical Machinery	3.4	5.5
6 Rubber	3.2	5.0
7 Textiles	3.1	4.7
8 Wood and Metal Products	2.6	4.1
9 Mining	2.5	3.9
10 Agriculture	2.4	2.1
11 Nonmetallic Mineral Products	1.9	3.0
12 Electrical Machinery	1.9	2.9
13 Chemical	1.8	2.5
14 Other Manufacturing	1.7	2.8
15 Paper	1.3	1.9
16 Food Processing	1.1	1.4
17 Construction	0.9	1.5
18 Electricity	0.9	1.4
19 Transportation and Communications	0.9	1.4
20 Commerce	0.9	1.4
21 Apparel	0.8	1.5
22 Other Services	0.8	1.3
23 Beverages	0.5	0.8
24 Petroleum	0.3	0.5
25 Finance, Insurance, and Real Estate	-0.2	-0.02
26 Tobacco	-0.6	-0.9

TABLE B-11. TRELA AND WHALLEY STUDY: OUTPUT EFFECTS

Industry Sector	Percentage Change in Output
Textiles	-0.1
Apparel	-5.0

NOTE: This study gives individual industry results for only the textile, apparel, and steel industries and not for the rest of the economy. The results for the steel industry are not presented here because the study focuses on the effect of removing the U.S. steel quotas, and those quotas no longer exist.

APPENDIX C: BRIEF SYNOPSES OF EMPIRICAL STUDIES ASSESSED IN THIS PAPER

Listed below are the studies that the Congressional Budget Office surveyed for this paper, each accompanied by a brief description of the model or other methodology used by the study. In the descriptions, "multifactor productivity growth" refers to the effects discussed in the section of this paper relating to such productivity growth, and it excludes the static gains discussed in the sections on resource allocation and increasing returns to scale.

1. F. Gerard Adams, Mario Alanis, and Abel Beltran del Rio, "The Mexico-United States Free Trade and Investment Area Proposal: A Macro-econometric Evaluation of Impacts on Mexico," *Journal of Policy Modeling*, vol. 14, no. 1 (February 1992), pp. 99-119.

Methodology: macroeconomic model
Regions modeled: 1--Mexico--with equations for trade with the United States and with the rest of the world (ROW)
Number of industrial sectors: 10 sectors each of imports and exports; the number of production sectors is not clear from the paper
Factors of production: not clear from the paper
Substitution among factors of production: not clear from the paper
Substitution among intermediate goods: not clear from the paper
Economies of scale: not clear from the paper
Labor markets: both employment and the average wage are allowed to vary
International labor migration resulting from NAFTA: allowed
Treatment of investment/capital stock: in one simulation, U.S. and foreign countries are assumed to increase their investment in Mexico by amounts starting at $1 billion in 1992 and gradually increasing to $5 billion in 2001
Exchange rate/trade balance: not completely clear from the paper, but both the nominal exchange rate and the trade balance are allowed to vary; 50 percent of the output resulting from the increased foreign investment in Mexico is assumed to be exported
Multifactor productivity growth resulting from NAFTA: not discussed in the paper

2. Clopper Almon/Inforum, "Industrial Effects of a Free Trade Agreement Between Mexico and the USA" (U.S. Department of Labor, September 15, 1990). A summary appears in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: macroeconomic model
Regions modeled: 2--United States and Mexico--with equations for trade with the ROW
Number of industrial sectors: 78 in the United States; 74 in Mexico
Factors of production: 0--no production function
Substitution among factors of production: implicitly allowed in modeling of investment flows, but lack of production function means that capital-labor substitution has no effect on production or labor productivity--only on demand for capital goods
Substitution among intermediate goods: not allowed
Economies of scale: implicitly no (no explicit production function)

Labor markets: wages are functions of unemployment rates, labor productivity, and variables related to the money supply and prices; industry employments are functions of output, labor productivity, and the length of the work year
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: standard macroeconomic investment equation (based on output and cost of capital) for each industry in the United States; standard macroeconomic economywide investment equation for Mexico; no allowance for increased foreign investment in Mexico resulting from increased investor confidence or elimination of investment restrictions
Exchange rate/trade balance: exchange rates held fixed by assumption; trade balance allowed to vary; nonallowance of increased investment in Mexico (see above) means that trade balance does not deteriorate substantially
Multifactor productivity growth resulting from NAFTA: not allowed

3. Carlos Bachrach and Lorris Mizrahi, "The Economic Impact of a Free Trade Agreement Between the United States and Mexico: A CGE Analysis," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992). Also, "The Effects of a Free Trade Agreement Between the U.S. and Mexico" (prepared for the U.S. Council of the Mexico-U.S. Business Committee by the Policy Economics Group of KPMG Peat Marwick, Washington, D.C., May 1, 1991).

Methodology: static general equilibrium model
Regions modeled: 2--the United States and Mexico--with equations for trade with the ROW
Number of industrial sectors: 44
Factors of production: 2--capital and labor
Substitution among factors of production: allowed
Substitution among intermediate goods: for Mexico, not allowed; for the United States, not allowed except between energy and a composite of the other intermediate goods
Economies of scale: no
Labor markets: employment held fixed and real wage allowed to vary in the United States; real wage held fixed and employment allowed to vary in Mexico
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: investment is a fixed proportion of the capital stock; Mexican capital stock is assumed to increase by 7.6 percent (the amount required by the model to reduce the rate of return on capital to its pre-NAFTA level) as a result of NAFTA; 40 percent of the increased capital is assumed to be owned by foreigners and therefore not matched by Mexican domestic saving, but the study does not examine the interim period of increased investment required to achieve the capital-stock increase (though it is mentioned in the text of the report)
Exchange rate/trade balance: exchange rates are determined by the requirement that the trade balance equal saving (which is modeled) minus investment (which is set exogenously), but since the study does not examine the interim period of increased investment, it cannot measure or predict the deterioration in the Mexican trade balance to be expected during that period; Armington assumption is used
Multifactor productivity growth resulting from NAFTA: not allowed

Other features: Mexican import restrictions on autos are not considered; U.S. investment in Mexico is assumed not to come at the expense of U.S. domestic investment (this assumption is defended on the basis of the model result that the return to capital increases in both Mexico and the United States as a result of NAFTA.); quotas are modeled as ad valorem equivalents; the Armington assumption is used

4. Roy G. Boyd, Kerry Krutilla, and Joseph A. McKinney, "The Impact of Tariff Liberalization Between the United States and Mexico: A CGE Analysis," manuscript, 1992.

Methodology: static general equilibrium model
Regions modeled: 1--the United States--with equations for trade with Mexico and the ROW
Number of industrial sectors: 13
Factors of production: 3--capital, labor, and land
Substitution among factors of production: allowed
Substitution among intermediate goods: not allowed
Economies of scale: no
Labor markets: labor-leisure choice explicitly modeled; wages allowed to vary to clear the market
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: saving is explicitly modeled and investment is set equal to saving; no allowance for increased foreign investment in Mexico resulting from increased investor confidence or elimination of investment restrictions
Exchange rate/trade balance: treatment of the exchange rate is unclear, but presumably it must be allowed to vary because the equating of investment with saving (see above) means that the trade balance must be zero at all times
Multifactor productivity growth resulting from NAFTA: not allowed

5. Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "A U.S.-Mexico-Canada Free Trade Agreement: Sectoral Employment Effects and Regional/Occupational Employment Realignments in the United States," in National Commission for Employment Policy, *The Employment Effects of the North American Free Trade Agreement: Recommendations and Background Studies*, Special Report No. 33 (October 1992). Also reviewed by CBO but not included in this survey is Drusilla K. Brown, Alan V. Deardorff, and Robert M. Stern, "A North American Free Trade Agreement: Analytical Issues and a Computational Assessment," *World Economy*, vol. 15, no. 1 (January 1992), which is based on the same model but is much shorter. Each paper has strengths and weaknesses relative to the other. To the extent that the results of the two papers overlap, they are very similar but not exactly the same because of a slight change made in the model.

Methodology: static general equilibrium model
Regions modeled: 4--the United States, Mexico, Canada, and a group of 31 major trading countries--with equations for trade with the ROW

Number of industrial sectors: 29--23 producing tradable products and 6 producing nontradable products
Factors of production: 2--capital and labor
Substitution among factors of production: allowed
Substitution among intermediate goods: not allowed
Economies of scale: yes in 22 sectors, no in the other 7 sectors (which are agriculture and the 6 nontradable products sectors)
Labor markets: employment held fixed and real wage allowed to vary
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: two kinds of simulations--one with no change in Mexican capital stock, another with Mexican capital stock increased by 10 percent by investment from the other 31 countries; no modeling of the interim period of increased investment that is required to achieve the increased capital stock
Exchange rate/trade balance: trade balances held fixed, exchange rates allowed to vary; since the study looks at final equilibrium with higher capital and not at interim period of higher investment, Mexican trade balance does not deteriorate in increased-growth simulation; rather, it increases to pay the interest cost of the investment
Multifactor productivity growth resulting from NAFTA: not allowed

6. David Cox and Richard G. Harris, "North American Free Trade and its Implications for Canada: Results from a CGE Model of North American Trade" (paper presented at the conference North American Free Trade: Economic and Political Implications, Washington, D.C., June 27-28, 1991). Also, David Cox and Richard G. Harris, "North American Free Trade and its Implications for Canada: Results from a CGE Model of North American Trade," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: static general equilibrium model
Regions modeled: 1--Canada--with equations for trade with the United States, Mexico, and ROW
Number of industrial sectors: 19--14 producing tradable products and 5 producing nontradable products
Factors of production: 2--capital and labor
Substitution among factors of production: allowed
Substitution among intermediate goods: not allowed
Economies of scale: yes in 10 sectors, no in the other 9 sectors
Labor markets: real wage allowed to vary to equate labor supply and demand
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: capital is internationally mobile at world interest rate
Exchange rate/trade balance: not clear from the paper, but the real exchange rate is allowed to vary
Multifactor productivity growth resulting from NAFTA: one simulation assumes a 10 percent productivity improvement for Mexico modeled in the form of a 10 percent reduction in real Mexican export prices
Other features: the Armington assumption is used

7. Raul Hinojosa-Ojeda and Sherman Robinson, "Alternative Scenarios of U.S.-Mexico Integration: A Computable General Equilibrium Approach," Working Paper No. 609 (Department of Agricultural and Resource Economics, Division of Agriculture and Natural Resources, University of California at Berkeley, April 1991).

Methodology: static general equilibrium model
Regions modeled: 2--United States and Mexico--with equations for trade with the ROW
Number of industrial sectors: 7
Factors of production: 6--land, capital, rural labor, urban unskilled labor, skilled labor, white-collar labor
Substitution among factors of production: allowed
Substitution among intermediate goods: not allowed
Economies of scale: no
Labor markets: full employment assumed, real wages allowed to vary
International labor migration resulting from NAFTA: allowed in most simulation runs--assumed sufficient to keep constant the ratio of Mexican to U.S. real wages for rural and urban unskilled workers; internal migration within Mexico also allowed--assumed sufficient to keep constant the ratio of rural to urban unskilled wages in Mexico
Treatment of investment/capital stock: has two increased-investment scenarios: (1) a final equilibrium simulation in which the Mexican capital stock is assumed to be 7.6 percent (the number is taken from the Bachrach and Mizrahi study) higher than before NAFTA, and (2) a transition simulation in which the Mexican capital stock is assumed to be 3.8 percent higher than before NAFTA and the trade deficit is assumed to be $5 billion
Exchange rate/trade balance: trade balance set by assumption, real exchange rate allowed to vary
Multifactor productivity growth resulting from NAFTA: not allowed

8. Gary Clyde Hufbauer and Jeffrey J. Schott, *North American Free Trade: Issues and Recommendations* (Washington, D.C.: Institute for International Economics, 1992), pp. 51-57.

Methodology: analogy with 31 similar countries that have liberalized economically in the past
Regions studied: 2--Mexico and the United States
Number of industrial sectors: not applicable
Factors of production: not applicable
Substitution among factors of production: implicitly allowed
Substitution among intermediate goods: implicitly allowed
Economies of scale: implicitly yes for wherever appropriate
Labor markets: Mexican jobs created at the rate of 87,000 per billion dollars of net exports; U.S. jobs created at the rate of 14,500 jobs per billion dollars of net exports
International labor migration resulting from NAFTA: unclear; if migration occurred in the 31 liberalization cases that Mexico and NAFTA are compared with, then it is implicitly included in this study
Treatment of investment/capital stock: study assumes $12 billion net annual foreign investment in Mexico

Exchange rate/trade balance: trade balance determined by saving-investment imbalance; increased investment is calculated to cause a 29 percent real appreciation of the peso
Multifactor productivity growth resulting from NAFTA: real per capita GDP assumed to grow at 4 percent per year in Mexico and 2 percent per year in the United States; the labor-market assumption above implies that these increases result from increased employment while productivity does not change, but that assumption is used only for calculating employment changes and not for calculating per capita GDP growth--thus, the labor-market assumption can be ignored
Other features: assumes privatization across the board in Mexico, stepped-up Mexican oil production, and fiscal and monetary restraint by Mexico in addition to trade liberalization; assumes Mexico purchases 75 percent of its imports from and sells 75 percent of its exports to the United States

9. Linda Hunter, James R. Markusen, and Thomas F. Rutherford, "Trade Liberalization in a Multinational-Dominated Industry: A Theoretical and Applied General Equilibrium Analysis," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: static general equilibrium model
Regions modeled: 4--the United States, Mexico, Canada, and the ROW
Number of industrial sectors: 2--the automobile industry and everything else
Factors of production: 2--"labor" and "resources," but the paper says that neither bears any relation to empirical entities of the same name; "resources" is sector-specific
Substitution among factors of production: allowed
Substitution among intermediate goods: not possible (no intermediate goods)
Economies of scale: yes in the automobile industry, no in the other sector
Labor markets: employment held fixed and real wage allowed to vary
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: no investment or capital stock
Exchange rate/trade balance: not discussed
Multifactor productivity growth resulting from NAFTA: not allowed
Other features: examines the implications for NAFTA of multinational firms in the automobile industry

10. Timothy J. Kehoe, "Free Trade and Economic Growth" (University of Minnesota, Department of Economics, Minneapolis, Minn., May 1991). Also, Timothy J. Kehoe, "Modelling the Dynamic Impact of North American Free Trade," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

This study does not fit into the framework used for summarizing the other studies. The study has three parts:

(1) It first demonstrates theoretically that "learning by doing" will cause a country's productivity growth rate to be positively correlated with a particular index of the extent to which the country's economy specializes in a few industries rather than many (so that it can get more experience in those industries and thereby become more productive). It also demonstrates that the ability to import specialized inputs to production will cause the productivity growth rate to be positively correlated with the Grubel-Lloyd index of trade in specialized products.

(2) It then uses a regression on cross-country data to estimate an empirical equation relating the productivity growth rate to the two indexes just discussed.

(3) Finally, it applies the estimated empirical equation to Mexico and NAFTA. It presents arguments that NAFTA will change the two indexes for Mexico by certain specified amounts, and it inserts those changes into the equation to estimate how much NAFTA would affect the Mexican productivity growth rate.

11. Edward Leamer, "Wage Effects of a U.S.-Mexican Free Trade Agreement" (paper presented at a conference on the Mexico-U.S. Free Trade Agreement at Brown University in Providence, R.I., October 17-19, 1991).

This study does not fit into the framework used for summarizing the other studies. It has three basic parts:

(1) It first demonstrates theoretically that if the United States eliminates all barriers to trade with Mexico and if the Mexican economy is sufficiently large, then any current or new U.S. barriers to imports from other countries will have no effect on wages or employment in the United States. Such barriers would merely cause imports from Mexico to replace imports from other countries without any effect on the U.S. economy: prices, total levels of imports of any product, wages, or employment.

(2) It then uses a rough, simple empirical model to project that with NAFTA Mexico will be sufficiently large for the above to occur. It concludes that with NAFTA the United States will not be able to use trade restrictions to prevent or alter the continuation of the trends of the past couple of decades in the effects of international trade on wages and the returns on capital in the United States, and that therefore the trends will continue unchanged.

(3) The study uses the same rough, simple empirical model along with a duality theorem from microeconomics to estimate the effects of trade on U.S. wages and capital returns from 1972 to 1985. It concludes that if NAFTA is implemented, those same changes will happen again over the next 10 to 15 years. This is not the same thing as estimating the effects of NAFTA. The effects of NAFTA would be the difference between this estimate and an estimate of what would happen over the next 10 to 15 years if NAFTA is not implemented. The study does not estimate these latter effects, so the effects of NAFTA cannot be determined from the study.

12. Santiago Levy and Sweder van Wijnbergen, "Transitional Problems in Economic Reform: Agriculture in the Mexico-U.S. Free Trade Agreement," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: dynamic general equilibrium model
Regions modeled: 1--Mexico
Number of industrial sectors: 7--producing 1 tradable industrial good, 1 nontradable service, and 5 agricultural goods
Factors of production: 5--capital, urban labor, rural labor, rainfed land, and irrigated land
Substitution among factors of production: some substitution allowed
Substitution among intermediate goods: not allowed
Economies of scale: no
Labor markets: employment held fixed and wages allowed to vary
International labor migration resulting from NAFTA: not allowed; internal migration within Mexico *is* allowed and is assumed to be sufficient to keep constant the per capita utility (well-being) differential between urban workers and landless rural workers
Treatment of investment/capital stock: urban capital assumed to grow at a constant exogenously determined rate; various assumptions are made in different simulations regarding government investment in irrigation and other improvements to agricultural land as part of an adjustment program to ameliorate negative effects of NAFTA
Exchange rate/trade balance: trade balance held fixed, real exchange rate allowed to vary
Multifactor productivity growth resulting from NAFTA: not allowed except for cases in which the government is assumed to convert rainfed agricultural land to irrigated land. Irrigated land is assumed to have a faster rate of productivity growth, so the conversion results in faster growth.
Other features: study focuses on Mexican agricultural sector and how policy should be structured to ease the transition to NAFTA for this sector and what the tradeoffs of these policies are in terms of economic efficiency

13. Robert K. McCleery, "An Intertemporal, Linked, Macroeconomic CGE Model of the United States and Mexico Focussing on Demographic Change and Factor Flows," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: dynamic general equilibrium model
Regions modeled: 2--the United States and Mexico--with equations for trade with the ROW
Number of industrial sectors: 2
Factors of production: 4 in the United States--capital, high-wage manufacturing labor, high-wage services labor, and low-wage services labor; 5 in Mexico--the same 4 plus land
Substitution among factors of production: some substitution allowed
Substitution among intermediate goods: not possible (only one intermediate good)
Economies of scale: no
Labor markets: full employment assumed, real wages allowed to vary
International labor migration resulting from NAFTA: not allowed; the model has equations for it that are disabled for this study; other studies (which CBO did not review) using the same model do not disable the equations
Treatment of investment/capital stock: direct investment flows determined by the requirement that returns on capital in Mexico differ from returns on capital in the United States by specified risk premiums; in one simulation NAFTA is assumed to reduce the risk premiums by specified amounts
Exchange rate/trade balance: purchasing-power parity is assumed to hold--all Mexican

transactions are modeled in dollar terms so there is no explicit exchange rate; trade balance is allowed to vary

Multifactor productivity growth resulting from NAFTA: modeled in one simulation

14. Clyde V. Prestowitz, Jr., and Robert B. Cohen, with Peter Morici and Alan Tonelson, *The New North American Order* (Washington, D.C.: Economic Strategy Institute, 1991), pp. 45-52.

Methodology: modified extrapolation of current trends

Regions studied: 2--the United States and Mexico

Number of industrial sectors: 6, but these are selective and do not encompass the entire economy of either region

Factors of production: 2 are discussed--capital and labor

Substitution among factors of production: not allowed (ratio of capital to labor assumed constant)

Substitution among intermediate goods: not discussed

Economies of scale: no

Labor markets: each billion dollars of trade deficit assumed to cause a loss of 30,000 jobs in the United States

International labor migration resulting from NAFTA: not considered

Treatment of investment/capital stock: current rate of growth of foreign direct investment in Mexico (10 percent annually) assumed for a "low-growth" baseline; twice that rate assumed for a "high-growth" scenario

Exchange rate/trade balance: exchange rate and trade-balance identity ignored; trade balance determined by assumptions regarding rate of growth of foreign investment in Mexican export industries, the fraction of the output of those industries exported to the United States, and the fraction of the inputs to these industries imported from the United States

Multifactor productivity growth resulting from NAFTA: new investment in Mexico assumed to have U.S. productivity levels rather than current Mexican levels

15. Sherman Robinson, Mary E. Burfisher, Raul Hinojosa-Ojeda, and Karen Thierfelder, "Agricultural Policies and Migration in a U.S.-Mexico Free Trade Area: A Computable General Equilibrium Analysis," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: static general equilibrium model

Regions modeled: 2--the United States and Mexico--with equations for trade with the ROW

Number of industrial sectors: 11, 5 of which are in agriculture and food processing

Factors of production: 6--land, capital, rural labor, urban unskilled labor, skilled labor, and white-collar labor

Substitution among factors of production: allowed

Substitution among intermediate goods: not allowed

Economies of scale: no

Labor markets: full employment assumed, real wages allowed to vary

International labor migration resulting from NAFTA: allowed in all simulation runs--assumed sufficient to keep constant ratio of Mexican to U.S. real wages for rural and urban unskilled workers; internal migration within Mexico also allowed--assumed sufficient to keep constant the ratio of rural to urban unskilled wages in Mexico
Treatment of investment/capital stock: in one simulation, Mexican capital stock is increased by 10 percent--no modeling of the required interim period of higher investment
Exchange rate/trade balance: trade balance held constant, real exchange rate allowed to vary
Multifactor productivity growth resulting from NAFTA: not allowed

16. David Roland-Holst, Kenneth A. Reinert, and Clinton R. Shiells, "North American Trade Liberalization and the Role of Nontariff Barriers," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: static general equilibrium model
Regions modeled: 3--the United States, Mexico, and Canada--with equations for trade with the ROW
Number of industrial sectors: 26
Factors of production: 2--capital and labor
Substitution among factors of production: allowed
Substitution among intermediate goods: not allowed
Economies of scale: yes
Labor markets: wages fixed and employment variable for all 3 countries
International labor migration resulting from NAFTA: not discussed and not relevant since wages are held fixed, permanent excess unemployment is assumed, and unemployment is neither modeled nor estimated
Treatment of investment/capital stock: capital stock of each region held fixed with no allowance for increased investment in Mexico resulting from NAFTA
Exchange rate/trade balance: trade balance held fixed, exchange rate allowed to vary
Multifactor productivity growth resulting from NAFTA: not allowed
Other features: trade flows for each country with respect to the rest of the world are governed by the small-country assumption; Armington assumption is used

17. Horacio Sobarzo, "A General Equilibrium Analysis of Gains from Trade for the Mexican Economy of a North American Free Trade Agreement," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic Implications of a FTA With Mexico and a NAFTA With Canada and Mexico*, USITC Publication 2508 (May 1992).

Methodology: static general equilibrium model
Regions modeled: 1--Mexico--with equations for trade with North America and with the ROW
Number of industrial sectors: 27--21 producing tradable goods and services and 6 producing nontradable goods and services
Factors of production: 2--capital and labor
Substitution among factors of production: allowed
Substitution among intermediate goods: not allowed

Economies of scale: yes
Labor markets: real wage held fixed and employment allowed to vary in versions 1 and 2; full employment assumed and wage allowed to vary in version 3
International labor migration resulting from NAFTA: not relevant for versions 1 and 2 (since the wage is held fixed and unemployment is neither modeled nor estimated); not allowed in version 3
Treatment of investment/capital stock: capital stocks kept constant in versions 1 and 2; interest rate held constant in version 3, and the resulting capital inflows are assumed to be owned by foreigners rather than Mexicans
Exchange rate/trade balance: trade balance is fixed and exchange rate is variable in version 1; exchange rate is fixed and trade balance is variable in versions 2 and 3
Multifactor productivity growth resulting from NAFTA: not allowed

18. Irene Trela and John Whalley, "Trade Liberalisation in Quota Restricted Items: U.S. and Mexico in Textiles and Steel," *The World Economy*, vol. 15, no. 1 (January 1992), pp. 45-63. Also, Appendix A of Irene Trela and John Whalley, "Bilateral Trade Liberalization in Quota Restricted Items: U.S. and Mexico in Textiles and Steel" (May 1991 draft of paper presented at the Conference on Modeling North American Free Trade, Washington, D.C., June 27, 1991).

Note: This study uses one model to examine the effects of eliminating U.S. textile and apparel import quotas and another model to examine the effects of eliminating U.S. steel import quotas. Since the steel quotas have already been eliminated even without NAFTA, this description focuses only on the textile and apparel model.

Methodology: static general equilibrium model
Regions modeled: 4--the United States, Mexico, Canada, and a 33-country aggregate of the rest of the countries covered by the Multifiber Arrangement
Number of industrial sectors: 5--4 textile and apparel sectors and 1 composite of all other goods (residual GDP)
Factors of production: 0
Substitution among factors of production: not possible (no factors of production)
Substitution among intermediate goods: not possible (no intermediate goods)
Economies of scale: no
Labor markets: not applicable (no labor in the model)
International labor migration resulting from NAFTA: not applicable (no labor in the model)
Treatment of investment/capital stock: not applicable (no capital or investment in the model)
Exchange rate/trade balance: trade balance assumed to equal 0
Multifactor productivity growth resulting from NAFTA: not allowed
Other features: domestic production and imports from various countries are perfect substitutes for each particular good

19. Leslie Young and Jose Romero, "Steady Growth and Transition in a Dynamic Dual Model of the North American Free Trade Agreement," in U.S. International Trade Commission, *Economy-Wide Modeling of the Economic*

Implications of a FTA With Mexico and a NAFTA With Canada and Mexico, USITC Publication 2508 (May 1992).

Methodology: dynamic general equilibrium model
Regions modeled: 1--Mexico
Number of industrial sectors: 12--3 producing capital goods and 9 producing consumption/intermediate goods
Factors of production: 13--labor, 3 capital goods (machinery, buildings, and vehicles), and 9 intermediate goods
Substitution among factors of production: allowed
Substitution among intermediate goods: allowed
Economies of scale: no
Labor markets: employment set by assumption, wage allowed to vary
International labor migration resulting from NAFTA: not allowed
Treatment of investment/capital stock: investment explicitly modeled; 2 simulations run--1 with interest rate constant at 10 percent and 1 with drop to 7.5 percent to reflect reduced uncertainty about economic policy and the economy generally
Exchange rate/trade balance: exchange rate held fixed (implicitly), trade balance allowed to vary
Multifactor productivity growth resulting from NAFTA: not allowed
Other features: imports and domestically produced goods are perfect substitutes for a given good; model actually looks at the effects of free trade between Mexico and the rest of the world, not of NAFTA